Corporate Financing Decisions: The Role of Managerial Overconfidence

by

BIN XU

A Doctoral Thesis

Submitted in partial fulfilment of the requirements for the award of

Doctor of Philosophy (PhD) of Loughborough University

August 2014

CERTIFICATE OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this thesis, that the original work is my own except as specified in acknowledgments or in footnotes, and that neither the thesis or the original work contained therein has been submitted to this or any other institution for a degree.

…… (Signed)

……08-2014..…… (Date)

Corporate Financing Decisions: The Role of Managerial Overconfidence

Abstract

This thesis examines the effects of managerial overconfidence on corporate financing decisions. Overconfident managers tend to overestimate the mean of future cash flow and underestimate the volatility of future cash flow. We propose a novel time-varying measure of overconfidence, which is based on computational linguistic analysis of "what the managers said" (i.e. Chairman's Statement). The overconfidence of CEO and CFO is also constructed based on "what the managers did" (i.e. how they trade their own firms' shares). We conduct three empirical studies that offer new insights into the roles of managerial overconfidence in the leverage decision (i.e. debt level), pecking order behaviour (i.e. the preference for debt over equity financing) and debt maturity decision (i.e. short-term debt vs. long-term debt). Study 1 documents a negative overconfidence-leverage relationship. This new finding suggests that debt conservatism associated with managerial overconfidence might be a potential explanation for the low leverage puzzle: some firms maintain low leverage, without taking tax benefits of debt, because overconfident managers believe that firm securities are undervalued by investors and thus are too costly (Malmendier, Tate and Yan, 2011). Study 2 finds managerial overconfidence leads to reverse pecking order preference especially in small firms, which sheds light on the pecking order puzzle that smaller firms with higher information costs surprisingly exhibit weaker pecking order preference. This new evidence is consistent with Hackbarth's (2008) theory that overconfident managers who underestimate the riskiness of earnings tend to prefer equity to debt financing. Study 3 finds managerial overconfidence leads to higher debt maturity. This evidence supports our proposition that overconfidence can mitigate the underinvestment problem (which is often the major concern of long-term debt investors) (Hackbarth, 2009), which in turn allows overconfident managers to use more and cheaper long-term debt. This evidence also implies that overconfidence may mitigate the agency cost of debt. Overall, our empirical analysis suggests that managerial overconfidence has significant incremental explanatory power for corporate financing decisions.

Key words: time-varying managerial overconfidence, disclosure tone, Chairman's Statement, content analysis, insider trading, capital structure, pecking order, debt maturity.

Corporate Financing Decisions: The Role of Managerial Overconfidence

Extended Abstract

This thesis contributes to the growing behavioural corporate finance literature by investigating the effects of managerial overconfidence on various aspects of corporate financing decisions including the capital structure decision, pecking order preference and debt maturity decision, which sheds new light on several major puzzles in the standard corporate financing literature namely the capital structure puzzle (particularly low leverage puzzle) and pecking order puzzle (size anomaly). We propose a novel *time-varying* measure of overconfidence based on computational linguistic analysis. The overconfidence of CEO and CFO is also constructed based on how they trade their own firms' shares. This thesis consists of six main chapters plus an introduction and conclusion. Chapter 2 reviews behavioural financing theories. Chapter 3 compares various measures of managerial overconfidence and describes how we gauge overconfidence. Chapter 4 discusses important panel data econometric techniques/issues related to our empirical analysis. Chapter 5, 6 and 7 are three self-contained empirical studies summarized below.

Empirical study 1: managerial overconfidence and low leverage puzzle
Chapter 5 examines the impact of managerial belief (i.e. overconfidence) on capital structure. Computational tone analysis of Chairman's Statement is used to gauge time-varying managerial overconfidence. We find that optimistic tone is negatively related to leverage. This finding provides initial empirical evidence consistent with Malmendier, Tate and Yan's (2011) proposition that managerial overconfidence may lead to debt conservatism. The negative tone-leverage relationship is similar across firms with different degree of information asymmetry and information environment, ruling out two alternative explanations of tone (i.e. information asymmetry and impression management). We further investigate the joint effects of insider trading, as another window into managerial belief, and tone on leverage. As expected, high insider purchase (selling) confirms (contradicts) optimistic tone, which in turn enhances (weakens) the negative tone-leverage relationship. Overall, this study establishes a link between managerial optimistic words and conservative debt policy, which may help to explain the low leverage puzzle: some firms maintain low leverage, without taking tax benefits of debt, because of overconfidence-induced debt conservatism.

Empirical study 2: managerial overconfidence and pecking order puzzle/size anomaly
Chapter 6 examines whether managerial overconfidence enhances or weakens pecking order preference. We construct time-varying managerial words-based (i.e. tone of Chairman's Statement) and action-based (i.e. insider trading and firm investment) measures of overconfidence. Both optimistic tone and industry-adjusted investment have significant and negative impacts on the pecking order coefficient in the Shyam-Sunder and Myers (1999) regression framework, suggesting that managerial overconfidence leads to a *reverse* pecking order preference. This new evidence is consistent with Hackbarth's (2008) theory that overconfident managers with a "risk perception bias" tend to believe that their debt (equity) is undervalued (overvalued) and therefore prefer equity to debt financing. This observed overconfidence-induced reverse pecking order preference also corroborates our earlier finding that optimistic tone is negatively associated with leverage. We also find that the effect of managerial overconfidence on the reverse pecking order preference is particularly stronger for firms

with higher earnings volatility, which confirms that "risk perception bias" is the underlying channel through overconfidence weakens the pecking order preference. Furthermore, we find that the effect of overconfidence on reverse pecking order preference is particularly strong for small firms. In other words, overconfident managers in those small firms are reluctant to follow standard pecking order behaviour, in which case managerial overconfidence contributes to the pecking order puzzle/size anomaly (i.e. small firms with higher information asymmetry surprisingly exhibit weaker pecking order preference relative to large firms). In addition, the effects of insider trading-based measures of managerial overconfidence are, however, relatively weak and less consistent, which is probably because insider (especially CEO) trading is driven by information asymmetry and thus is not a perfect proxy for managerial overconfidence. Overall, this study supports the proposition that managerial overconfidence is an underlying driver of reverse pecking order preference especially for small firms, which partly explains the pecking order puzzle/size anomaly.

Empirical study 3: managerial overconfidence and higher debt maturity
Chapter 7 examines the impact of managerial overconfidence on corporate debt maturity. We hypothesize that overconfidence can increase debt maturity. The intuition is that overconfidence can mitigate the underinvestment problem (Hackbarth, 2009) which is often the major concern of long-term debt investors. The reduced agency cost of debt, in turn, allows overconfident managers to use more and cheaper long-term debt. Our empirical evidence is based on time-varying overconfidence measures (i.e. first person pronouns and optimistic tone) constructed using computational linguistic analysis. Interestingly, the changes of both first person singular pronouns and optimistic tone are positively related to the change of debt maturity consistent with our main hypothesis. Further support for our main hypothesis is provided by showing: 1) that the overconfidence-debt maturity relationship is strongest for the director who most influences investment decision, the CEO and 2) that overconfidence-debt maturity relationship strengthens for firms with high growth opportunities that exacerbate the underinvestment problem. Overall, this study provides initial and consistent evidence for a positive overconfidence-debt maturity relationship via overconfidence mitigating the agency cost of long-term debt.

To sum up, Study 1 documents a negative overconfidence-leverage relationship. This finding suggests that debt conservatism associated with managerial overconfidence might be a potential explanation for the low leverage puzzle. Study 2 shows that managerial overconfidence may lead to reverse pecking order preference especially in small firms, which sheds light on the pecking order puzzle/size anomaly that smaller firms exhibit weaker pecking order preference. Study 3 finds that managerial overconfidence increases debt maturity and implies that managerial overconfidence does not always cause suboptimal/value-destroying decisions but can mitigate the agency cost of debt.

Key words: time-varying managerial overconfidence, disclosure tone, Chairman's Statement, content analysis, insider trading, capital structure, pecking order, debt maturity.

Acknowledgements

I thank my parents, Songxiang Xu and Xiazhen Yuan, and my wife, Qian Xu, for their love and encouragement.

I must express my sincere and deepest gratitude to my supervisors, Dr Andrew Vivian and Dr Ali Ataullah, for their excellent guidance, constructive comments and ongoing support. I believe that the experience of doing a PhD with knowledgeable and open-minded supervisors will benefit me in the long run.

I am grateful to Professor Richard Taffler for his insightful comments and valuable suggestions which improve the quality of my research.

I would also like to thank Professor William Forbes, who encouraged me to do a PhD at Loughborough University, for his useful comments on my thesis.

Special thanks also go to the School of Business and Economics for the PhD scholarship. I thank my friends and all staff at Loughborough University who have supported me in various ways.

Contents

Abstract 4

Extended Abstract 5

Acknowledgements 7

Abbreviations 16

Tables 17

Figures 18

Appendices 18

Chapter 1. Introduction 20

1.1 Background and Motivations: Economic Man vs. Bounded Rationality 20

1.1.1 The importance of irrational manager approach 21

1.2 Theoretical Foundations: Managerial Overconfidence and Corporate Financing 22

1.2.1 Research questions 23

1.2.1.1 Empirical study 1: capital structure decision (chapter 5) 24

1.2.1.2 Empirical study 2: pecking order preference (chapter 6) 24

1.2.1.3 Empirical study 3: debt maturity decision (chapter 7) 24

1.3 Empirical Challenges and Managerial Overconfidence Measures 25

1.3.1 Our measures of managerial overconfidence 25

1.3.1.1 Managerial words-based measure of overconfidence 26

1.3.1.2 Managerial action-based measure of overconfidence 26

1.4 Empirical Tests and Contributions 26

1.4.1 Empirical study 1: capital structure decision 26

1.4.2 Empirical study 2: pecking order behaviour 27

1.4.3 Empirical study 3: debt maturity decision 28

1.5 Structure of the Thesis 29

Chapter 2. Behavioural Capital Structure Theories: The Effects of Managerial Overconfidence 31

2.1 Introduction 31

2.2 Standard Capital Structure Theories and Their Interactions 31

2.2.1 Standard capital structure theories 32

2.2.1.1 Modigliani-Miller theorem (without and with taxes) 32

2.2.1.2 Trade-off theory 33

2.2.1.3 Pecking order theory 35
2.2.1.4 Market timing theory 36
2.2.2 Interactions among main capital structure theories 37
2.2.2.1 Interaction between trade-off and pecking order: financing deficit and dynamic adjustment (see Table 2.1) 38
2.2.2.2 Interaction between trade-off and market timing: market timing and dynamic adjustment (see Table 2.2) 38
2.2.2.3 Interaction between pecking order and market timing: market timing and pecking order preference (see Table 2.3) 39
2.3 Main Facets of Overconfidence 40
2.3.1 Miscalibration 40
2.3.2 Better-than-average effect 41
2.3.3 Illusion of control 41
2.3.4 Excessive optimism 42
2.3.5 Self-attribution bias: "endogenous overconfidence" 42
2.3.6 Definitions of overconfidence in empirical studies 43
2.4 Behavioural Capital Structure Theories 44
2.4.1 Definitions (modelling approaches) of overconfidence and optimism 44
2.4.2 A simple model of non-fundamental effect 46
2.4.3 Irrational investor approach vs. irrational manager approach 48
2.4.3.1 Irrational investor-rational manager approach 48
2.4.3.2 Irrational manager-rational investor approach 49
2.4.4 A more comprehensive market timing theory: Market Timing Matrix 50
2.4.4.1 Baker and Wurgler's (2002) market timing theory is incomplete 50
2.4.4.2 Further development of behavioural timing theory: Market Timing Matrix 51
2.4.5 Optimism vs. overconfidence as a driver of pecking order 55
2.4.5.1 Managerial optimism and standard pecking order 55
2.4.5.2 Managerial overconfidence and reverse pecking order 55
2.4.6 Heaton's (2002) model (perceived information asymmetry) 57
2.4.7 Hackbarth's (2008) model (trade-off theory) 58
2.4.8 Malmendier, Tate and Yan's (2011) model (debt conservatism) 59
2.4.9 Managerial overconfidence and agency problem (Hackbarth, 2008, 2009) 60
2.4.9.1 Manager-shareholder conflicts: agency cost of equity 61
2.4.9.2 Bondholder-shareholder conflicts: agency cost of debt 61
2.5 Conclusion 62

Chapter 3. Methodology: Empirical Measures (operationalization of managerial overconfidence) 66

3.1 Measures of Managerial Overconfidence 66

3.1.1 Stock option-based measures 66

3.1.1.1 Option-based measure: Holder67 67

3.1.1.2 Option-based measure: Longholder 67

3.1.1.3 Continuous option-delay measures 68

3.1.1.4 Why option-based measure might not be valid for UK executives 69

3.1.2 Media coverage approach 70

3.1.3 Self-attribution bias 71

3.1.4 Time-varying words-based proxy: optimistic tone 72

3.1.5 Insider trading-based measure: net purchase ratio 73

3.1.6 Managerial earnings forecast 74

3.1.7 Executive compensation-based proxy 74

3.1.7.1 Relative pay 75

3.1.7.2 Variable pay 75

3.1.7.3 Alternative explanations of equity-based compensation (EBC) 76

3.1.8 Industry-adjusted investment rate 76

3.1.9 Dividend payment 77

3.1.10 Multiple acquisitions 78

3.1.11 Recent stock performance 78

3.1.12 R&D expenditure (innovation) 79

3.2 Managerial Overconfidence Measures Used In This Thesis 81

3.2.1 The importance of using time-varying measure of overconfidence 81

3.2.2 Tone of Chairman's Statement 81

3.2.2.1 Why we use Chairman's Statement 81

3.2.2.2 Computational content analysis 82

3.2.2.3 Measurement of tone 85

3.2.2.4 Composite tone index: principal component analysis (PCA) 87

3.2.3 Insider trading-based measure 89

3.2.4 Caveats and conclusion 91

Chapter 4. Methodology: Estimation Methods of Unbalanced Panel Data 93

4.1 Introduction 93

4.2 Estimators for Models with Fractional Dependent Variable 94
4.2.1 Pooled Tobit model 95
4.2.2 Random-effect Tobit model 95
4.2.3 Likelihood ratio test: pooled Tobit vs. RE-Tobit 96
4.3 Estimators for Models with Binary Dependent Variable 96
4.3.1 Linear probability model (LPM) 96
4.3.2 Logit and Probit models 97
4.4 Estimators for Dynamic Panel 98
4.4.1 Dynamic capital structure model (partial adjustment model) 99
4.4.2 Dynamic misspecification 100
4.4.3 Estimation methods of dynamic panel 100
4.4.3.1 Pooled OLS 101
4.4.3.2 Fixed effect (within) 101
4.4.3.3 First difference 101
4.4.3.4 Instrumental variable estimator 102
4.4.3.5 Generalised method of moment (GMM) 102
4.4.3.6 Doubly-censored Tobit model 104
4.5 Firm Fixed Effects 105
4.5.1 Potential fixed effects (omitted variables) as a source of endogeneity 105
4.5.2 How and when to control for unobserved heterogeneity 106
4.5.3 Limitations of fixed effects and how to address them 107
4.5.3.1 Fixed effects (within) estimator vs. first difference estimator 108
4.5.4 Potential problem with unbalanced panel 108
4.5.5 Fixed effects vs. random effects 109
4.6 Interaction Effects and Multicollinearity 109
4.6.1 Reparameterization of the model with interaction terms 110
4.6.2 Consequences of imperfect multicollinearity 111
4.6.3 An indicator of multicollinearity: variance inflation factor (VIF) 111
4.6.4 Another way to test interaction effects: subsample analysis 112
4.7 Internal Validity: Components, Threats and Solutions 113
4.7.1 Finite sample and asymptotic properties of estimators 113
4.7.2 Threats to internal validity and solutions 114
4.7.2.1 Omitted variable bias 115
4.7.2.2 Functional form misspecification 116

4.7.2.3 Measurement error in independent variable (errors-in-variables) 118
4.7.2.4 Estimation of standard errors in panel models..... 118
4.8 Conclusion and the Choice of the Methods of Our Empirical Analysis 119
Chapter 5. Empirical Study 1: Optimistic Disclosure Tone, Insider Trading and Capital Structure 123
5.1 Introduction..... 123
5.2 Hypothesis Development 125
5.2.1 Corporate disclosure tone - an overview..... 126
5.2.1.1 Information asymmetry perspective: “inform investors” 126
5.2.1.2 Impression management perspective: “intentionally disinform investors” 127
5.2.1.3 Managerial overconfidence perspective: “unintentionally disinform investors”. 127
5.2.2 Testable hypotheses 128
5.2.2.1 Optimistic tone and leverage..... 128
5.2.2.2 Joint effect of tone and insider trading on leverage..... 130
5.3 Methodology and Data 131
5.3.1 Dependent variable: book leverage vs. market leverage 132
5.3.2 Measurement of managerial overconfidence 132
5.3.2.1 Words-based measure of overconfidence: optimistic tone 132
5.3.2.2 Action-based measure of overconfidence: net purchase ratio 136
5.3.3 The sample 138
5.3.3.1 Descriptive statistics and correlation matrix 139
5.4 Results and Discussion..... 142
5.4.1 Univariate leverage regression 142
5.4.2 Multivariate leverage regression 142
5.4.3 Multivariate leverage regression in first differences 148
5.4.4 Interaction between optimistic tone and insider trading..... 148
5.4.5 Subsample analysis: alternative interpretations of optimistic tone and insider trading 152
5.4.5.1 Sensitivity of tone-leverage relationship to information asymmetry..... 152
5.4.5.2 Sensitivity of NPR-leverage relationship to information asymmetry 156
5.4.6 Robustness checks 159
5.4.6.1 System-GMM 159
5.4.6.2 Logistic analysis of low/zero-leverage 159
5.4.6.3 Non-linear effect 160

5.4.6.4 Year and industry effects 164
5.5 Conclusions 164
Chapter 6. Empirical Study 2: Managerial Overconfidence and Reverse Pecking Order Preference 166
6.1 Introduction 166
6.2 Related Literature 170
6.2.1 Pecking order tests 170
6.2.1.1 Shyam-Sunder and Myers (SSM) test of pecking order theory 171
6.2.1.2 Pecking order puzzle 171
6.2.2 Tests of pecking order conditions: modified SSM (1999) framework 172
6.2.2.1 Information asymmetry 172
6.2.2.2 Market timing (firm level): equity mispricing 173
6.2.2.3 Market timing (market level): time-varying cost of capital 173
6.3 Hypothesis Development 174
6.3.1 Managerial overconfidence enhances pecking order preference 174
6.3.2 Managerial overconfidence weakens pecking order preference 175
6.4 Methodology and Data 176
6.4.1 The model 176
6.4.1.1 Heterogeneity of the pecking order coefficient 177
6.4.1.2 Asymmetry of the pecking order coefficient 177
6.4.2 Measurement of financing deficit (DEF) 178
6.4.2.1 Balance sheet approach 178
6.4.2.2 Cash flow approach 179
6.4.3 Measurement of managerial overconfidence 179
6.4.3.1 Words-based measure of overconfidence: optimistic tone 180
6.4.3.2 Action-based measure of overconfidence: overinvestment 180
6.4.3.3 Action-based measure of overconfidence: net purchase ratio 181
6.4.4 The sample 181
6.4.4.1 Descriptive statistics 182
6.4.4.2 Correlation analysis 184
6.5 Results and Discussion 186
6.5.1 Optimistic tone and pecking order preference 186
6.5.2 Industry-adjusted investment rate and pecking order preference 187
6.5.3 Further analysis 191

6.5.3.1 Can managerial overconfidence explain the pecking order puzzle/size anomaly? 191
6.5.3.2 What is the underlying channel through which managerial overconfidence leads to reverse pecking order preference? 192
6.5.3.3 Do net purchases (as a proxy for overconfidence) of CEO and CFO have the same impact on pecking order preference? 193
6.5.4 Further robustness tests 200
6.5.4.1 Alternative definitions of DEF using cash flow data 200
6.5.4.2 Alternative specification to distinguish between firms with positive and negative DEF 200
6.5.4.3 Scaling of the DEF 201
6.5.4.4 Exclusion of zero-leverage firms 201
6.6 Conclusions 207
Chapter 7. Empirical Study 3: Managerial Overconfidence and Corporate Debt Maturity Structure 209
7.1 Introduction 209
7.2 Related Research and Hypotheses 212
7.2.1 Related research 212
7.2.2 Hypothesis development 214
7.2.2.1 Managerial overconfidence decreases debt maturity 214
7.2.2.2 Managerial overconfidence increases debt maturity 217
7.2.2.3 Managerial duty hypothesis: CEO versus CFO 220
7.3 The Methodology and Data 221
7.3.1 The empirical model 221
7.3.2 Measurement of managerial overconfidence 222
7.3.3.1 Words-based measure of managerial overconfidence 222
7.3.3.2 Action-based measure of managerial overconfidence 225
7.3.3 Estimation methods 226
7.3.4 The sample 226
7.3.4.1 Descriptive statistics 228
7.3.4.2 Correlation analysis 229
7.4 Empirical Results 232
7.4.1 The role of words-based managerial overconfidence: first person pronouns 232
7.4.2 The role of words-based managerial overconfidence: optimistic tone 234
7.4.3 The role of NPRs of CEO, CFO and Chairman 236

7.4.4 The role of NPRs of executive vs. non-executive directors 239
7.4.5 Change of managerial overconfidence and change of debt maturity 240
7.4.6 Control variables 241
7.4.7 Further analysis 244
7.4.7.1 Subsample analysis 244
7.4.8 Robustness tests 246
7.4.8.1 Dummies of first person pronouns and NPRs 246
7.4.8.2 Alternative estimator: Random Effects Tobit (RE-Tobit) 247
7.4.9 Summary and further discussions 249
7.5 Conclusions 249
Chapter 8. Conclusion 253
8.1 Major Contributions 253
8.1.1 Theoretical contributions 253
8.1.2 Methodological contributions 254
8.1.3 Empirical contributions (new economic insights) 254
8.2 Potential Limitations 256
8.3 Implications and Directions for Future Research 258
Appendices 260
References 272

Abbreviations

MTM	Market Timing Matrix
SAB	Self-attribution bias
MD&A	Managerial Discussion and Analysis
NPR	Net purchase ratio
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CDF	Cumulative density function
VA_CEO	Value-based net purchase ratio of CEO
VOL_CEO	Volume-based net purchase ratio of CEO
VA_CFO	Value-based net purchase ratio of CFO
VOL_CFO	Volume-based net purchase ratio of CFO
TONE	Tone index
TONE_RES	Orthogonalized tone index
MO	Managerial overconfidence
LIWC	Linguistic Inquiry and Word Count software
PCA	Principal component analysis
SSM	Shyam-Sunder and Myers
PDEF	Positive financing deficit
NDEF	Negative financing deficit (financing surplus)
PO	Pecking order
DIF-GMM	Difference Generalized Method of Moment
SYS-GMM	System Generalized Method of Moment
FE	Fixed effect
RE	Random effect
OLS	Ordinary least square
RE-Tobit	Random effect Tobit
P-Logit	Pooled Logit
FE-Logit	Fixed effect Logit
Hausman	Hausman test
LPM	Linear probability model
LM test	Lagrange Multiplier test
LR test	Likelihood ratio test
MLE	Maximum likelihood estimation
AR(1)	First order autocorrelation test
AR(2)	Second order autocorrelation test
Sargan	Sargan test of instrument validity
Hansen	Hansen test of instrument validity
Firm	Number of firms
Obs.	Number of observations

Tables

Table 2.1 Interaction between financing deficit and leverage adjustment
Table 2.2 Interaction between market timing and leverage adjustment
Table 2.3 Interaction between market timing and pecking order
Table 2.4 Definitions of overconfidence in behavioural corporate finance models
Table 2.5 Market Timing Matrix with irrational managers and investors
Table 2.6 Distinct impacts of overconfidence and optimism on debt-equity choice
Table 2.7 Empirical predictions on the effects of overconfidence on financing decisions
Table 2.8 Behavioural theories tested in our empirical chapters

Table 3.1 A summary of measures of managerial overconfidence
Table 3.2 Types of transformation errors and examples
Table 3.3 Interaction between managerial optimistic words and actions

Table 4.1 Choices of methods based on the characteristics of data and theories
Table 4.2 Marginal effects of LPM, Logit and Probit models
Table 4.3 Choice of estimators of dynamic panel based on data features
Table 4.4 Comparison of the performance of estimators in presence of unobserved heterogeneity
Table 4.5 Linear panel model: common estimators and models
Table 4.6 Threats to internal validity: definitions and solutions

Table 5.1 Descriptive statistics
Table 5.2 Correlation matrix
Table 5.3 Univariate leverage regressions
Table 5.4 Leverage
Table 5.5 Leverage regressions in first differences
Table 5.6 Leverage regression with interaction effects of tone and insider selling
Table 5.7 Leverage regression with interaction effects of tone and insider purchase
Table 5.8 Subsample analysis: sensitivity of tone-leverage relationship to information asymmetry
Table 5.9 Subsample analysis: sensitivity of value-based NPR-leverage relationship to information asymmetry
Table 5.10 Dynamic leverage adjustment: system GMM
Table 5.11 Logistic analysis of low leverage
Table 5.12 Logistic analysis of zero leverage

Table 6.1 Descriptive statistics
Table 6.2 Correlation matrix
Table 6.3 Tone and pecking order preference
Table 6.4 Tone dummies and pecking order preference
Table 6.5 Industry-adjusted investment rate and pecking order preference
Table 6.6 Comparison of the effects of tone on pecking order preference for small and large firms
Table 6.7 Comparison of the effects of industry-adjusted investment rate on pecking order preference for small and large firms
Table 6.8 Comparison of the effects of tone on pecking order preference for firms with high and low earnings volatility

Table 6.9 Comparison of the effects of industry-adjusted investment rate on pecking order preference for firms with high and low earnings volatility
Table 6.10 Net purchase of CEO and CFO and pecking order preference
Table 6.11 Net purchase dummies and pecking order preference
Table 6.12 Alternative definition of financing deficit (DEF) using cash flow data: the effects of tone
Table 6.13 Alternative definition of financing deficit (DEF) using cash flow data: the effects of industry-adjusted investment rate
Table 6.14 Alternative specification to test asymmetric pecking order behaviour (PDEF vs. NDEF)

Table 7.1 Summary statistics and correlation matrix
Table 7.2 Words-based measures of overconfidence and debt maturity: the roles of first person pronouns
Table 7.3 Words-based measures of overconfidence and debt maturity: the roles of optimistic tone
Table 7.4 Action-based measures of overconfidence and debt maturity
Table 7.5 Changes of words-based measures of overconfidence and change of debt maturity
Table 7.6 Subsample analysis: sensitivity of overconfidence-debt maturity relationship to firm characteristics
Table 7.7 Dummies of first person pronouns and NPRs and debt maturity
Table 7.8 Alternative estimator: random-effects Tobit model

Figures

Figure 2.1 Interactions between capital structure theories
Figure 2.2 Three definitions of overconfidence
Figure 2.3 Behavioural capital structure theories: an irrational-manager approach
Figure 3.1 Construction of option-based measure of overconfidence
Figure 3.2 Steps of computational content analysis of Chairman's Statement

Appendices

Appendix 3.A A description of content analysis software: Diction 6 vs. LIWC 2007
Appendix 5.A Variable definitions
Appendix 6.A Variable definitions
Appendix 7.A Variable definitions
Appendix 7.B Empirical studies on standard determinants of debt maturity
Appendix 7.C Standard theories of debt maturity
Appendix 7.D Tone and debt maturity: OLS

CHAPTER 1

INTRODUCTION

Chapter 1. Introduction

1.1 Background and Motivations: Economic Man vs. Bounded Rationality

Standard corporate finance models assume that managers and investors are rational utility maximisers (i.e. economic man or *homo economicus*). However, in Simon's (1955) view, the "economic man" assumption made by traditional economic theories is overly simplistic. Consequently, traditional economic theories are often more related to normative (i.e. "how they should rationally behave") rather than actual (i.e. "how firms do behave") decision processes. In particular, he argues that

> *"Because of the psychological limits of the organism (particularly with respect to computational and predictive ability), actual human rationality-striving can at best be an extremely crude and simplified approximation of the kind of global rationality that is implied, for example, by game-theoretical models."*

Therefore, to have a better understanding of "how firms do behave", behavioural corporate finance theories incorporate well-established findings from psychological studies and are built upon a more valid and realistic assumption of "bounded rationality" (Simon, 1957)[1]. Most of the existing behavioural corporate finance theories and empirical evidence can be broadly categorised into either of the following two approaches, namely irrational manager-rational investor approach and rational manager-irrational investor approach (Baker and Wurgler, 2013). Among a wide range of human irrationalities (e.g. see Table 2.2 in Bazerman (2002) for a review on various behavioural biases[2]), existing behavioural finance studies suggest that investors and managers are particularly prone to two similar irrationalities including investor

[1] The concept of "bounded rationality" is first proposed by Simon (1957) in his Nobel Prize-winning book "Models of Man". He describes the "principle of bounded rationality" as: "The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world – or even for a reasonable approximation to such objective rationality."

[2] Bazerman (2002) provides a good review on thirteen common biases (including overconfidence) that influence managerial decision making. Those biases are mainly caused by three heuristics (i.e. rule of thumb), namely availability heuristic, representativeness heuristic and anchoring and adjustment heuristic.

sentiment and managerial overconfidence/optimism respectively. Overconfidence is not only a well-established but also an important bias that is relevant to managerial decision making. Plous (1993) argues that "no problem in judgement and decision making is more prevalent and more potentially catastrophic than overconfidence" (cited in Glaser and Weber, 2010).

1.1.1 The importance of irrational manager approach

This thesis focuses on the irrational manager-rational investor approach because of the importance of managerial (especially CEO) effects on corporate decisions (e.g. Bertrand and Schoar, 2003; Bennedsen, Perez-Gonzalez and Wolfenzon, 2011; Frank and Goyal, 2007). Roll (1986) proposes hubris hypothesis in the context of merger and acquisitions. However, behavioural corporate finance is still under-researched, as mentioned in Heaton (2002) that "behavioral approaches are now common in asset pricing, of course, but little work in corporate finance has dropped the assumption that managers are fully rational. This is somewhat surprising considering that the common objections to behavioral economics have less vitality in corporate finance than in asset pricing".

Heaton (2002) provides several reasons why it is more plausible to assume that financial markets are more rational or less optimistic than managers. First, arbitrage against market mispricing due to investors' irrationality is easier than against managerial irrationality. For example, corporate takeover, as an arbitrage of managerial irrationality, is associated with high transaction costs and idiosyncratic risks (Heaton, 2002). Second, it is less likely for managers to learn from past experience to be more rational. This is because corporate decisions (e.g. financing and investment) are much less frequent than investors' trading decisions. More importantly, the outcome of a particular managerial decision is much more difficult to be observed. Therefore, the learning process of managers is less effective in reducing irrationalities than that of investors.[3] Third, agents tend to be more optimistic if they are highly committed to the task and they believe that outcome is under their control. This is particularly true for senior managers who are responsible for firm decisions and whose personal portfolio is less diversified.

[3] Hackbarth (2008) also argues that many managerial decisions are not well suited for learning since the feedback on the quality of their decisions is often "delayed and vague".

Besides, regarding drivers of overconfidence, both the process of CEO selection and high executive compensation may contribute to managerial overconfidence. In terms of CEO selection, Goel and Thakor (2008) develop a model showing that overconfident managers are more likely to be promoted to CEO than their rational counterparts. On the other hand, Paredes (2004) models managerial overconfidence as a product of executive compensation. The rationale is that managers attribute recent "success", as signalled by high compensation, to their own abilities, which in turn leads to higher level of confidence (see section 3.1.7 for more discussions on the relationship between managerial overconfidence and compensation).

1.2 Theoretical Foundations: Managerial Overconfidence and Corporate Financing

This thesis also provides a rigorous review of existing behavioural capital structure theories (see chapter 2). Besides, we propose a more comprehensive version of market timing theory, namely Market Timing Matrix (MTM). The main objective is to show how managerial overconfidence can be incorporated into standard financing models, which in turn generate testable predictions on the roles of overconfidence in various aspects of financing decisions.[4]

Major implications of behavioural capital structure models can be outlined as follows:

- Heaton's (2002) model provides a reinterpretation of information asymmetry-based pecking order theory. His model suggests that managerial overconfidence can be an alternative explanation of the preference for internal over external financing and the preference for debt over equity;

- Hackbarth's (2008) model distinguishes between the roles of optimism (i.e. growth perception bias) and overconfidence (i.e. risk perception bias). In particular, optimism is associated with enhanced pecking order preference[5], while

[4] Hypotheses tested in this thesis are developed in subsequent empirical studies (see chapter 5, 6 and 7).
[5] Pecking order preference refers to a preference for internal over external financing and a preference for debt over equity financing.

overconfidence leads to reverse pecking order preference. In addition, he shows that, in a trade-off framework, overconfidence causes underestimation of bankruptcy cost, which in turn increases leverage and therefore mitigate agency cost of equity (i.e. free cash flow problem).

- Consistent with Heaton's (2002) model, Malmendier, Tate and Yan's (2011) model also predicts a relationship between managerial overconfidence and the standard pecking order. A unique prediction of Malmendier, Tate and Yan's (2011) model is that overconfidence is associated with debt conservatism, meaning that overconfident managers may be reluctant to use debt or retain more earnings and therefore avoid using debt.

- Hackbarth's (2009) model shows that, in a real-options framework, optimism/overconfidence can mitigate agency costs of debt including both the underinvestment problem (i.e. debt overhang) and asset substitution and risk shifting.

- Existing behavioural capital structure theories incorporate managerial overconfidence into either the pecking order or trade-off framework. However, we argue that managerial overconfidence can be easily incorporated into Baker and Wurgler's (2002) market timing theory which assumes that managers are rational. We propose a more comprehensive version of market timing theory, namely the Market Timing Matrix (MTM). The key prediction of MTM is that managerial overconfidence may lead to perceived mispricing which induces overconfident managers to repurchase their firms' shares which they believe are undervalued by the market.

1.2.1 Research questions

We contribute to behavioural capital structure literature by examining the impacts of time-varying managerial overconfidence on various corporate financing decisions including (1) capital structure, (2) pecking order behaviour and (3) the debt maturity decision. Importantly, our empirical analysis is based on some new theoretical

frameworks and modified empirical models. More specifically, this thesis attempts to address the following main questions:

1.2.1.1 Empirical study 1: capital structure decision (chapter 5)

- Can managerial overconfidence help to explain the capital structure puzzle? In other words, whether managerial overconfidence has incremental explanatory power for capital structure decision?
- Empirically test Malmendier, Tate and Yan's (2011) competing propositions on the relationship between managerial overconfidence and leverage, i.e. whether managerial overconfidence has a positive or negative effect on leverage?
- Is managerial overconfidence associated with debt conservatism and therefore a potential explanation of the low leverage puzzle?

1.2.1.2 Empirical study 2: pecking order preference (chapter 6)

- Is managerial overconfidence a potential driver of the pecking order preference? More specifically, does managerial overconfidence enhance or weaken pecking order preference?
- What is the impact of managerial overconfidence on firms' financing (repurchase) decisions when there is a financing deficit (surplus)?
- Can managerial overconfidence help to explain the pecking order puzzle (size anomaly)?

1.2.1.3 Empirical study 3: debt maturity decision (chapter 7)

- Is managerial overconfidence a determinant of the corporate debt maturity decision?
- Empirically test competing theories on the relationship between managerial overconfidence and debt maturity, i.e. whether managerial overconfidence has a positive or negative effect on debt maturity?
- Is managerial overconfidence favourable from debt investors' perspective?

1.3 Empirical Challenges and Managerial Overconfidence Measures

However, managerial biases are not directly observable. The major challenge of empirical examination of managerial overconfidence is therefore to develop clean and valid proxies for this bias. In contrast to existing studies, we articulate the importance of using a time-varying rather than a static measure of managerial overconfidence for the following two reasons. First, existing behavioural finance studies tend to examine managerial overconfidence in isolation and assume that overconfidence is static. However, in the presence of another common managerial bias (i.e. self-attribution bias), managers may "learn to be overconfident" (Hirshleifer, 2001; Gervais and Odean, 2001). Self-attribution bias is regarded as "endogenous overconfidence". Thus, the level of managerial overconfidence tends to be time-varying.[6]

Second, behavioural corporate financing theories suggest that the effects of overconfidence can be non-linear, e.g. mild overconfidence is beneficial while excessive overconfidence may be detrimental. For example, in Hackbarth's (2009) behavioural capital structure model, mild overconfidence is associated with reduced agency costs of debt (underinvestment problem). Time-varying measures allow empirical testing of the non-linear effect of overconfidence. Furthermore, another challenge is to empirically distinguish between managerial overconfidence and two alternative perspectives including information asymmetry and agency problem. Chapter 3 provides a comprehensive review of various measures of managerial overconfidence.

1.3.1 Our measures of managerial overconfidence

We attempt to gauge the biased beliefs of managers based on their words (i.e., what managers said) and actions (i.e., what managers did). A key difference between our measures of overconfidence and commonly used stock option-based and press-based

[6] One may argue that only "selected events" (see Daniel, Hirshleifer and Subrahmanyam, 1998) will lead to time-variations in the level of overconfidence. However, the main purpose of this thesis is not to identify the events that may lead to time-variations in managerial overconfidence. Put differently, the focus of the analysis is not on the events or outcomes that boost managerial overconfidence. In particular, we are not suggesting that financing decisions are the source of time-varying overconfidence rather the financing decision could be a consequence of it. In addition, DHS (1998) are mainly concerned with investor overconfidence while this thesis focuses on managerial overconfidence.

overconfidence measures is that we capture time-variation in the level of managerial overconfidence.

1.3.1.1 Managerial words-based measure of overconfidence

The words-based overconfidence measures are constructed by conducting computational linguistic analysis (content analysis) of Chairman's Statement in the UK annual report. More specifically, we create over six language dimensions that are closely related to the construct of optimism, which allows us to check the validity of our measures by constructing a composite index using principal component analysis (PCA). The idea is that overconfident managers are more likely to use optimistic words in their accounting narratives.

1.3.1.2 Managerial action-based measure of overconfidence

The action-based overconfidence measures are based on the insider trading of UK managers (i.e. how managers trade their own firm's shares). The rationale is that overconfident managers who are optimistic about firm's future performance are more (less) likely to buy (sell) their firm's stocks. We have the insider trading data of CEO, CFO and Chairman, which enable us to compare the effects of overconfidence of different senior managers.

1.4 Empirical Tests and Contributions

As mentioned above, the main objective of this thesis is to examine *to what extent managerial overconfidence, as a key element of the irrational manager approach of behavioural capital structure, can help explain firm financing decisions*. This section summarizes testable hypotheses developed based on behavioural capital structure theories and our major empirical findings and contributions.

1.4.1 Empirical study 1: capital structure decision

This chapter examines the impact of managerial belief on capital structure. Computational tone analysis of Chairman's Statement is used to gauge time-varying managerial overconfidence. We find that optimistic tone is negatively related to leverage. This finding provides initial empirical evidence consistent with Malmendier,

Tate and Yan's (2011) proposition that managerial overconfidence may lead to debt conservatism. The negative tone-leverage relationship is similar across firms with different degree of information asymmetry and information environment, ruling out two alternative explanations of tone (i.e. information asymmetry and impression management).

We further investigate the joint effects of insider trading, as another window into managerial belief, and tone on leverage. As expected, high insider purchase (selling) confirms (contradicts) optimistic tone, which in turn enhances (weakens) the negative tone-leverage relationship. Overall, this study establishes a link between managerial optimistic words and conservative debt policy, which may help to explain the low leverage puzzle: some firms maintain low leverage, without taking the tax benefits of debt, because of overconfidence-induced debt conservatism.

1.4.2 Empirical study 2: pecking order behaviour

This chapter examines whether managerial overconfidence enhances or weakens pecking order preference. We construct time-varying managerial words-based (i.e. tone of Chairman's Statement) and action-based (i.e. insider trading and firm investment) measures of overconfidence. Both optimistic tone and industry-adjusted investment have significant and negative impacts on the pecking order coefficient in the Shyam-Sunder and Myers (1999) regression framework, suggesting that managerial overconfidence leads to *reverse* pecking order preference. This new evidence is consistent with Hackbarth's (2008) theory that overconfident managers with "risk perception bias" tend to believe that their debt (equity) is undervalued (overvalued) and therefore prefer equity to debt financing. This observed overconfidence-induced reverse pecking order preference also corroborates our earlier finding that optimistic tone is negatively associated with leverage.

We also find that the effect of managerial overconfidence on the reverse pecking order preference is particularly strong for firms with higher earnings volatility, which confirms that "risk perception bias" is the underlying channel through which overconfidence weakens pecking order preference. Furthermore, we find that the effect of overconfidence on the reverse pecking order preference is especially strong for small

firms. In other words, overconfident managers in those small firms are reluctant to follow the standard pecking order behaviour, in which case managerial overconfidence contributes to the pecking order puzzle (or pecking order size anomaly i.e. small firms with higher information asymmetry surprisingly exhibit weaker pecking order preference relative to large firms). In addition, the effects of insider trading-based measures of managerial overconfidence are, however, relatively weak and less consistent, which is probably because insider (especially CEO) trading is driven by information asymmetry and thus is not a perfect proxy for managerial overconfidence. Overall, this study supports the proposition that managerial overconfidence is an underlying driver of reverse pecking order preference especially for small firms, which partly explains the pecking order puzzle (or size anomaly).

1.4.3 Empirical study 3: debt maturity decision

This chapter examines the impact of managerial overconfidence on corporate debt maturity. We hypothesize that overconfidence can increase debt maturity. The intuition is that overconfidence can mitigate the underinvestment problem (Hackbarth, 2009) which is often the major concern of long-term debt investors. The reduced agency cost of debt, in turn, allows overconfident managers to use more and cheaper long-term debt. Our empirical evidence is based on time-varying overconfidence measures (i.e. first person pronouns and optimistic tone) constructed using computational linguistic analysis. Interestingly, the changes of both first person singular pronouns and optimistic tone are positively related to the change of debt maturity consistent with our main hypothesis.

Further support for our main hypothesis is provided by demonstrating: i) that the overconfidence-debt maturity relationship is strongest for the director who most influences investment decision, the CEO, based on their insider trading behaviour and ii) that overconfidence-debt maturity relationship strengthens for firms with high growth opportunities (where the agency cost of debt is exacerbated). Overall, our study provides initial and consistent evidence for a positive overconfidence-debt maturity relationship via overconfidence mitigating the agency cost of long-term debt.

In summary, the major contributions of this thesis are threefold. *First*, we develop time-varying managerial overconfidence measures, which allow us to examine the impact of the changes in managerial overconfidence on the changes of debt level and debt maturity structure. *Second*, although previous empirical studies also suggest that managerial overconfidence is an important determinant of corporate financing decisions, we provide initial empirical evidences which are different from those documented in the literature but are consistent with behavioural corporate financing theories. In particular, we are the first to document that managerial overconfidence is negatively related to leverage and that managerial overconfidence (especially the "risk perception bias") is associated with reverse pecking order preference. *Third*, we propose an agency cost of debt hypothesis based on Hackbarth (2009) that rationalizes the positive relation between managerial overconfidence and debt maturity.

1.5 Structure of the Thesis

This thesis proceeds as follows. Chapter 2 presents the conceptual framework with a particular focus on the theoretical effects of managerial overconfidence on firm financing decisions. Chapter 3 shows and evaluates various ways managerial overconfidence can be operationalized and chapter 4 discusses how specific estimation methods are selected based on both certain capital structure theories and the characteristics of our data. Chapter 5, 6 and 7 are three empirical studies examining the impacts of managerial overconfidence on capital structure, pecking order behaviour and debt maturity respectively. These three empirical chapters are by and large self-contained. Chapter 8 concludes the thesis by summarizing the key contributions, potential limitations and providing suggestions for future research.

CHAPTER 2

Behavioural Capital Structure Theories: The Effects of Managerial Overconfidence

Chapter 2. Behavioural Capital Structure Theories: The Effects of Managerial Overconfidence

2.1 Introduction

This chapter provides a review of behavioural capital structure theories and importantly we propose a more comprehensive market timing theory, namely Market Timing Matrix (MTM).[7] In particular, we compare and discuss behavioural models that incorporate managerial overconfidence/optimism in market timing, trade-off and pecking order frameworks. The purpose of this review is to show that the irrational manager approach of behavioural capital structure matters - it can *complement* standard capital structure theories and therefore has important implications for firm financing decisions.[8]

Furthermore, this review articulates the interactions among standard theories of capital structure. This leads to interesting testable hypotheses. For example, managerial overconfidence influences market timing behaviour which in turn affects the dynamic adjustment speed of capital structure and pecking order preference. This review also provides a solid foundation for our development of testable hypotheses related to more specific financing decisions (level of leverage, choice between debt and equity, choice between short-term and long-term debt, etc.) in the subsequent empirical chapters (Chapter 4, 5 and 6).

2.2 Standard Capital Structure Theories and Their Interactions

Standard capital structure theories provide useful frameworks to analyse the effects of behavioural bias on financing decisions. Therefore, we first provide an overview of standard capital structure theories and their building blocks (e.g. tax, bankruptcy costs,

[7] Gider and Hackbarth (2010) provide an excellent review of two important behavioural financing models (Hackbarth, 2008; Hackbarth; 2009). However, we attempts to offer a more comprehensive review on behavioural capital structure theories by including important discussions on market timing theory (here, we propose a more comprehensive market timing theory, namely Market Timing Matrix (MTM), which incorporates managerial overconfidence) and other behavioural models by Heaton (2002), Malmendier, Tate and Yan (2011) and Baker and Wurgler (2012).

[8] For example, Hackbarth (2008) incorporates managerial overconfidence into the trade-off framework and Heaton's (2002) model shows that managerial overconfidence provide a re-interpretation of information asymmetry-based pecking order theory.

agency costs and information asymmetry). Many previous studies tend to consider different theories of capital structure as competing theories and attempts to empirically identify the theory that can explain the data best. However, empirical literature shows that major capital structure theories can explain some but not all empirical patterns. In this section, we first briefly introduce three major capital structure theories: trade-off theory, pecking order theory and market timing theory.

2.2.1 Standard capital structure theories

Modigliani and Miller's (MM) (1958) seminal work forms the basis of modern capital structure theories. (See e.g., Harris and Raviv (1991), Myers (2003) and Frank and Goyal (2011) for reviews on standard capital structure theories.) This section discusses major capital structure theories which have been developed by relaxing some key assumptions of MM theorem (e.g. there are no tax, bankruptcy costs, information cost, agency costs, etc.).

2.2.1.1 Modigliani-Miller theorem (without and with taxes)

We first describe MM propositions without corporate taxes (Modigliani and Miller, 1958) and then incorporate the role of corporate taxes (Modigliani and Miller, 1963). *MM Proposition I (without taxes)* suggests that the market value of a firm is not influenced by its financing decisions. According to Proposition I, the market value of the firm (V) can be represented as the sum of the market value of equity (V_E) and debt (V_D), i.e., $V = V_E + V_D$, and the value of unlevered (V_U) and levered (V_L) firms are the same, i.e., $V_U = V_L$. This means that capital structure is irrelevant to firm's market value. The intuition is that the size of a pie is not determined by how the pie is sliced. In other words, firm value is determined by investment rather than financing decisions, assuming that those two decisions are completely separated.

MM Proposition II (without taxes) shows that the cost of equity of levered firms (K_E) is equal to the cost of unlevered equity (K_U) plus a financial risk premium that is the spread between K_U and risk-free rate (r) multiplied by the debt-to-equity ratio (D/E). In MM Proposition II, cost of levered equity can be shown as follows: $K_E = K_U + (K_U - r)(D/E)$. This equation suggests that cost of equity is positively related to the debt-to-equity ratio. This is because debt financing will increase shareholders' risk.

However, the above arguments ignore corporate taxes[9]. Taking effective corporate taxes (T_C) into consideration, *MM Proposition I (with taxes)* becomes $V_L = V_U + T_C D$, where $T_C D$ is the present value of tax shields[10] which makes the value of levered firms higher than that of unlevered firms. This is because interest payment reduces tax payment and therefore increases shareholders' wealth.

MM Proposition II (with taxes) can be written as $K_E = K_U + (K_U - r)(1 - T_C)(D/E)$. This equation also shows that cost of equity will increase with debt level. However, in the presence of corporate taxes, MM propositions suggest that firm value is positively related to debt level and thus is optimal to adopt an all-debt capital structure. However, this proposition ignores bankruptcy and agency costs associated with debt and therefore might not be realistic.

Although MM theorem provides a probably oversimplified view of financing, recognizing its underlying assumptions[11] may help to identify the factors (i.e. frictions/market imperfections) that can make financing value relevant. In the subsequent sections, we further relax assumptions of MM theorem by incorporating various frictions including bankruptcy costs, agency problems, information asymmetry and investor and managerial irrationalities. We particularly focus on one friction: managerial overconfidence.

2.2.1.2 Trade-off theory

Trade-off theory is developed based on Modigliani and Miller's (1958, 1963) seminal work. The central idea of trade-off theory is that two alternative sources of financing (i.e. debt and equity) are associated with various costs and benefits and therefore optimal leverage can be identified when the marginal costs equal marginal benefits.

[9] Here, we do not consider personal taxes. However, personal taxes will reduce net tax saving because at the personal level interest income is taxed while capital gain is not taxed.

[10] The present value of tax shield ($T_C D$) is calculated as follows: $T_c(rD)/r = T_C D$, where tax savings are discounted at the cost of debt (r).

[11] Modigliani-Miller's (1958) irrelevance theorem is based on several strong assumptions (e.g. there are no taxes, bankruptcy costs, agency costs, information asymmetries, etc.).

This section first introduces tax benefit and bankruptcy cost of debt and then describes agency costs of debt and equity.

a. Tax benefit of debt vs. bankruptcy cost of debt

Trade-off theory suggests that financing decisions are based on the trade-off between tax benefits and bankruptcy costs associated with debt financing (Kraus and Litzenberger, 1973). Debt financing can be beneficial because interest payment is tax deductible, meaning that interest payments will reduce taxable income (especially for profitable firms). In terms of the bankruptcy costs of debt, there are direct and indirect costs and the latter is usually more considerable. Firms with higher debt levels will have a higher probability that they may not be able to pay their debt holders and consequently go bankrupt. The direct cost is associated with the bankruptcy process (e.g., legal and administrative fees). More importantly, highly leveraged firms may also suffer from various indirect costs of financial distress that are difficult to quantify. For example, customers may stop buying products from financially distressed firms and employees are less willing to work for those firms. This is because, as Titman's (1984) model suggests, bankruptcy can impose costs on its customers, workers and suppliers.

b. Agency costs of debt and equity

In addition to tax benefit and bankruptcy costs of debt, agency costs of debt and equity may also influence firms' optimal leverage. In particular, from an agency perspective, managers should compare the agency costs of debt (overinvestment and underinvestment problem) and the agency cost of equity (free cash flow problem).

Asset substitution and debt overhang: Both debt and equity are associated with agency problems. On one hand, the conflict of interest between debt holders and shareholders may lead to overinvestment and underinvestment problems. Overinvestment refers to shareholders' incentive to invest in risky projects at the expense of debt holders, which is also known as "asset substitution" (Jensen and Meckling, 1976). This can be regarded as a risk-shifting strategy where shareholders gain most if the risky project generates high returns while debt holders bear the costs if the project fails. In anticipating this suboptimal investment behaviour, bond holders demand a higher risk premium, which increases cost of debt. Another form of conflict between debt holders and shareholders is underinvestment or "debt overhang" problem (Myers, 1977). Shareholders may want

to forgo some value-enhancing investment if debt holders capture most of the gains from the investment. In brief, debt financing is subject to two types of agency costs, which makes firms less willing to use debt.

Free cash flow problem: On the other hand, the conflict of interest between managers and shareholders may cause free cash flow problem (Jensen, 1986). Self-interested managers have the incentive to invest the free cash flow in "empire building" that can increase their power but decrease shareholders' value. In this case, debt plays a disciplinary role because debt payment reduces the amount of free cash flow available for those self-interested managers. Therefore, debt financing has the benefit of reducing agency costs of free cash flow. To sum up, debt financing may increase agency costs associated with both overinvestment and underinvestment problems but decrease agency cost of free cash flow. Therefore, firm's optimal capital structure can also be determined by balancing between the agency costs of debt and equity.

In sum, trade-off theory implies that there is some optimal target leverage where the marginal benefits of debt (tax shields and disciplinary role of debt) equal its marginal costs (bankruptcy costs and agency costs of overinvestment and underinvestment problems). To maximize firm value, firms need to adjust their current leverage toward their target leverage. However, trade-off theory only provides an incomplete picture of potential costs and benefits associated with debt and equity. Therefore, other capital structure theories including pecking order theory and market timing theory may interact with trade-off theory, which jointly influence leverage adjustment.

2.2.1.3 Pecking order theory

Pecking order theory is first proposed by Donaldson (1961), which suggests that there is a preference for internal financing over external financing (including both debt and equity) and if internal financing is not sufficient debt is preferred to equity. It is important to recognize that the pecking order preference is conditional. The most widely cited condition is information asymmetry, as developed by Myers and Majluf (1984). The idea is that the pecking order preference is driven by information costs associated with different sources of financing. In particular, internal financing is subject to zero information cost. However, in terms of external financing, equity is more likely to be undervalued by outside investors and therefore has higher information cost than debt.

Therefore, equity is only used as a last resort. Put differently, the information asymmetry problem can be considered as the conflict between existing shareholders, who have an information advantage, and future investors. In contrast to the prediction of trade-off theory, there is not target leverage according to pecking order theory.

The pecking order preference might also be conditional on other factors (e.g. transaction costs, agency costs, tax and managerial overconfidence). This thesis focuses on managerial overconfidence as a potential condition of pecking order preference. Heaton's (2002) model suggests that overconfident managers who believe that external financing (especially equity) are undervalued by outside investors and therefore tend to have a standard pecking order preference. (Chapter 6 provides a review of empirical studies on various factors (e.g. market timing, information asymmetry) influencing the degree of pecking order preference using modified Shyam-Sunder and Myers (1999) method.)

2.2.1.4 Market timing theory

More recently, Baker and Wurgler (2002) articulate and empirically test a market timing theory of capital structure. The idea is simply "buy low and sell high". More specifically, a firm will issue more equity when its managers believe that the firm stocks are overvalued. This proposition is consistent with Graham and Harvey's (2001) survey evidence that two-thirds of CFOs in their sample take equity mispricing into consideration when making equity issuance decisions. The underlying assumption is that managers are rational and are able to take the benefit of market mispricing which is mainly a product of investor irrationalities. In brief, capital structure can be seen as the accumulative outcome of past attempts to time the equity market (Baker and Wurgler, 2002).

Another type of market timing is based on time-varying information asymmetry. Korajczyk, Lucas and McDonald's (1992) model predicts that firms tend to issue equity following information releases which mitigate Myers and Majluf's (1984) adverse selection problem. In contrast to the key prediction of trade-off theory, market timing theory does not imply the existence of an optimal leverage target.

However, this thesis articulates that Baker and Wurgler's (2002) market timing theory might be incomplete in the sense that it does not incorporate managerial irrationalities (especially managerial overconfidence). We will propose a more comprehensive market timing theory, namely "Market Timing Matrix" (see section 2.4.4 for a detailed description of this theoretical framework).

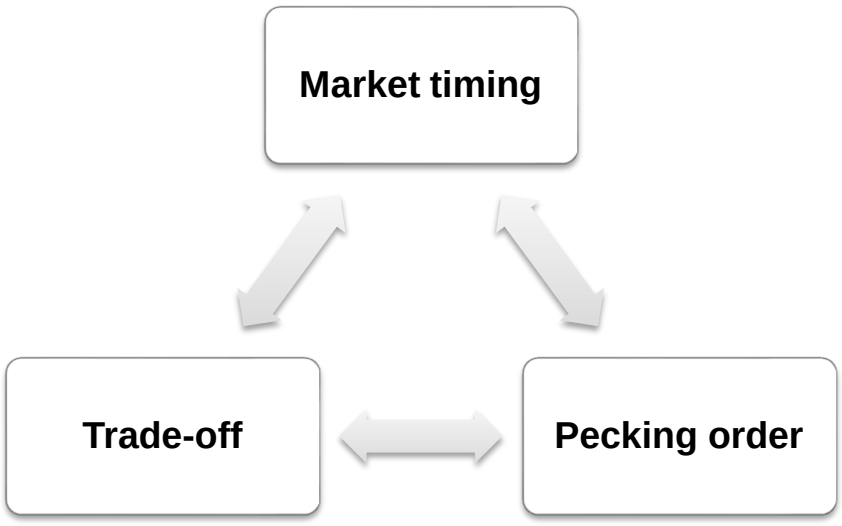
2.2.2 Interactions among main capital structure theories

More importantly, we articulate and discuss the interactions among standard capital structure theories. We believe that all capital structure theories are useful in the sense that they shed light on various *costs and benefits associated with different choices of financing*. In other words, capital structure theories can be complementary rather than competing. For example, trade-off theory suggests there is a long-run optimal target debt level, while market timing theory might help explain the speed of adjustment to the target.

More specifically, corporate financing decisions are often made where various costs and benefits, as suggested by multiple theories, are taken into consideration. That is why there are potential interactions among capital structure theories (see Figure 2.1 below), which will be explained in the following sections.

Figure 2.1 Interactions between capital structure theories

This figure shows the interactions among three major capital structure theories. More specifically, the interaction between trade-off and pecking order is explained in section 2.2.2.1 (see **Table 2.1**); the interaction between trade-off and market timing is explained in section 2.2.2.2 (see **Table 2.2**) and the interaction between pecking order and market timing is explained in section 2.2.2.3 (see **Table 2.3**).



2.2.2.1 Interaction between trade-off and pecking order: financing deficit and dynamic adjustment (see Table 2.1)[12]

Financing deficit affects the leverage adjustment speed. More specifically, underleveraged firms with a financing deficit and overleverage firms with a financing surplus are more likely to use debt. This pattern is consistent with Byoun's (2008) empirical evidence that "most of the adjustments occur when firms are above target with a surplus or below target debt with a financial deficit". This is because debt issuance is driven by both the incentive to reduce the deviation from target leverage and a pecking order preference for debt over equity to meet financing needs.

Table 2.1 Interaction between financing deficit and leverage adjustment

Interaction between trade-off and pecking order		Pecking order	
		Financing deficit	Financing surplus
Trade-off	Underleveraged	$\uparrow \boldsymbol{D}$ **or** $\downarrow \boldsymbol{E} + \uparrow \boldsymbol{D}$ **Higher SOA**	$\uparrow D$ *or* $\downarrow E + \downarrow D$ Lower SOA
	Overleveraged	$\downarrow D$ *or* $\uparrow E + \uparrow D$ Lower SOA	$\downarrow \boldsymbol{D}$ **or** $\uparrow \boldsymbol{E} + \downarrow \boldsymbol{D}$ **Higher SOA**

Note: "$\uparrow D$" and "$\uparrow E$" represent debt and equity issuance respectively, while "$\downarrow D$" and "$\downarrow E$" represent debt and equity buyback respectively. "+" means joint effect. The left side of "+" shows the prediction of trade-off theory while the right side of "+" shows the prediction of pecking order theory. SOA refers to the speed of adjustment.

2.2.2.2 Interaction between trade-off and market timing: market timing and dynamic adjustment (see Table 2.2)

Market timing opportunity (i.e. firm stock mispricing) affects the leverage adjustment speed. In particular, the adjustment speed is higher for underleveraged firms whose stocks are undervalued and overleveraged firms whose stocks are overvalued. The reason is that both market timing opportunity and trade-off between tax benefits and bankruptcy may jointly influence the speed of leverage adjustment. This proposition is consistent with the argument that "*capital structure adjustment speeds should respond to some of the market timing variables previously identified in the literature as affecting leverage levels*" Faulkender *et al*. (2012, p 641). Empirically, Warr *et al*. (2012) test the interaction between market timing and the trade-off theory. They suggest that the rate of adjustment towards target leverage depends on whether the firm is undervalued or

[12] Also see Table 1 in Byoun (2008).

overvalued. In particular, the target adjustment is more rapid when the firm's leverage is above (below) the target and the firm is overvalued (undervalued).

Table 2.2 Interaction between market timing and leverage adjustment

Interaction between trade-off and market timing		Market timing	
		Overvalued	Undervalued
Trade-off	Underleveraged	$\uparrow D$ *or* $\downarrow E + \uparrow E$ Lower SOA	$\uparrow \boldsymbol{D}$ **or** $\downarrow \boldsymbol{E} + \downarrow \boldsymbol{E}$ **Higher SOA**
	Overleveraged	$\downarrow \boldsymbol{D}$ **or** $\uparrow \boldsymbol{E} + \uparrow \boldsymbol{E}$ **Higher SOA**	$\downarrow D$ *or* $\uparrow E + \downarrow E$ Lower SOA

Note: "↑ D" and "↑ E" represent debt and equity issuance respectively, while "↓ D" and "↓ E" represent debt and equity buyback respectively. "+" means joint effect. The left side of "+" shows the prediction of trade-off theory while the right side of "+" shows the prediction of market timing theory. SOA refers to the speed of adjustment.

2.2.2.3 Interaction between pecking order and market timing: market timing and pecking order preference (see Table 2.3)

Both market timing and information asymmetry may influence the degree of pecking order preference. In particular, firms with financing deficit are more likely to follow pecking order (i.e. the preference for debt over equity) when their stocks are undervalued. Elliott *et al*. (2007) empirically test the effect of equity mispricing on the pecking order behaviour. They report that the degree of overvaluation (undervaluation) is positively related to the proportion of the firm's financing deficit that is funded with equity (debt). Their evidence suggests that market timing affects pecking order preference, especially the preference for debt over equity.

Table 2.3 Interaction between market timing and pecking order

Interaction between pecking order and market timing		Market timing	
		Overvalued	Undervalued
Pecking order	Financing deficit	$\uparrow D + \uparrow E$ Weakened PO	$\uparrow \boldsymbol{D} + \downarrow \boldsymbol{E}$ **Enhanced PO**
	Financing surplus	$\downarrow \boldsymbol{D} + \uparrow \boldsymbol{E}$ **Enhanced PO**	$\downarrow D + \downarrow E$ Weakened PO

Note: "↑ D" and "↑ E" represent debt and equity issuance respectively, while "↓ D" and "↓ E" represent debt and equity buyback respectively. "+" means joint effect. The left side of "+" shows the prediction of pecking order theory while the right side of "+" shows the prediction of market timing theory. PO refers to pecking order.

However, those costs and benefits are difficult to value, the perceptions of which are therefore subject to managerial biases. That is why behavioural capital structure theories become an important and necessary complement to the standard theories.

2.3 Main Facets of Overconfidence

Ackert and Deaves (2010) define overconfidence as "the tendency for people to overestimate their knowledge, abilities, and the precision of their information, or to be overly sanguine of the future and their ability to control it" (see Ackert and Deaves (2010) for a more detailed description of various strains of overconfidence). From the above definition, we can see that overconfidence has many facets including, for example, miscalibration, better-than-average effect and illusion of control. Therefore, the word "overconfidence" has often been used in a broad sense that it subsumes several aspects of overconfidence. In addition, overconfidence and another related concept, i.e. optimism, are often used interchangeably in the behavioural finance literature. This section first briefly introduces various forms of overconfidence as a psychological bias and then shows how overconfidence/optimism is formally modelled in the context of corporate financing.

2.3.1 Miscalibration

Miscalibration is one of the most well-established forms of overconfidence and it can be defined as the tendency to overestimate the precision of people's own knowledge. This form of overconfidence has been documented in Fischhoff, Slovic and Lichtenstein (1977) that participants tend to be overconfident about their knowledge when answering questions of moderate to extreme difficulty. Tversky and Kahneman (1974) attribute miscalibration to anchoring. In particular, narrow confidence interval[13] constructed around an answer is due to insufficient adjustment from an anchor (i.e. an initial estimate). In a financial context, Ben-David, Graham and Harvey (2013) measure miscalibration of senior financial executives by asking their views on future stock market. They find evidence that financial executives are subject to miscalibration. More specifically, they document that less than 40 percent of the time the actual market

[13] Miscalibration test is often conducted by asking the participants to construct confidence intervals for their answers. Overconfidence is detected if their intervals are too narrow.

returns are within the executives' 80 percent confidence interval[14] meaning that their subjective confidence intervals are too narrow.

2.3.2 Better-than-average effect

Another common form of overconfidence is called better-than-average effect. This effect means that people tend to believe that they are better than average in terms of their abilities or positive personal attributes. In other words, people tend to have unrealistically positive views of the self (see Taylor and Brown (1988) for a more detailed description). For example, Svenson (1981) reports that 82 percent of a sample students believe that they are top 30 percent in terms of driving safety. Taylor and Brown (1988) conclude that most individuals see themselves as not only better than the average person but also better than others see them.

2.3.3 Illusion of control

Illusion of control is also considered as one form of overconfidence. This means that overconfident people tend to overestimate the control they have over events and outcomes. Langer (1975) defines the phenomenon of "illusion of control" as "an expectancy of a personal success probability inappropriately higher than the objective probability would warrant". Langer's (1975) experimental evidence suggest that the participants become more confident and more willing to take risks when factors from skill situations (e.g. competition, choice, stimulus or response familiarity, or passive or active involvement) are introduced into chance situations which are not controllable. In other words, when a chance situation mimics a skill situation, people tend to behave as if they are able to influence the outcome of uncontrollable events. For example, in one experiment of the effect of choice on illusion of control, participants strongly prefer the case when they are allowed to choose their own lottery tickets. However, in fact, this choice will not change the likelihood of winning the lottery but lead to illusion of control.

[14] An 80 percent confidence interval means that the executive is 80 percent sure that the stock returns will be within a particular range provided by him/her.

2.3.4 Excessive optimism

Another closely related but distinct psychological bias is excessive optimism. Different from overconfidence which leads to overestimation of the precision of one's knowledge/information and ability, excessive optimism makes people overestimate the probability of good outcomes and underestimate the probability of bad outcomes. Weinstein (1980) provides experimental evidence of the existence of excessive optimism. In his experiment, students are asked to estimate their chance of experiencing positive and negative future events respectively relative to their classmates. He finds that students tend to believe they are more likely to experience positive events and less likely to experience negative events than their classmates. Weinstein (1980) attributes this unrealistic optimism to the tendency that the students focus on what they can do to improve their chances of achieving positive outcomes without realizing that their classmates may also be able to take the same actions. This underlying mechanism of excessive optimism seems closely related to illusion of control.

2.3.5 Self-attribution bias: "endogenous overconfidence"

Overconfidence bias is durable partly because people fail to learn from past failures or mistakes. Instead, people may learn to be overconfident (Gervais and Odean, 2001). This is because people often interpret their performance in a biased manner, namely self-attribution bias. In particular, People with self-attribution bias tend to attribute good outcomes to personal factors (e.g. ability), while attributing bad outcomes to external factors that are not controllable (Miller and Ross, 1975). In brief, self-attribution bias may contribute to the durability and level of overconfidence.

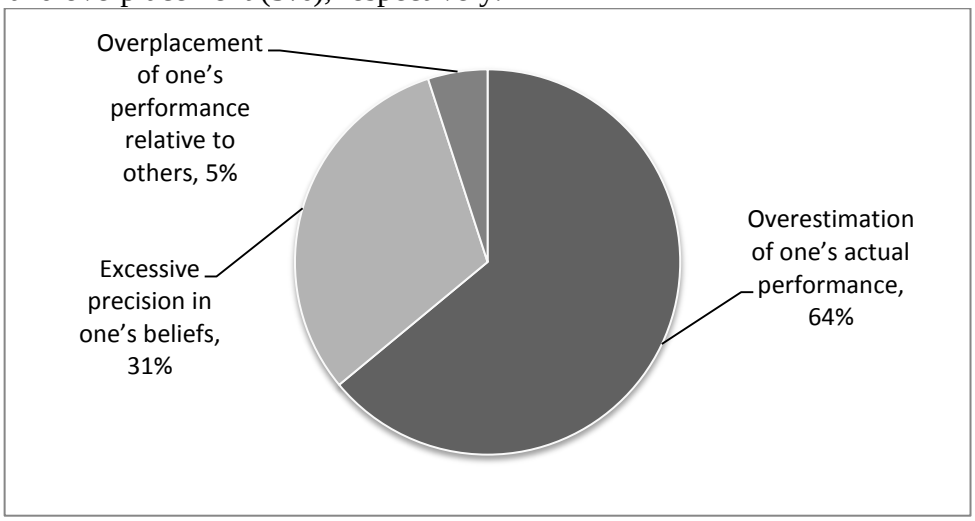
To sum up, given various manifestations of overconfidence, it is challenging to empirically distinguish between different forms of overconfidence considering that there might be some overlaps among various facets of overconfidence. As argued by Ackert and Deaves (2010) that "it is not always easy to tease out the different strains of overconfidence". However, this is an important empirical issue because different facets of overconfidence may have different implications for financing decisions. In what follows, we will describe how overconfidence is modelled and incorporated into capital structure theories and its predicted influences on financing decisions.

2.3.6 Definitions of overconfidence in empirical studies

Given multiple facets of overconfidence, empirical studies on overconfidence may focus on different aspects of overconfidence. As expected, Moore and Healy (2008) raise the concern that "overconfidence has been studies in inconsistent ways", meaning that existing empirical studies are based on three distinct definitions of overconfidence (see Figure 2.2). In particular, they report that around 64 percent of empirical studies examine "overestimation of one's actual ability, performance, level of control, or chance of success". Roughly 31 percent of empirical overconfidence studies are related to "excessive certainty regarding the accuracy of one's belief". The remaining 5 percent of studies focus on better-than-average effect. Consequently, different types of overconfidence may have distinct empirical implications. However, Moore and Healy (2008) further point out that many researchers treat all three types of overconfidence as if they are the same and are related to the same underlying psychological problems. Similarly, Gervais (2010) also argue that overconfidence and optimism[15] are typically used and discussed interchangeably in the finance literature, although those two biases are "technically distinct". Fortunately, in many cases the effects of overconfidence and optimism are similar. Gervais (2010) show the similar effects of these two biases on capital budgeting and therefore also discuss both biases interchangeably.

Figure 2.2 Three definitions of overconfidence

This figure shows the percentages of previous studies on overconfidence that focus on one of three facets of overconfidence, namely overestimation (64%), overprecision (31%) and overplacement (5%), respectively.



Source: based on the information from Moore and Healy (2008)

[15] Gervais (2010) considers overconfidence as miscalibration and optimism as overestimation of the likelihood of favourable future events.

2.4 Behavioural Capital Structure Theories

Next, we provide an overview of major behavioural capital structure theories. We first briefly compare how overconfidence and optimism are modelled in the finance context and then discuss various behavioural financing models and their main implications.

2.4.1 Definitions (modelling approaches) of overconfidence and optimism

In a review paper on behavioural finance, Shefrin (2010) defines optimism as overestimation of the first moment of cash flows or returns and overconfidence as underestimation of the second moment (i.e. risk). More specifically, Table 2.4 compares how optimism and overconfidence are modelled in the behavioural corporate finance literature. Although same terms (optimism/overconfidence) have been used in those models, their definitions (i.e. modelling approaches) are not identical. In particular, optimism is modelled as *overestimation* of probability of good firm performance (Heaton, 2002), growth rate of earnings (Hackbarth, 2008), growth rate of assets in place (Hackbarth, 2009), value of firm's assets and investment opportunities (Baker and Wurgler, 2012) and probability of good project (Landier and Thesmar, 2009).

On the other hand, the definitions of overconfidence are even less consistent. Overconfidence is modelled as either *underestimation* of riskiness of earnings (Hackbarth, 2008) and riskiness of assets in place (Hackbarth, 2009) or *overestimation* of mean returns to investment (Malmendier, Tate and Yan, 2011) and precision of own information (Gervais, Heaton and Odean, 2011). Different modelling approaches will lead to differing predictions. For example, Hackbarth's (2008) model distinguishes between optimism (i.e. "growth perception bias") and overconfidence ("risk perception bias") which have different effects on firm's financing decisions. However, as summarised by Gervais (2010, p417), "despite the fact that overconfidence and optimism are technically distinct, the two biases are often taken to mean the same thing in the finance literature". In the following sections, we will discuss the roles of overconfidence and/or optimism in various behavioural finance models. (In this thesis, we use overconfidence and optimism interchangeably except in the pecking order context where the effects of these two biases are different (see section 2.4.5).)

Table 2.4 Definitions of overconfidence in behavioural corporate finance models

This table summarizes how overconfidence and/or optimism are modelled in behavioural corporate finance (mainly financing-related) models.

Terms used	Definitions (modelling approaches)	Contexts	References
Optimism	"Managers are "optimistic" when they systematically overestimate the probability of good firm performance and underestimate the probability of bad firm performance."	Financing; pecking order; free cash flow	Heaton (2002) FM
Optimism	"growth perception bias" i.e. "optimistic managers overestimate the growth rate of earnings"	Financing; trade-off; pecking order	Hackbarth (2008) JFQA
Overconfidence	"risk perception bias" i.e. "overconfident managers underestimate the riskiness of earnings"		
Optimism	"Optimistic managers overestimate the growth rate of assets in place."	Financing; agency problem	Hackbarth (2009) JCF
Overconfidence	"Overconfident managers underestimate the riskiness of assets in place."		
Overconfidence	"overestimation of mean returns to investment"	Financing; pecking order; debt conservatism	Malmendier, Tate and Yan (2011) JF
Optimism	"We assume the manager is optimistic about the value of the firm's assets and investment opportunities."	Financing and investment (market timing and catering)	Baker and Wurgler (2012)
Optimism	"Optimists do not have realistic a priori beliefs on the project's type. *Ex ante*, they believe the project is good with probability 1."	Debt maturity	Landier and Thesmar (2009) RFS
Overconfidence	"individuals overestimate the precision of their information or their ability to interpret that information when they make economic decisions"	Investment and compensation	Gervais, Heaton and Odean (2011) JF

Next, we compare existing behavioural capital structure theories. First, we present a simple model of non-fundamental effects, i.e. the effect of non-fundamental factors including managerial overconfidence, limited intermediation and corporate opportunism on the supply and demand of equity capital. Second, we review more specific behavioural capital structure models. We propose a more comprehensive market timing theory (namely "Market Timing Matrix"), where managerial overconfidence is incorporated into Baker and Wurgler's (2002) market timing framework. We further show how existing behavioural models incorporate managerial overconfidence into pecking order and trade-off frameworks. We will particularly focus on empirical predictions generated by various behavioural capital structure theories.

2.4.2 A simple model of non-fundamental effect[16]

This section presents a simple model including all the building blocks of non-fundamental effects. Our model incorporates managerial overconfidence into Baker's (2009) work on capital market driven corporate finance. The model shows how a combination of investor sentiment, managerial overconfidence, limited intermediation and corporate opportunism may affect the supply and demand of equity capital respectively, and thus have an impact on firms' capital structure in equilibrium.

First, from the supply side of equity market, investors' supply of capital (Q^s) is determined by (see Baker, 2009):

$$Q^s = (\emptyset - P)K + [(\emptyset + \delta) - P]k \qquad (2.1)$$

where, $\emptyset$ is firm fundamentals; P is the price of equity; δ is investor sentiment; K is the capital of rational intermediaries; k is the capital of irrational investors.

[16] Many previous studies on capital structure assume that investors and managers are rational and try to examine the relationship between firm fundamental characteristics, such as profit, size, tangible assets, growth, tax, etc., and firm leverage, which can be called fundamental effect. However, the non-fundamental effect (i.e. the impact of investor and managerial irrationalities on capital structure, especially equity issuance) is under-researched and may add incremental explanatory power.

In standard corporate finance, we assume that the capital of rational intermediaries ($K \to \infty$) dominates the capital of irrational investors (k). As a result, any price deviations from the fundamentals will be eliminated by those competitive intermediaries through capital market arbitrage. However, in a more realistic case of limited intermediation ($K < \infty$), which is a broader notion of limits to arbitrage, investor sentiment can generate mispricing, which also affect the supply of equity capital.

Second, from the demand side of equity market, firms' demand of capital (Q^D) is:

$$Q^D = a + b[P - (\emptyset + \mu)] + c\emptyset \tag{2.2}$$

where, μ is managerial overconfidence, the coefficient b represents corporate opportunism.

From the perspective of standard corporate finance, there is no managerial overconfidence ($\mu = 0$) and prices reflect fundamentals ($P=\emptyset$), therefore, the demand of capital is only determined by firm fundamentals ($Q^D = a + c\emptyset$). However, from behavioral perspective, prices deviate from fundamentals because of the combination of investor sentiment and limited intermediation, and the managers are also subject to overconfidence bias. The coefficient b, called corporate opportunism, suggests that managers are trying to take advantage of their perceived mispricing. Equation (2.2) also shows that managerial overconfidence (μ) is negatively related to the demand of equity financing (Q^D).

From Equation (2.1), we obtain the inelastic price of equity:

$$P = \emptyset + \frac{k}{K + k}\delta - \frac{1}{K + k}Q^S \tag{2.3}$$

By substituting P in Equation (2.3) into Equation (2.2) we get the amount of equity issues in equilibrium:

$$Q^E = Q^S = Q^D = a' + b'(\frac{k}{K+k}\delta - \mu) + c'\emptyset, \text{where } x' = x\frac{K+k}{K+k+b} \quad (2.4)$$

From Equation (2.4), we may conclude that the firms' level of equity issued in equilibrium is determined by a combination of investor sentiment, managerial overconfidence, limited intermediation, and corporate opportunism. In particular, investor sentiment, the degree of limited intermediation (i.e. the proportion of the capital of irrational investors) and corporate opportunism are negatively related to firm leverage, while managerial overconfidence has a positive effect on leverage.

2.4.3 Irrational investor approach vs. irrational manager approach

Next, we show the effects of investor and managerial irrationalities in a market timing and catering framework. In Baker and Wurgler's (2012) survey on behavioural corporate finance, they present market timing and catering models incorporating investor and managerial irrationalities respectively.[17] Their models, however, do not consider standard frictions including tax, bankruptcy cost, agency costs and information asymmetry.

2.4.3.1 Irrational investor-rational manager approach

We first introduce their model with irrational investors who make firms' stocks mispriced and therefore create market timing opportunities for rational managers. According to Baker and Wurgler (2012), rational managers have three conflicting goals: (1) maximization of firm fundamental value, (2) catering (i.e. maximization of current firm share price) and (3) market timing (i.e. exploit current market mispricing). Balancing the above three goals, the objective function of a rational manager is[18]:

[17] Following Baker and Wurgler's (2012) modelling approach, Shefrin (2010) provide a simple model that incorporates both investor and managerial irrationalities that sheds light on the optimal decision of overconfident managers in an inefficient market with irrational investors.

[18] It is assumed that investment and financing decisions are independent.

$$\max_{K,e} \lambda[f(K;\cdot) - K + e\delta(\cdot)] + (1-\lambda)\delta(\cdot)$$

$$\max_{K,e} \lambda \left[\underbrace{f(K;\cdot) - K}_{fundamental\ value} + \underbrace{e\delta(\cdot)}_{market\ timing\ gains} \right] + (1-\lambda) \underbrace{\delta(\cdot)}_{temporary\ mispricing} \tag{2.5}$$

where K is new investment, $f(K;\cdot)$ is a function of investment and financing, which specifies the present value of future cash flow, $(f(K;\cdot) - K)$ represents fundamental value, $\delta(\cdot)$ is temporary mispricing of equity, e is the fraction of the firm sold to exploit market mispricing, $e\delta(\cdot)$ is the gains of existing and long-run shareholders from market timing, λ is a measure of manager's horizon ($\lambda \in [0,1]$).

Optimal financing decision for the rational manager in an inefficient market with irrational investors can be obtained by differentiating the objective function with respect to e:

$$-f_e(K;\cdot) = \delta(\cdot) + (e + \frac{(1-\lambda)}{\lambda})\delta_e(\cdot) \tag{2.6}$$

Equation 2.6 suggests that rational managers will be unwilling to issue stocks when they are under-priced by irrational investors.

2.4.3.2 Irrational manager-rational investor approach

In contrast, Baker and Wurgler (2012) show another similar model based on the assumption that managers are irrational but investors are rational. More specifically, those irrational managers tend to overestimate the value of firm assets and future investment. In addition, irrational managers balance two conflicting goals: (1) maximization of "perceived" firm fundamental value and (2) minimization of "perceived" financing cost. Therefore, the objective function of an irrational manager is:

$$\max_{K,e}(1+\gamma)f(K;\cdot) - K - e\gamma f(K;\cdot)$$

$$\max_{K,e} \underbrace{(1+\gamma)f(K;\cdot) - K}_{perceived\ fundamental\ value} - \underbrace{e\gamma f(K;\cdot)}_{perceived\ market\ timing\ losses} \tag{2.7}$$

where γ represents managerial overconfidence and/or optimism, $\gamma f(K;\cdot)$ is the amount of manager's perceived undervaluation, $e\gamma f(K;\cdot)$ is manager's perceived losses of existing and long-run shareholders from market timing, other parameters have the same definitions as in Equation 2.5.

Optimal financing decision for the irrational/overconfident manager in an efficient market can be obtained by differentiating the objective function with respect to e:

$$(1+\gamma)f_e(K;\cdot) = \gamma(f(K;) + ef_e(K;)) \tag{2.8}$$

Equation 2.8 suggests that overconfident managers will be reluctant to issue equity which they believe to be under-priced.[19]

2.4.4 A more comprehensive market timing theory: Market Timing Matrix

This section develops a more comprehensive market timing theory based on Baker and Wurgler's (2002) market timing theory which assumes that investors are irrational and managers are rational (i.e. irrational investor-rational manager approach). However, the main focus of this thesis is the effect of irrational managers. In particular, we complement Baker and Wurgler's (2002) market timing theory by incorporating managerial overconfidence in firm's market timing decisions.

2.4.4.1 Baker and Wurgler's (2002) market timing theory is incomplete

Baker and Wurgler (2002) articulate and test the market timing theory of capital structure. They claim that "capital structure evolves as the cumulative outcome of past attempts to time the equity market". The purpose of market timing is to exploit temporary fluctuations of the cost of equity by issuing shares at high prices and repurchasing at low prices. The critical assumption of market timing is that 'managers believe that they can time the market'. As argued by Baker and Wurgler (2002), market

[19] This prediction is consistent with Heaton's (2002) model described in section 4.6.

timing will benefit the ongoing shareholders in the company at the expense of entering and existing ones.[20]

However, Baker and Wurgler's argument may overlook an important underlying concept of market timing. Consequently, their definition and the results of market timing suggested by them may be incomplete. Shefrin (2007), in his book *Behavioral Corporate Finance*, emphasises the role of "biased and unbiased perception of mispricing" in market timing.

> "The main behavioral consideration is market timing, meaning buying low and selling high to take advantage of perceived inefficient prices. Executives sell high when they issue equity that they perceive to be overvalued and buy low when they repurchase that they perceive to be undervalued. In this connection, *perceptions are key, being unbiased in some circumstances and biased in others*."

Shefrin (2007) further claims that behavioural approach of capital structure is concerned with both when managers' perceptions are correct/unbiased and incorrect/biased. Therefore, from the behavioural perspective, Baker and Wurgler's (2002) version of market timing theory can be further developed by relaxing their assumption that managers are rational.

2.4.4.2 Further development of behavioural timing theory: Market Timing Matrix

To extend the existing market timing theory, it is important to be explicit about the underlying behavioural assumptions of different versions of market timing that are related to the irrationalities of two major participants of market timing: investors and managers. Baker and Wurgler's (2002) market timing theory assumes that managers are rational and investors are irrational, in which case rational managers with an

[20] However, the results of empirical tests of market timing hypothesis are controversial. Some studies question the persistence of the impact of market timing on capital structure. Leary and Roberts (2005) find that US firms rebalance their capital structure towards a target in three to five years. Studies by Alti (2006), Hovakimian (2006), Flannery and Rangan (2006) and Kayhan and Titman (2007) also suggest that the impact of market timing is short-lived. By contrast, Welch (2004) and Huang and Ritter (2006) argue that the rebalance is very slow and thus the influence of past market timing is long-lived.

information advantage buy or sell their own firm's stocks when they believe that their stocks are mispriced by irrational investors. However, their assumption that managers are rational is not realistic given that managers are even more likely to be subject to cognitive biases (especially managerial overconfidence) (see, e.g., Heaton, 2002). Managerial overconfidence will cause biased perception of mispricing which in turn drives irrational managers' market timing behaviour. In brief, managers' perception of mispricing can be either *unbiased* or *biased*. Taken together, perceived mispricing, as a key reason for market timing, can not only be driven by investor irrationality but also managerial irrationality (or some combination thereof).

Taking various behavioural assumptions on the rationality of investors and managers into consideration, we propose a more comprehensive market timing framework, namely the Market Timing Matrix (MTM), which shows four distinct situations where the participants of market timing can be either rational or irrational (see Table 2.5). In particular, there are rational investor-rational manager approach (Approach I), irrational investor-rational manager approach (Approach II), rational investor-irrational manager approach (Approach III) and irrational investor-irrational manager approach (Approach IV).

Figure 2.3 displays the key mechanisms of two distinct approaches in behavioural finance: (1) Baker and Wurgler's market timing theory (Approach II) and (2) our managerial overconfidence-based market timing theory (Approach III). Part A of Figure 2.3 shows that investor irrationality leads to real stock mispricing that creates market timing opportunity for rational managers who have an unbiased perception about their fundamental values. Rational managers can successfully buy low and sell high and therefore benefit ongoing shareholders of their firm at the expense of existing and entering investors. In contrast, Part B of Figure 2.3 shows that, for irrational managers who are subject to biased perceptions of stock price, managerial irrationality will make the firm lose from attempts at market timing, which can be regarded as market mistiming. This is because managerial timing activities are simply motivated by their biased perceived mispricing, even though the market prices correctly reflect firm fundamentals. In this case, irrational managers may mistime the market (e.g. repurchase when the stocks are overvalued). In brief, investor and managerial irrationalities may lead to equity timing and mistiming respectively. To our knowledge, the latter approach

(i.e. Approach III) has not been articulated in the market timing literature. Our empirical analysis in this thesis is also more related to Approach III.

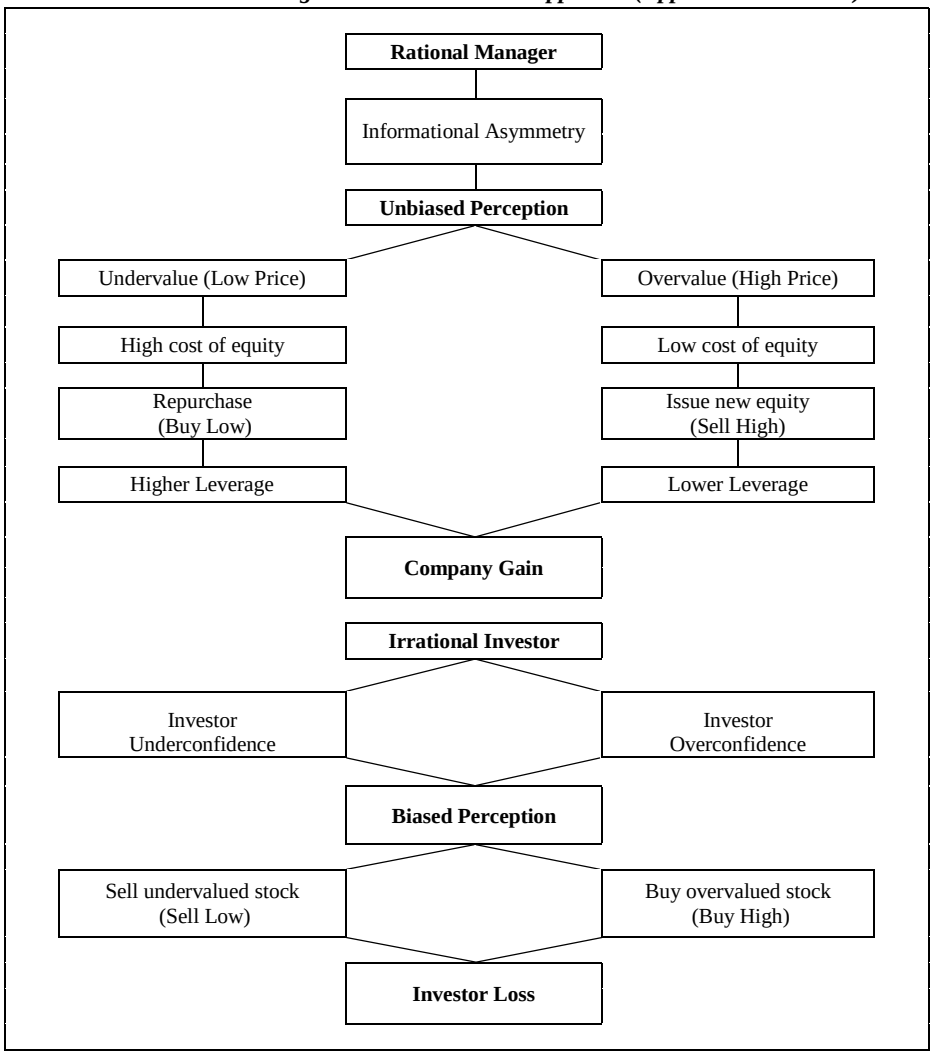
Table 2.5 Market Timing Matrix (MTM) with irrational managers and investors
This table presents a more comprehensive market timing framework. Approach II represents Baker and Wurgler's (2002) market timing theory, which suggests that rational managers with information advantage are able to take the benefit of real mispricing of their firms' stock associated with investor irrationalities. We propose Approach III, in which we relax Baker and Wurgler's (2002) assumption that managers are rational. Instead, we articulate that managerial overconfidence is associated with managers' biased perception of mispricing which in turn leads to market (mis)timing.

Participants of Market Timing (MT)		**Manager**	
		Rational	**Irrational (Overconfidence)**
Investors	**Rational**	**Approach I** **(Both are rational)** **Efficient price** **MT doesn't work** **Time-varying information asymmetry**	**Approach III** **(Irrational manager but rational market)** **Perceived mispricing** **MT takes place** **(benefit the investors[21])**
	Irrational (Overconfidence)	**Approach II** **(Rational manager but irrational market)** **Real mispricing** **MT takes place** **(benefit the company)**	**Approach IV** **(Both are irrational)** **Ambiguity**

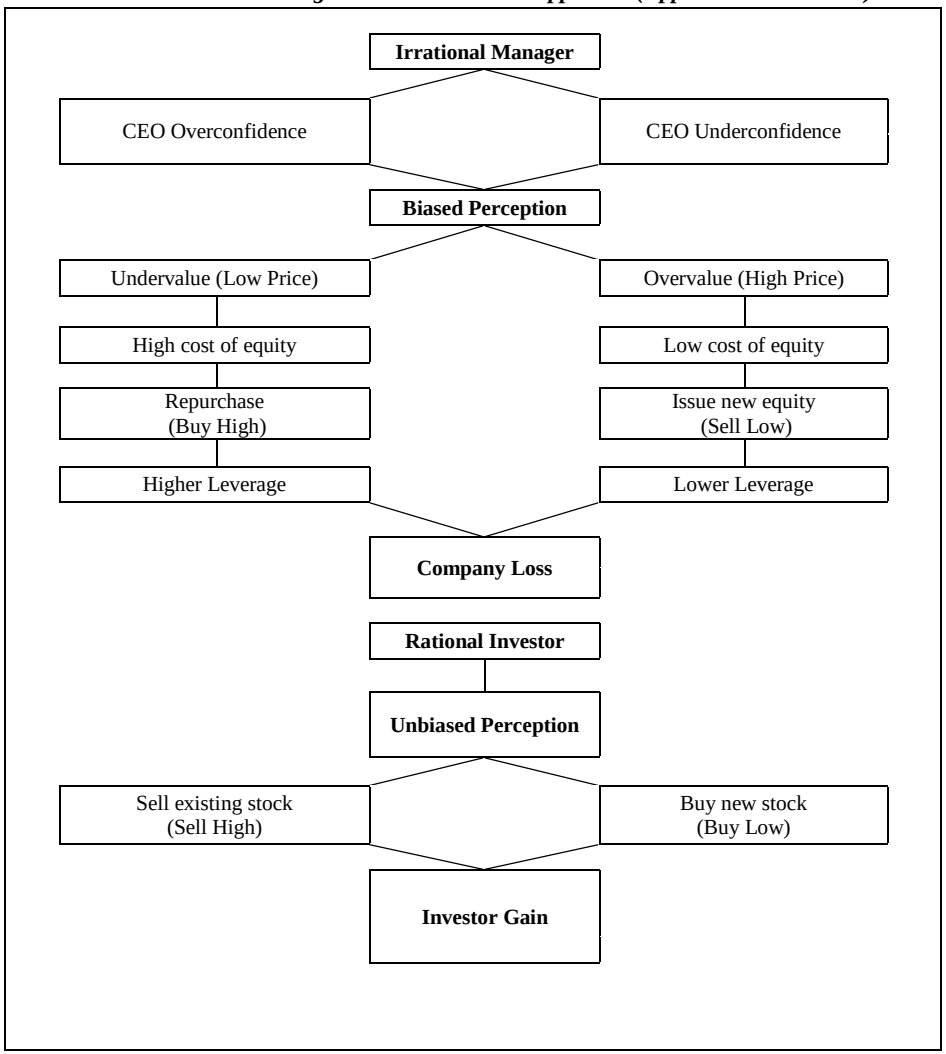
[21] Managerial overconfidence leads to market mistiming, which benefits investors on the other side of the transaction but not shareholders who hold the firm's stock.

Figure 2.3 The impacts of investor and managerial irrationalities on market timing and capital structure

Part A: Rational Manager-Irrational Investor Approach (Approach II in MTM)



Part B: Irrational Manager-Rational Investor Approach (Approach III in MTM)



2.4.5 Optimism vs. overconfidence as a driver of pecking order

Gider and Hackbarth (2010) provide two simple models on the effects of managerial optimism and overconfidence respectively on pecking order preference. Interestingly, their models illustrate that optimism and overconfidence have distinct implications for the choice between debt and equity issuance. In the subsequent sections, we will show why optimism and overconfidence are associated with standard and reverse pecking order preference respectively.

2.4.5.1 Managerial optimism and standard pecking order

Gider and Hackbarth's (2010) optimism model shows that managerial optimism is a driver of standard pecking order preference. In their model, optimistic managers tend to overestimate the likelihood of the good state and underestimate the likelihood of bad state, meaning that the expected future cash flows are overestimated. Optimistic managers think that their firms' securities are undervalued by the market. More specifically, they believe that equity is more undervalued than risky debt. This is because the value of equity is more sensitive to biased beliefs. Therefore, optimistic managers prefer debt to equity. In addition, optimistic managers prefer internal financing that is insensitive to biased beliefs to risky debt. In other words, optimistic managers are reluctant to use external financing. Instead, they will increase retained earnings in anticipation of future investment to avoid issuing debt and equity. Taken together, managerial optimism is associated with a preference for internal over external financing and a preference for debt over equity. This model is similar to Heaton's (2002) model and also provides a reinterpretation of Myers and Majluf's (1984) information asymmetry-based pecking order theory.

2.4.5.2 Managerial overconfidence and reverse pecking order

Different from optimism, Gider and Hackbarth's (2010) overconfidence model predicts a *reverse* rather than standard pecking order preference. In this model, overconfident managers tend to underestimate the value of project in the good state and overestimate the value of project in the bad state, meaning that the project is perceived to be less risky. Overconfident managers believe risky debt is undervalued because they think that debt investors underestimate the payoff in a bad state (e.g. default).

In contrast, overconfident managers believe equity is overvalued. This is because overconfident managers think that equity investors also underestimate the payoff to debt holders and therefore overestimate the residual payoff to equity holders. Put differently, equity can be viewed as a call option[22] on the firm's assets and the value of this call option is partly determined by the risks of firm's project (Gider and Hackbarth, 2010). In particular, the value of call option is positively related to project risk[23]. Therefore, overconfident managers who underestimate the project risk believe that equity is overvalued. Taken together, perceived undervaluation of debt and perceived overvaluation of equity by overconfidence managers leads to a reverse pecking order preference for equity over risky debt. In brief, managerial overconfidence is associated with *reverse* pecking order preference. However, in reality, managers can be both optimistic and overconfident. Recall that optimism and overconfidence may lead to standard and reverse pecking order respectively (as summarized in Table 2.6), firms' actual pecking order preference therefore depends on "the actual mix of the two managerial biases" (Gider and Hackbarth, 2010).[24]

Table 2.6 Distinct impacts of overconfidence and optimism on debt-equity choice

	Debt	Equity	Pecking order preference
Optimism (i.e. higher perceived probability of good outcome)	Perceived undervaluation	Higher perceived undervaluation	*Standard* pecking order: preference for debt over equity

[22] Shareholders have a call option on the firm with an exercise price of *X*. In a call-option graph where the horizontal axis is cash flow to firm and vertical axis is cash flow to shareholders, if firm's cash flow is beyond *X*, shareholders will exercise the option by buying the firm from the debt holders (i.e. owner of the firm) for the price *X*. If firm's cash flow is below *X*, shareholders will not exercise the call option and debt holders receive entire firm's cash flow. (see e.g., Hillier *et al*. (2010) for more descriptions on equity and call option)

[23] As shown in Black-Scholes model, the value of call option is positively related to the variance of the continuous stock returns.

[24] Hackbarth (2008) first explicitly distinguish between optimism (i.e. growth overestimation) and overconfidence (i.e. risk underestimation) and also predict that optimism and overconfidence are associated with standard and reverse pecking order preference, although Hackbarth's (2008) modelling approaches are much more complicated than Gider and Hackbarth (2010).

Overconfidence (i.e. biased perceived future project value)	Perceived undervaluation	Perceived overvaluation	*Reverse* pecking order: preference for equity over debt

Note: this table is based on models presented in Gider and Hackbarth (2010) that distinguish the roles of managerial overconfidence and optimism.

2.4.6 Heaton's (2002) model (perceived information asymmetry)

Heaton's (2002) model shows the impact of managerial overconfidence on corporate financing decisions, which seems to be compatible with pecking order theory. He points out that overconfident managers tend to overestimate the expected return of their firm projects. They believe that the equities and debts issued by the firm are systematically undervalued by outside investors. Therefore, the managers prefer internal rather than external finance. Furthermore, equities are more subject to perceived undervaluation than debt. Therefore, equity financing is only used as a last resort, as suggested by the standard pecking order theory. The model also predicts that the pecking order type of financing decision is more pronounced the more overconfident the managers are, ceteris paribus. Baker, Ruback and Wurgler (2004) also denote that optimistic managers will have a pecking order preference and would never wish to issue new equity.

Heaton (2002) defines managerial optimism as overestimation (underestimation) of the probability of good (bad) firm performance. The good (bad) firm performance refers to good (bad) future cash flow and high (low) payoffs to new projects. More risky securities are more sensitive to probabilistic beliefs and hence are believed by overconfident managers to be more overvalued by the outside investors. Therefore, equity issues are more likely to be affected by managerial overconfidence than debt issues.

In Heaton's (2002) model, the cost of all-equity financing is greater than the cost of all risk-free debt financing because of the biased estimation of future cash flow. The risky debt can be regarded as a combination of risk-free debt and equity. Therefore, the cost of financing, as a weighted average of cost of risk-free debt and equity, is as follows.

$$\frac{w}{K}+\left(\frac{K-w}{K}\right)\left(\frac{K-w}{E_T(y_2)-w}\right)\left(\frac{E_M(y_2)-w}{K-w}\right) = \frac{w}{K}+\left(\frac{K-w}{K}\right)\left(\frac{E_M(y_2)-w}{E_T(y_2)-w}\right)>1 \quad (2.9)$$

where, w is amount of risk-free debt, K is initial investment, subscripts "T" and "M" denote true probability and managerial perception respectively, $E_T(y_2)$ is the expected firm value and $E_M(y_2)$ is manager's perceived firm value at date t=2.

When $w = K$, meaning the initial investment is fully financed by risk-free debt, the cost of financing is the lowest, which equals one. Therefore, the model suggests that overconfident managers will always prefer to issue the security with the largest component of risk-free debt. In other words, the standard pecking order behaviour is followed by overconfident managers.

2.4.7 Hackbarth's (2008) model (trade-off theory)

Hackbarth (2008) incorporates managerial traits (i.e. overconfidence and optimism) into trade-off theory of capital structure. According to Hackbarth's managerial traits theory, managers' irrationalities are reflected on their biased perception of their firm's growth and risk. That is irrational managers are subject to two types of biases: one is growth perception bias (i.e. optimistic managers overestimate the earnings growth); the other is risk perception bias (i.e. overconfident managers underestimate the risk associated with future earnings). His model predicts that overconfident managers tend to issue more debt and their financing decisions need not follow a pecking order.

Managerial traits have implications on both debt-equity mix and debt issuance. With regard to debt-equity choice, managers with growth perception bias may perceive external finance, especially equity, as very costly and therefore have a standard pecking order preference, which is consistent with the prediction of Heaton's (2002) model. In contrast, managers with risk perception bias have *reverse* pecking order preference. The reason is that those managers perceive their firms' equity to be overvalued while believe that debt is undervalued by the market.

Besides, in terms of the impact of managerial traits on debt issuance, it is suggested that both types of biases may lead irrational managers to issue more debt. Those managers believe their firm is more profitable and less risky, which makes them underestimate the likelihood of financial distress. In the light of trade-off theory, managerial irrationalities (i.e. optimism and overconfidence) are positively related to the level of debt issued.

It can be concluded that both the magnitude and the combinations of managerial biases including optimism (i.e. growth perception bias) and overconfidence (i.e. risk perception bias) may affect both pecking order and trade-off behaviours. Therefore, as suggested by Hackbarth (2008), it is necessary to rethink the way capital structure tests are conducted and interpreted.

To sum up, Heaton's (2002) model provides a re-interpretation of information asymmetry-based pecking order theory, suggesting a preference for debt over equity driven by managerial overconfidence. Hackbarth's (2008) model shows that overconfidence and optimism have differing effects on pecking order preference. In addition, Hackbarth's (2008) model predicts that overconfident managers who underestimate bankruptcy cost of debt tend to use more debt for tax benefit.

2.4.8 Malmendier, Tate and Yan's (2011) model (debt conservatism)

More recently, Malmendier, Tate and Yan's (2011) model also shows that managerial overconfidence, which is defined as "overestimation of mean returns to investment", is associated with a standard pecking order preference, which is similar to Heaton's (2002) model prediction. In particular, managerial overconfidence will lead to an unconditional preference for internal over external financing and a conditional (on accessing external financing) preference for debt over equity. However, they articulate that overconfidence may lead to "debt conservatism", meaning that "the absolute amount of debt used by overconfident CEOs can be smaller even if leverage is higher (due to less frequent equity issuance)" (Malmendier, Tate and Yan, 2011). Regarding the overconfidence-leverage relationship, in contrast to the models of Heaton (2002) and Hackbarth (2008), Malmendier, Tate and Yan's (2011) unique prediction is that managerial overconfidence may be either positively or negatively related to leverage. This is because, as argued by Malmendier, Tate and Yan (2011), debt conservatism "*can, but*

need not" imply lower leverage, considering that overconfidence managers are even more reluctant to use equity relative to debt. Table 2.7 summarizes Malmendier, Tate and Yan's (2011) model predictions on the impacts of managerial overconfidence on various aspects of financing decisions.

Table 2.7 Empirical predictions on the effects of overconfidence on financing decisions

This table presents the implications of Malmendier, Tate and Yan (2011) related to two aspects of financing including (i) debt vs. equity issuance (column a and b) and (ii) firm's aggregate indebtedness (column c and d). Column a and b suggest that managerial overconfidence is associated with the preference for debt over equity conditional on using external financing. This prediction is consistent with existing behavioural models (e.g. Heaton, 2002). Column c and d include more unique prediction that managerial overconfidence may explain debt conservatism. In particular, column c predicts that overconfident managers often do not use enough debt to take available tax benefits. Similarly, column d suggests that overconfident managers are reluctant to use debt, which leads to lower leverage.

	(a)	(b)	(c)	(d)	
	Raising new external financing		Aggregate indebtedness		
	Preference for debt vs. equity	Choice between debt and equity given "financing deficit"	Debt level relative to maximum tax benefit available ("Kink")	Leverage	
Overconfidence	Debt	Debt	Low	High	Low

Source: adapted from Malmendier, Tate and Yan (2011)

2.4.9 Managerial overconfidence and agency problem (Hackbarth, 2008, 2009)

Our above discussions suggest that managerial overconfidence is often associated with biased perception and consequently leads to suboptimal financing decisions. However, if overconfidence is always detrimental to firm value, one may ask why firms hire overconfident managers. This is so-called "overconfident manager puzzle" (Hirshleifer *et al*., 2012). This section shows how managerial overconfidence can reduce agency problem in a real-options framework. In particular, in Shefrin's (2010) review paper on behavioural finance, he summarizes that

> "… unrealistic optimism and overconfidence can produce benefits in the presence of agency-related managerial traits that lead to underinvestment, such as risk aversion or debt overhang. (Gervais *et al*., 2003; Goel and Thakor, 2008; Hackbarth, 2009)."

Gider and Hackbarth (2010) also argue that "managerial biases can play a positive role for levered firms because they ameliorate manager-shareholder conflicts and bondholder-manager conflicts". Standard corporate financing theories suggest that agency problems have implications for optimal capital structure. From a behavioural perspective, agency problems serve as channels through which managerial overconfidence has impacts on financing policies. In particular, managerial overconfidence has important influences on agency problems related to (1) the conflicts between manager and shareholders and (2) the conflicts between bondholders and shareholders. This section explains how managerial overconfidence changes agency costs of equity and debt, which in turn affects firm's financing decisions.

2.4.9.1 Manager-shareholder conflicts: agency cost of equity

Managerial overconfidence mitigates a particular form of conflict between manager and shareholders, namely the free cash flow problem, by reducing the amount of free cash flow. This mechanism is called leverage effect. The idea is that overconfident managers underestimate the bankruptcy cost of debt and tend to use more debt than their rational counterparts for tax benefits. The resulting higher debt levels play a disciplinary role and thus reduce agency cost of equity (Hackbarth, 2008).

2.4.9.2 Bondholder-shareholder conflicts: agency cost of debt

Managerial overconfidence can also reduce agency costs of debt. Hackbarth's (2009) model shows that managerial overconfidence can also mitigate two types of agency costs of debt, namely (1) debt overhang and (2) risk shifting and asset stripping, in real options frameworks. Gider and Hackbarth (2010) conclude that

> "… biased beliefs lead to more *favourable* corporate policies from the *bondholders'* point of view: more investment and earlier bankruptcy"

Next, we explain the how overconfidence/optimism can serve as a solution to debt agency problems.

a. Debt overhang

Managerial overconfidence can reduce agency problems associated with the conflict between bondholders and shareholders. Hackbarth (2009) develops agency models of corporate borrowing from a behavioural perspective. His model shows that managerial overconfidence may alleviate debt overhang/underinvestment problem. This can be explained by the timing effect of managerial overconfidence, meaning that overconfident managers invest earlier and more than rational managers. The idea is that overconfident managers underestimate the value of waiting for more information about new investment, which leads to earlier exercise of the option to invest. Therefore, managerial overconfidence reduces the conflict between bondholders and shareholders over the exercise of growth options, that is underinvestment problem.

b. Risk shifting and asset stripping

Also in a real option framework, managerial overconfidence can mitigate another type of agency cost of debt, namely risking shifting or asset stripping. This benefit of managerial overconfidence can also be attributed to the timing effect. In particular, overconfident/optimistic managers underestimate the likelihood of bankruptcy and therefore their perceived option value of waiting to risk shift or asset strip is higher than their rational counterparts. In other words, overconfident/optimistic managers tend to exercise option at relatively lower thresholds, meaning *later* risky new investment decisions and asset sales. Therefore, managerial overconfidence is beneficial, especially from bondholders' perspective, in terms of later risk shifting and asset stripping.

2.5 Conclusion

To conclude, this section summarizes major empirical implications of behavioural capital structure theories discussed in the previous sections. We will present the hypotheses tested in the thesis, which are developed based on tailored behavioural capital structure theories, in the subsequent empirical chapters.

Major implications of behavioural capital structure models can be outlined as follows: (1) Heaton's (2002) model provides a reinterpretation of information asymmetry-based pecking order theory. His model suggests that managerial overconfidence can be an alternative explanation of the preference for internal over external financing and the preference for debt over equity; (2) Hackbarth's (2008) model distinguishes between the roles of optimism and overconfidence. In particular, optimism (i.e. growth overestimation) is associated with enhanced pecking order preference, while overconfidence (i.e. risk underestimation) leads to reverse pecking order preference. In addition, he shows that, in a trade-off framework, overconfidence causes underestimation of bankruptcy cost, which in turn increases leverage and therefore mitigate agency cost of equity (i.e. free cash flow problem); (3) Consistent with Heaton's (2002) model, Malmendier, Tate and Yan's (2011) model also predicts a relationship between managerial overconfidence and the standard pecking order. A unique prediction of Malmendier, Tate and Yan's (2011) is that overconfidence is associated with debt conservatism, meaning that overconfident managers may be reluctant to use debt or retain more earnings and therefore avoid using debt; and (4) Hackbarth's (2009) model shows that, in a real-options framework, optimism/overconfidence can mitigate agency costs of debt including both the underinvestment problem (i.e. debt overhang) and asset substitution and risk shifting.

Existing behavioural capital structure theories incorporate managerial overconfidence into either the pecking order or trade-off framework. However, we argue that managerial overconfidence can be easily incorporated into Baker and Wurgler's (2002) market timing theory which assumes that managers are rational. We propose a more comprehensive version of market timing theory, namely Market Timing Matrix (MTM). The key prediction of MTM is that managerial overconfidence may lead to perceived mispricing which induces overconfident managers to repurchase their firms' shares which they believe is undervalued by the market.

In brief, the empirical predictions regarding the effect of managerial overconfidence are sensitive to the modelling approach adopted (e.g. whether overconfidence is modelled as growth perception bias or risk perception bias in Hackbarth (2008)). In addition, there may be potential non-linear effects of managerial overconfidence, meaning that mild overconfidence and extreme overconfidence have different effects on corporate

policies (see e.g. Hackbarth, 2009). Finally, Table 2.8 shows major behavioural theories reviewed above which are empirically tested in this thesis. Detailed hypotheses development will be presented in the subsequent empirical chapters.

Table 2.8 Behavioural theories tested in our empirical chapters

Empirical chapters	Relevant behavioural financing theories
Leverage	Debt conservatism (Malmendier, Tate and Yan, 2011); trade-off theory (Hackbarth, 2008); Market Timing Matrix (MTM) proposed in this thesis
Pecking order	Perceived information asymmetry (Heaton, 2002); pecking order preference (Hackbarth, 2008; Malmendier, Tate and Yan, 2011); Market Timing Matrix (MTM) which is advanced in this thesis
Debt maturity	Agency cost of debt (Hackbarth, 2009)

Note: not all the implications of behavioural/standard financing theories reviewed in this chapter are empirically tested in this thesis.

CHAPTER 3

Methodology: Empirical Measures (operationalization of managerial overconfidence)

Chapter 3. Methodology: Empirical Measures (operationalization of managerial overconfidence)

This chapter outlines and evaluates various ways in which the key construct of the thesis, i.e. managerial overconfidence, can be operationalized.

3.1 Measures of Managerial Overconfidence

This section shows the rationale for the use of various proxies for managerial overconfidence and discusses the advantages and limitations associated with each of the following proxies:

1. Stock options
2. Media portrayal
3. First-person pronouns
4. Optimistic disclosure tone (composite index)
5. Insider trading (net purchase ratio)
6. Managerial earnings forecast
7. Relative pay and fraction of variable compensation
8. Industry-adjusted investment rate
9. Dividend payment
10. Recent performance
11. Multiple acquisitions
12. R&D expenditure (innovation)

Table 3.1 presents the rationales, advantages and limitations of various types of overconfidence proxies.

3.1.1 Stock option-based measures

The two most commonly used overconfidence measures in the existing behavioural corporate finance literature are based on executive stock options and media portrayal proposed by Malmendier and Tate (2005, 2008). In what follows, we first describe the option-based measures and then discuss its potential limitations and consider its applicability in the UK context.

Based on the personal portfolio decisions of the CEO, Malmendier and Tate (2005, 2008) construct two option-based measures of CEO overconfidence. CEOs who hold options beyond rational thresholds are considered as overconfident. It is often the case

that CEOs held their executive stock options until they are close to expiration. In this case their portfolios are under-diversified. This is mainly because stock and option grants are often a large part of CEO compensation contracts, and more importantly CEOs are prohibited to short sell those stocks. In addition, CEO's reputational (human) capital is also exposed to the firm risk. Therefore, the underdiversification of CEOs' portfolio may indicate that they are overconfident about the company's future stock performance. In particular, Malmendier and Tate (2005, 2008) measure the overconfidence of the U.S. CEOs by looking at whether a CEO exercises options too late. The rationale is that an overconfident executive delays the exercise of in-the-money options in the belief that the firm's stock price will be higher in the future.

3.1.1.1 Option-based measure: Holder67

As proposed by Malmendier and Tate (2005), there are two ways to construct the rational thresholds. One approach is called Holder 67, which is based on the Hall and Murphy (2002) model. The model will be used to calibrate a range of rational benchmarks for exercise given various risk aversion and diversification. Then, those CEOs with options beyond these benchmarks are categorized as overconfident. The Holder 67 measure can be constructed through the following four steps:

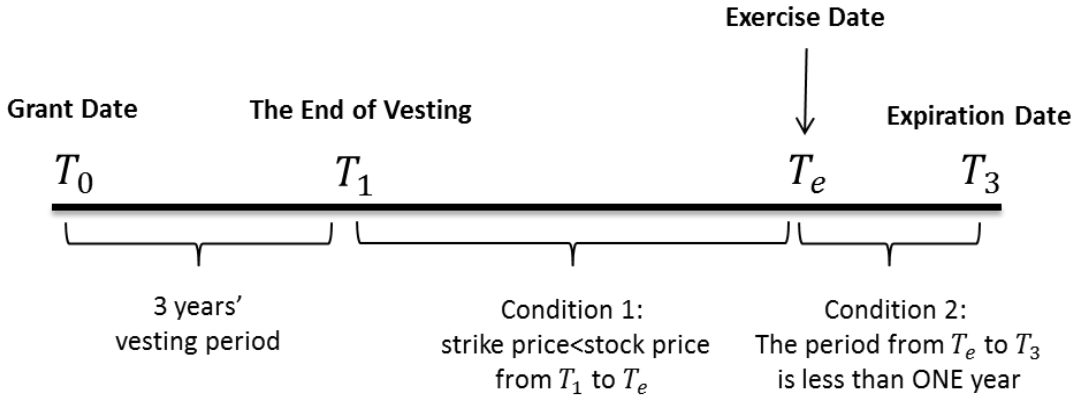
- **Step 1:** Take 67% in-the-money during the fifth year as the threshold (i.e. a rational CEO should have exercised part of its portfolio during or before the fifth year, if the option is over 67% in-the-money in year five).
- **Step 2:** Then pick a subsample of CEOs whose value of options are above the threshold more than twice during the sample period.
- **Step 3:** From the subsample above, identify the first time (if any) when the CEO fails to exercise the option during or before the fifth year.
- **Step 4:** The CEO is classified as overconfident if from that point in time onward he/she continues failing to exercise at least one more time during his/her term as CEO.

3.1.1.2 Option-based measure: Longholder

The other approach is called Longholder. Longholders are the overconfident CEOs who hold the option into final year of its duration. Similar to the Holder 67 measure, it

captures the habitual failure to diversify, which means the overconfidence is not time-varying, as pointed out by Malmendier and Tate (2005). Figure 3.1 illustrates how the option-based measure of overconfidence can be constructed. Items needed to construct the proxy: (1) a list of the names of managers, (2) the date that the stock option was granted to the manager (T_0), (3) the date that exercise of the option could begin (T_1), (4) the exercise date of the option (T_e), (5) the expiration date of the option (T_3), (6) the strike price and (7) company stock price throughout the entire life of the option. (Note: UK executive option has a life span of 10 years and a vesting period of three years). In particular, a manager is classified as overconfident if: (1) he/she holds the option until the expiration date or until the last year before the expiration date and (2) the options are in-the-money (i.e. the company stock price is higher than the strike price) throughout the entire life of the option.

Figure 3.1 Construction of option-based measure of overconfidence



However, Malmendier and Tate's (2005, 2008) option-based proxies are subject to criticisms. Cao (2009) re-examines the impact of CEO option exercise on firm investment. However, according to Cao (2009), CEO option exercise is more related to stock mispricing and firm growth opportunities and therefore is not a clean proxy for managerial overconfidence. Similarly, Jin and Kothari (2008) argue that CEO's persistent holding of options are affected by "a myriad of economic factors" and therefore may not only reflect CEO overconfidence.

3.1.1.3 Continuous option-delay measures

More recently, several U.S. studies (Li *et al.*, 2009; Schrand and Zechman, 2011) propose the option-delay proxy of managerial overconfidence which attempts to

quantify the degree of delay in exercising options based on the value of unexercised exercisable options. Li *et al*. (2009) measure the delay as the intrinsic value of the unexercised exercisable options divided by the total value of unexercised exercisable and unexercisable options and stock holdings. Similarly, Schrand and Zechman (2011) define the option-delay as the natural logarithm of the value of the CEO's in-the-money unexercised exercisable options. The option-delay measures are superior to Longholder and Holder 67 in the sense that they reflect different degrees of overconfidence. However, the option-delay measures are based on Black-Scholes option pricing model and thus subject to various limitations of the model and its assumptions.[25]

3.1.1.4 Why option-based measure might not be valid for UK executives

Kyriacou, Luintel and Mase (2010) point out that "UK executives' need to diversify is less pressing" because of the significant differences in the structure of executive remuneration and regulation. On the one hand, option grants of UK CEOs contribute to a much smaller proportion of their total remuneration, which means that UK CEO's personal portfolio is relatively less undiversified. Conyon and Murphy (2000) estimate that the effective value of US CEOs' total holdings (i.e. the sum of unexercised options and inventive plans) is almost 10 times higher than that of UK CEOs. More recently, Conyon, Core and Guay (2011) compare incentives (including stock holdings and stock options) of US and UK CEOs. They report that US CEOs have much higher incentives than UK CEOs. More specifically, US CEO incentives are 5.6 times higher than UK CEO incentives in the year 2003. Taken together, the remunerations of UK CEOs are less exposed to their firms' stock market performance and hence they have less incentive to diversify by exercising options early.

On the other hand, vesting period of UK executive options is much longer (Kole, 1997), which is associated with less grant value (Hall and Murphy, 2002) and hence less need to diversify. By contrast, it is claimed by Kyriacou, Luintel and Mase (2010) that a unique regulatory regime of the UK, namely "four times emoluments rule", may encourage the UK executives to exercise early. The Rule specifies that the maximum

[25] Black-Scholes model is based on several strong assumptions, which may influence the fairness of the computed option price. For example, continuously compounded stock returns are assumed to be normally distributed and independent over time and there are no transactions costs (see e.g., Hull, 2010).

amount of options a UK executive can hold is four times emoluments including base salaries and bonuses. As a result, we may argue that the rule may provide some incentive for UK executives, especially those whose option value almost hit the "four times emoluments" limit, to exercise part of their existing options in order to receive new stock options.

Taken together, we argue that the distinct remuneration structure and regulation may challenge the applicability of the option-based proxy for managerial overconfidence in the UK. In particular, given the smaller proportion of remuneration from options and longer vesting period, delaying the exercise of options by UK executives may simply because of their reduced desire to diversify rather than overconfidence. Moreover, the "four times emoluments rule" may force some overconfident UK executives to exercise early. (One possible reason that a UK CEO may want to replace the existing options with new options is that the CEO is especially optimistic about the farther future covered by the life of the new options.) In this case, early exercise becomes an indicator of long-term overconfidence. In brief, we conclude that the option-based measure of managerial overconfidence can be contaminated by UK's unique feature of remuneration structure and regulatory regime.

3.1.2 Media coverage approach

This proxy for CEO overconfidence is based on the trait theory, particularly the Five Factor Model (FFM) which is composed of five personality traits: openness, conscientiousness, extroversion, agreeableness and neuroticism. Those factors are measured on a continuous and normally distributed scale (Brown and Sarma, 2007). Overconfidence of each CEO can be calculated by the following formula:

$$Overconfidence = \frac{(a) + (b)}{(c)} \tag{3.1}$$

where the parameters a, b and c are the numbers of articles (e.g. newspapers and business publications) that portray each individual CEO as: (a) "confident"; (b) "optimistic" and (c) "reliable", "cautious", "conservative", "practical", "frugal", "disciplined", "conscientious", "not confident" or "not optimistic"

In practice, the degree of overconfidence can be measured by the following four steps.

- **Step 1:** Collect information on how business press portrayed our target CEOs during the sample period.
- **Step 2:** Five separate searches are conducted for each CEO based on the FFM.
- **Step 3:** Record the number of articles that describe the CEO as (a), (b) and (c) respectively
- **Step 4:** Using the formula above, we get a continuous variable (OC) indicating the degree of overconfidence for each CEO.

However, this press-based proxy of managerial overconfidence has also been criticised because of the highly subjective nature of the judgements made by journalists. As pointed out by Doukas and Petmezas (2007), "any judgment made by a newspaper or journal has a high probability of subjective judgment leading to unreliable conclusions". Furthermore, this problem is more severe for small firms considering limited media coverage (i.e. fewer articles available) of smaller firms. Consequently, the reliability of the press-based measure of CEO overconfidence is also questionable.

3.1.3 Self-attribution bias

We will now introduce self-attribution bias (SAB), a closely related concept to managerial overconfidence. SAB is regarded as an important source of managerial overconfidence. People with self-attribution bias are prone to attribute success (failure) to their own abilities (external factors) (Miller and Ross, 1975). Regarding the relationship between the SAB and overconfidence, Hirshleifer (2001) argues that overconfidence and self-attribution bias can be described as "static and dynamic counterparts". This means that self-attribution bias is related to people's learning process and can make them "learn to be overconfident". In other words, the overconfidence stemming from self-attribution bias can develop over time and therefore the level of this particular type of overconfidence is time-varying.

Theoretically, Gervais and Odean's (2001) model shows that biased self-attribution may contribute to overconfidence. In their model, even those managers born without bias

may become overconfident if they are subject to SAB. Similarly, Daniel *et al*. (1998) model confidence as outcome dependent. In brief, self-attribution bias may feed overconfidence. However, previous behavioural corporate finance literature primarily focuses on the static and exogenous overconfidence.

We measure SAB using computational linguistic analysis. Linguistic analysis of financial narratives is becoming increasingly widely used.[26] Recent accounting and finance studies use several content analysis softwares (e.g., DICTION, LIWC and General Inquirer) to analyse various language dimensions of different narratives,[27] for instance, (1) optimistic vs. pessimistic, (2) positive vs. negative, (3) forward-looking, and (4) the usage of personal pronouns.

3.1.4 Time-varying words-based proxy: optimistic tone

In the presence of self-attribution bias, managers may learn to be overconfident, meaning that the level of overconfidence is time-varying. Therefore, it is important to construct a time-varying measure of managerial overconfidence. A recent study (Garrard, *et al*., 2014) on the linguistic hubris syndrome argue that

> "meaning, emotion and attitude are communicated intentionally through *language*, but *psychological and cognitive changes* can be reflected in more subtle ways, of which a speaker remains unaware".

Considering the above relationship between language and psychological/cognitive bias, we use the optimistic tone of Chairman's Statement as a proxy for overconfidence. The rationale is that the use of optimistic words in financial narratives is driven by managers' overconfidence bias. In practice, this tone measure is constructed using computational content analysis. We postpone a more detailed description of how the tone measures are constructed using content analysis software to section 3.2.2.

[26] This is partly because of the development of content analysis software and the availability of digital financial narratives.

[27] Various texts analysed in the finance and accounting literature include MD&A (Kothari *et al*., 2009; Li, 2010a), CEO interviews (Kim, 2011) and earnings announcement (Rogers *et al*., 2009). For a more comprehensive summary of textual analysis studies, see Appendix A2 in Li (2010b).

However, the optimistic tone is also subject to alternative interpretations. In particular, rational managers may want to use optimistic words to inform investors and therefore reduce information asymmetry. In addition, rational managers are also likely to intentionally disinform investors by using optimistic words to manipulate investors' perception of firm performance (i.e. impression management). (see Chapter 5 for an more detailed review of alternative interpretations of optimistic tone from information asymmetry, impression management and hubris perspectives respectively).

3.1.5 Insider trading-based measure: net purchase ratio

The insider trading patterns of the managers may reflect their perceptions of firms' prospects (Jenter, 2005). Overconfident managers tend to overestimate the firm value and hence are more willing to purchase their own stocks. This trading behaviour can be considered as managers' market timing in their personal portfolios. In the spirit of Malmendier and Tate (2005b)[28], Jenter (2005) and Jin and Kothari (2008), we use insider trading-based measures of managerial overconfidence. More specifically, we construct the net purchase ratio (NPR) as follows:

$$NPR = \frac{insider\ purchase - insider\ selling}{insider\ purchase + insider\ selling} \tag{3.2}$$

The NPR ranges from -1 to 1. If NPR is 1, insiders buy shares without selling; if NPR is -1, insiders sell shares without buying in a particular fiscal year.

However, both insider trading-based measure and stock option-based measure are related to managerial personal portfolio choice and are likely to be motivated by inside information. In particular, rational managers may buy more shares and hold options longer to take the advantage of their superior information about firm value. Therefore, it

[28] Malmendier and Tate (2005) construct a "net buyer" measure of overconfidence based on insider trading. A manager is defined as "net buyer" if his/her net purchase ratio (NPR) is positive for more than two years out of the first five sample years. However, the "net buyer" proxy captures habitual/persistent rather than time-varying managerial overconfidence.

is important to empirically rule out information asymmetry as an alternative explanation of a higher net purchase ratio.[29]

3.1.6 Managerial earnings forecast

Lin, Hu and Chen (2005) propose a measure of overconfidence based on managerial earnings forecast. The idea is that overconfident managers who are optimistic about firm's future profitability tend to make upward-biased earnings forecasts. A manager is considered as overconfident if the number of upwardly-biased forecasts is greater than that of downwardly-biased forecasts during the manager's tenure (Lin, Hu and Chen, 2005). A particular forecast is regarded as upwardly-biased if the forecast error is positive, where forecast error is defined as follows:

$$Forecast\ error = managerial\ earnings\ forecast - actual\ earnings \qquad (3.3)$$

However, factors other than overconfidence, including information asymmetry, market timing, managerial skills and luck, are also likely to influence the sign and magnitude of the forecast errors. More specifically, as mentioned in Lin, Hu and Chen (2005), rational managers tend to release biased forecasts in the following three situations: (1) upwardly-biased forecast will be released prior to equity offerings to increase share prices and therefore reduce the cost of equity, (2) upwardly-biased forecasts will be released prior to insider selling to take the benefit from price increase and (3) managers of financially distressed firm also have more incentive to publish upwardly-biased forecasts. Consequently, considering that it is empirically challenging to rule out all rational managerial incentives, earnings forecast might not be a clean proxy for managerial overconfidence.

3.1.7 Executive compensation-based proxy

Managerial overconfidence could also be related to two aspects of CEO compensation: one is the pay of the CEO relative to other executives and the other is the convexity of CEO compensation contract (i.e. the proportion of variable pay).

[29] One way to examine whether the NPR is contaminated by information asymmetry is to conduct subsample analysis and see how sensitive the relationship between NPR and the dependent variable (e.g. leverage) is to various proxies for information asymmetry.

3.1.7.1 Relative pay

Hayward and Hambrick (1997) use CEO relative compensation as a proxy for CEO's self-importance, which is regarded as a driver of CEO hubris. Chatterjee and Hambrick (2007) use the relative pay as a measure of CEO narcissism. In addition, Paredes (2004) theorize that CEO overconfidence is a product of corporate governance, in particular, their own executive compensation package. He emphasizes the psychological effect of CEO pay, that is, high compensation provides positive feedback to the CEO and also signals recent success, both of which contribute to CEO overconfidence. The CEO pay-based proxy can be calculated as follows:

$$RELATIVE\ PAY = \frac{CEO\ pay}{2nd\ highest\ Pay} \tag{3.4}$$

There are two versions of relative pay based on cash and non-cash compensation respectively. Specifically, relative cash pay is defined as CEO's cash compensation including salary and bonus divided by that of the second highest-paid executive. Alternatively, relative non-cash pay is defined as CEO's non-cash compensation such as deferred income, stock grants and stock options (using Black-Scholes valuation) divided by that of the second highest-paid executive (alternatively, the denominator can be the pay of the top four executives except the CEO). However, relative pay is also subject to an alternative interpretation. Bebchuk, Cremers and Peyer (2011) use CEO pay slice (i.e. CEO's relative pay among top-five executives) as a proxy for CEO power/dominance, which captures the relative importance of CEO's abilities and power in the top management team.[30]

3.1.7.2 Variable pay

Moreover, the composition of CEO compensation, especially the fraction of variable (i.e. performance-based) compensation, is determined by managerial overconfidence (Gervais, Heaton and Odean, 2011). The idea is that overconfident managers tend to

[30] Jiraporn, Chintrakarn and Liu (2012) find that CEOs' power, as measured by their relative pay, has a significant and negative impact on firm leverage. However, if their CEO power measure captures CEO overconfidence, the negative relationship between CEO power and leverage is likely to be partly driven by managerial overconfidence.

underestimate the risks associated with highly variable pay and therefore prefer highly convex [31] compensation contracts. The fraction of variable compensation can be constructed as follows:

$$VARIABLE\ PAY = \frac{Bonus}{Bonus + Salary} \tag{3.5}$$

However, there is a non-linear relationship between managerial overconfidence and compensation contracts. In particular, mild overconfidence will reduce the fraction of variable pay (Gervais, Heaton and Odean, 2011). In contrast, extreme overconfidence will increase the fraction of variable pay.

3.1.7.3 Alternative explanations of equity-based compensation (EBC)

However, the above compensation-based measure of overconfidence is also subject to alternative explanations. For example, previous studies (e.g., Datta, Iskandar-Datta and Raman, 2001; Datta, Iskandar-Datta and Raman, 2005) on the effect of equity-based compensation (EBC) show that high EBC may enhance manager-shareholder alignment. In particular, Datta, Iskandar-Datta and Raman (2001) document that a high EBC firms pay lower acquisition premium and have better postacquisition stock price performance. This evidence suggests that EBC is not a valid proxy for managerial overconfidence which will lead to value-destroying acquisitions. In addition, Datta, Iskandar-Datta and Raman (2005) further show that high EBC leads to a more negative market reaction to seasoned equity offerings. This is because future shareholders believe that managers with high EBC have more incentive to issue overvalued stocks for the benefit of existing shareholders. In brief, compensation structure can be more related to agency problems rather than managerial overconfidence.

3.1.8 Industry-adjusted investment rate

Campbell, Gallmeyer, Johnson, Rutherford and Stanley (2011) classify CEOs as overconfident if their firm is in the top quintile of firms based on industry-adjusted investment rates for two consecutive years. The idea is that overconfident managers

[31] "Highly convex compensation contracts" means that the fraction of variable compensation is high.

tend to overinvest and therefore higher IAIR may indicate that the manager of a particular firm is overconfident. Given that the industry median is a proxy for the optimal level of investment for a particular sector, the investment rate is adjusted by the Datastream's Level 4 (INDM4) industry median. In particular, industry-adjusted investment rate is defined as the difference between a firm's investment rate and the median investment rate of the firms in the same INDM4 industry as follows:

$$IAIR_{it} = IR_{it} - \overline{IR_{s,it}} \tag{3.6}$$

where, IR_{it} is the investment rate of firm i. $\overline{IR_{s,it}}$ is the average investment rate of industry s. The investment rate is defined as the ratio of capital expenditures to beginning of year property, plant and equipment. Alternatively, we define the investment rate as the ratio of capital expenditures to beginning of year sales.

However, the problem with the investment-based measure of overconfidence is that it may fail to capture managerial overconfidence because overconfidence may be associated with underinvestment. Managerial overconfidence may lead to underinvestment especially when internal financing is not sufficient and perceived benefits from the investment are less than perceived cost of external financing by overconfident managers (Malmendier, Tate and Yan, 2011).

3.1.9 Dividend payment

Baker, Ruback and Wurgler (2007) argue that the relationship between dividend policy and managerial overconfidence depends on whether the overconfident managers are more optimistic about future cash flow or investment opportunities. In particular, if the managers overestimate future cash flow, dividend payment will more likely to be maintained. However, if the managers believe that there will be more investment opportunities and therefore increasing financing needs, they may want to retain more earnings and hence not initiate dividends.

Baker and Wurgler (2004) articulate and test the catering theory of dividends. The catering theory of dividends predicts that firms will initiate dividends when the stocks of existing dividend payers are relatively overvalued by the investors (i.e. there is a

positive dividend premium being paid). It might be the case that non-payers with overconfident managers may attribute their perceived underpricing to non-payment of dividend. Therefore, the catering theory seems to imply that overconfident non-payers are more likely to initiate dividends.

Furthermore, Deshmukh, Goel and Howe (2013) develop a more direct model of the relationship between managerial overconfidence and dividend policy. They hypothesize that dividends provide information about managerial overconfidence. More specifically, their model predicts that dividend payment is negatively related to managerial overconfidence, which is supported by their empirical evidences. They find that the negative relationship is more pronounced in the firms with less growth opportunities, lower cash flow and greater information asymmetry. In brief, the relationship between managerial overconfidence and dividend payment is not conclusive. That is why dividend payment is probably not a suitable proxy for managerial overconfidence.

3.1.10 Multiple acquisitions

Several studies (Malmendier and Tate, 2008) find that managerial overconfidence is associated with more value-destroying merger and acquisitions. Doukas and Petmezas (2007) also document that managerial overconfidence leads to higher frequency of merger and acquisitions. A manager is regarded as overconfident if he/she makes over five acquisitions during the sample period. However, the use of this acquisition-based measure will lead to a much smaller sample size. Consequently, one may not be able to control for firm fixed effects which might be correlated with managerial overconfidence. Another problem is that managers, who do not engage in multiple acquisitions, are also likely to be highly overconfident. This is partly because some overconfident managers of small and young firms may not yet have the ability to acquire another company.[32]

3.1.11 Recent stock performance

Hayward and Hambrick (1997) use recent stock performance as one proxy for managerial overconfidence. The idea is that managers may attribute good stock

[32] Overconfident managers, who underestimate bankruptcy risks, may be more willing to work in small and young firms with more volatile financial performance. In addition, some managers in these types of firms are founders/entrepreneurs who tend to be overconfident.

performance to their superior abilities and therefore become increasingly overconfident. However, stock performance is highly endogeneous, meaning that it may be contaminated by several firm fundamental characteristics (e.g., firm size, growth opportunities and profitability), and therefore is probably not a clean proxy for managerial overconfidence.

3.1.12 R&D expenditure (innovation)

Galasso and Simcoe (2011) examine the relationship between CEO overconfidence and firm innovation. They report that overconfident CEOs perform around 18% more research and development (R&D) than their rational counterparts. Dong, Hirshleifer and Teoh (2012) also document that CEO overconfidence is positively related to the level of R&D expenditure. However, the R&D expenditure is also subject to alternative explanations. For example, large R&D investment might be associated with higher information asymmetry. Barker and Mueller (2002) examine the impact of CEO characteristics on firm R&D spending. They find that R&D spending is negatively related to CEO age and positively related to CEO stockholdings and career experience in marketing and/or engineering/R&D.

Table 3.1 summarizes and compares various overconfidence measures discussed above. The table shows major advantages and limitations of each proxy, which provides a good justification of our choice of overconfidence measures, namely optimistic tone and insider trading-based measure. In brief, the major advantage of our measures relative to other measures is that our measures capture time-varying overconfidence.

Table 3.1 A summary of measures of managerial overconfidence

No.	Measure	Type	Data	Rationale	Advantage	Limitation	References
1	Option exercise	Managerial personal portfolio decision	Executive compensation	Late exercise of options of managers with under-diversified portfolio reveals overconfidence	Widely used and comparability	Alternative explanations: mispricing, growth opportunity and inside information	Malmendier and Tate (2005, 2008)
2	Media portrayal	Outside perception	Newspapers and journal articles	The judgement of journalists and analysts	Widely used and comparability	Highly subjective and biased media coverage	Malmendier and Tate (2008); Brown and Sarma (2007)
3	First person pronouns	Managerial words	Accounting narrative	Self-serving attribution contributes to the level of overconfidence / narcissism	Time-varying overconfidence	Alternative explanations: impression management	Li (2010); Chatterjee and Hambrick (2007)
4	Optimistic tone index	Managerial words	Accounting narrative	Overconfident managers tend to use optimistic words	Time-varying overconfidence	Alternative explanations: information asymmetry and impression management	Developed in this study
5	Insider trading	Managerial personal portfolio decision	Insider trading data	High net insider purchase reveals overconfidence	Easy to construct	Alternative explanations: information asymmetry	Glaser *et al*. (2008); Marciukaityte and Szewczyk (2011)
6	Managerial earnings forecast error	Managerial behaviour	Earnings forecast and actual earnings	Upward-biased earnings forecast indicates overconfidence	Easy to construct	Alternative explanations: information asymmetry, skills and luck	Lin, Hu and Chen (2005)
7	Relative pay	Corporate governance	Executive compensation	High compensation contributes to the level of overconfidence	Easy to construct	Alternative explanations: power and abilities	Hayward and Hambrick (1997)
8	Recent performance	Firm performance	Stock price data	Good recent stock performance contributes to overconfidence	Data availability	Multiple explanations of stock performance	Hayward and Hambrick (1997)
9	Industry-adjusted investment	Firm decision	Accounting data	Investment behaviour is driven by managerial overconfidence	Data availability	Inconsistent overconfidence-investment relationship; alternative explanation: growth opportunity	Campbell *et al*. (2011)
10	Dividend payment	Firm decision	Accounting data	Dividend policy is driven by managerial overconfidence	Data availability	Inconsistent overconfidence-dividend relationship	Deshmukh, Goel and Howe (2013)
11	Multiple acquisitions	Firm decision	M&A data	The propensity of M&A is driven by managerial overconfidence	Easy to construct	Smaller sample size	Doukas and Petmezas (2007)
12	R&D expenditure	Firm decision	Accounting data	Firm innovation activities are driven by managerial overconfidence	Data availability	Industry effect	Galasso and Simcoe (2011)

3.2 Managerial Overconfidence Measures Used In This Thesis

Next, our discussion moves to two managerial overconfidence measures used in our empirical tests. One is based on managerial words, i.e., tone of UK Chairman's Statement and first person pronouns. The other is based on managerial actions, i.e., how managers trade their own firm's shares. In what follows, we introduce how these words-based and action-based measures are constructed.

3.2.1 The importance of using time-varying measure of overconfidence

Static/categorical measures of managerial overconfidence are widely used in the previous literature. However, we articulate that for empirical studies examining the effect of overconfidence, it is important to construct a time-varying/continuous measure of overconfidence for the following two reasons. First, the level of overconfidence may change over time as people, who are subject to self-attribution bias, may learn to be increasingly overconfident. Second, the theoretical effect of overconfidence might not be monotonic, in which case continuous measures of overconfidence are necessary to empirically test the non-linear effect of overconfidence. Moreover, time-varying overconfidence measures allow us to examine the impact of changes in overconfidence on the change of firm financial policies. Furthermore, time-varying overconfidence measures make it easier to control for unobserved heterogeneity using fixed effects (within) or first difference estimator. This is particularly important considering that overconfidence measures are likely to be contaminated by managerial/firm fixed effects that may also potentially drive corporate financial policies, which consequently could lead to a spurious relationship.

3.2.2 Tone of Chairman's Statement

In this section, we will first introduce the key steps of computational content analysis and then show how a composite tone index can be constructed.

3.2.2.1 Why we use Chairman's Statement

We use the Chairman's Statement from the UK annual reports as the source of narrative to construct managerial words-based measures of overconfidence for several reasons. First, Chairman's Statement is widely read by investors and analysts (Bartlett and Chandler, 1997). According to Clatworthy and Jones (2003), the Chairman's Statement

is "the most read of the UK's accounting narratives" and "the longest established". [33] Second, Chairman's Statement is largely unaudited and not heavily regulated. The language used in the Chairman's Statement is much less standard than Directors' Report which is subject to regulatory requirements. Third, disclosure-related litigation is rare in the UK relative to the US. Therefore, the UK accounting narratives (e.g., Chairman's Statement) are relatively less constrained compared with the MD&A in the US 10-K report. Finally, while Chairman's Statement is signed by the chairman, who is often a non-executive director in the UK, existing literature[34] seems to agree that Chairman's Statement is an organizational rather than individual communication (Clatworthy and Jones, 2003, 2006; Schleicher and Walker, 2010). This means that firm's key financial decision makers (e.g., CEO/CFO) also have an influence on the choice of language in the Chairman's Statement.

3.2.2.2 Computational content analysis

To facilitate large sample analysis, instead of conducting manual content analysis which is not feasible, we apply some well-established computational linguistic analysis tools. In particular, we use two content analysis software, namely Diction 6 and Linguistic Inquiry and Word Count (LIWC) 2007, to analyse UK Chairman's Statement. First, we will briefly introduce and compare those two pieces of software and then describe in detail the major steps of our content analysis.

---

[33] Many previous studies on UK accounting narratives focus on Chairman's Statement (see e.g., Smith and Taffler, 2000; Clatworthy and Jones, 2003; Clatworthy and Jones, 2006). Smith and Taffler (2000) use Chairman's Statement to predict firm bankruptcy. A more recent study (Schleicher and Walker, 2010) conduct manual content analysis of the tone of forward-looking statements (i.e. outlook sections) in the UK annual reports (most of which are located at the end of Chairman's Statement).

[34] For example, Clatworthy and Jones (2003) argue that accounting narratives such as UK Chairman's Statement allow "management" to describe corporate financial performance. In addition, in a study on impression management, Clatworthy and Jones (2006) point out that the analysis of the signs of impression management in Chairman's Statement may reflect managers' belief about whether impression management is worthwhile. This also implies that not only chairman but managers have an impact on the writing of Chairman's Statement. More specifically, Clatworthy and Jones (2006) argue that managers tend to "elaborate on positive financial performance in the Chairman's Statement". More recently, Schleicher and Walker (2010) attribute the bias in the tone of outlook statements to "managers". In particular, they argue that "managers with a willingness to engage in impression management are likely to target forward-looking statements", while 73.5 percent of the forward-looking narratives are located in Chairman's Statement (Schleicher and Walker, 2010).

a. Content analysis software

We use two types of content analysis software, namely Diction 6 and LIWC 2007. The default dictionaries of these two software (e.g. optimism, certainty, net emotion, etc.) are used to measure managerial overconfidence. Diction 6 quantifies five main semantic features (including Activity, Optimism, Certainty, Realism and Commonality) and 35 sub-features. LIWC 2007 mainly captures 22 linguistic dimensions (e.g. pronouns) and 32 psychological constructs (e.g. affect, cognition). In addition, both Diction 6 and LIWC 2007 support the use of a user-defined dictionary. This allows us to use dictionaries/wordlists developed by finance and accounting researchers (Henry, 2008; Loughran and McDonald, 2011) to construct optimistic tone measures.

Appendix 3.A briefly compares those two pieces of software. (Lowe (2002) provides a review of various content analysis software.) In brief, this study uses dictionaries from various sources (i.e. default dictionaries and custom dictionaries) to ensure the validity of our words-based overconfident measure. We will describe each dictionary/wordlist used to gauge overconfident beliefs in subsequent sections.

b. Steps of computational content analysis

Figure 3.2 shows the major steps of computational content analysis of the Chairman's Statement, which is a labour intensive and time-consuming process.

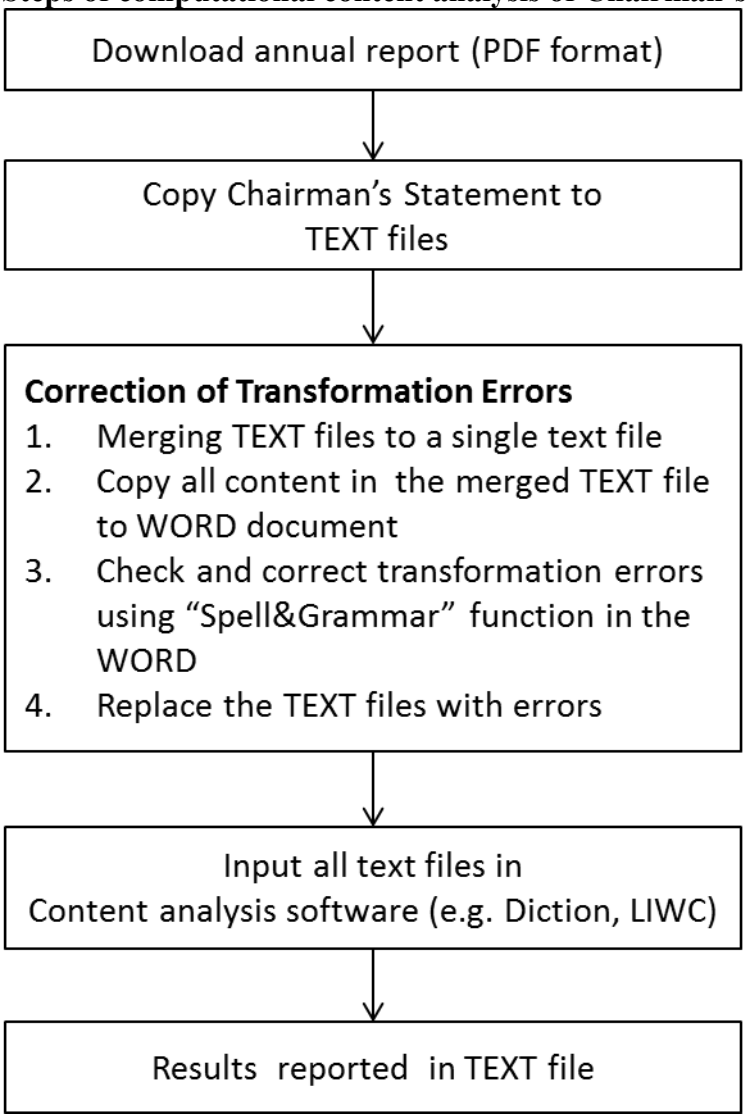
First, UK annual reports are downloaded from company websites. Second, Chairman's Statements[35] are manually copied[36] from the annual reports (in PDF format) to text files. In particular, each Statement is stored in one specific text file which is named with a unique number corresponding to a particular firm-year. Third, content analysis of those Chairman's Statements are performed using LIWC 2007 by inputting all the text files

[35] Firm-years in which there is no Chairman's Statement are excluded from our sample. However, for some firm years, as an equivalent to the Chairman's Statement, we also use statements made by Chairman but under different titles such as Chairman's Review, Chairman's Overview, Chairman's Introduction, Chairman's Letter/Message and Letters to Shareholders.

[36] The text in the annual report must be copyable in the sense that the PDF report is not made of the scanned version of the original report. This is a problem especially for some annual report in the 1990s. In addition, some annual reports in the Secured PDF format are also unable to be copied and therefore are excluded from the sample

into the software. Both standard Diction 6 and LIWC 2007 dictionaries and wordlists developed by finance and accounting researchers (e.g. positive/negative wordlists (i.e. tone) developed by Henry (2008) and Loughran and McDonald (2011)) are used to analysis various language dimensions of our texts (e.g. optimism, certainty). Finally, the software will report all the results (i.e. various dimensions of language) as a table in one text file.

Figure 3.2 Steps of computational content analysis of Chairman's Statement



c. Transformation errors

When copying text from the PDF document to the text file, various transformation errors may appear. For example, some separate words will be mistakenly combined into one after transforming to the text file. In other words, the gap between neighbouring words disappears, which will make the subsequent content analysis biased. To correct

various transformation errors, we first combine all the text files into a single file (using the text files merging tool i.e. TXT Collector Software) and then copy all the content in that single file into MS Word Document to detect and correct the errors. Table 3.2 presents various examples of transformation errors and how we correct them.

Table 3.2 Types of transformation errors and examples

This table presents examples of various transformation errors in TEXT files and illustrates how we manually correct for those errors before the texts are used for content analysis.

Original text in PDF format	**Examples of transformation errors in TEXT file**	**Corrections**
to perform well during flight tests. We signed	to perform well during flight **tests.We** signed	Add space before "We"
Confident; financial	Conf**i d**ent; f**i n**ancial	Remove space after the letter "I"
Flexibility of our business model and our consistently	flexibilityofourbusinessmodelandourconsistently	Add spaces among neighbouring words
Senior made significant progress in getting	Senior made signi**Þ**cant progress in getting	Replace the symbol "Þ" with letter "fi"
Our response	**O** **ur** response	Remove the space between "O" and "ur"
Employees	E m p l o y e e s	Remove the spaces between the letters
Trading profits in most of the Group's aerospace	Trading profits in most of the Group**Õ**s aerospace	Replace the letter "Õ" with the inverted comma

3.2.2.3 Measurement of tone

This section describes how tone measures are constructed. Tone is defined as the difference between positive and negative words divided by the sum of positive and negative words as follows:

$$Tone_{it} = \frac{Positive_{it} - Negative_{it}}{Positive_{it} + Negative_{it}} \quad (3.7)$$

We use two wordlists developed by Loughran and McDonald (2011) and Henry (2008) respectively to identify "positive" and "negative" words in the Chairman's Statement. In particular, there are 354 positive words and 2,349 negative words in Loughran and McDonald's (2011) wordlist and 105 positive words and 85 negative words in Henry's (2008) wordlist. Therefore, we expect the mean of Loughran and McDonald's tone will be less positive relative to Henry's tone because Loughran and McDonald's wordlist includes a much more comprehensive list of negative words.

We construct optimistic tone measures by counting both optimism-increasing and optimism-decreasing words. We use six individual wordlists. Our first three wordlists are the same as those in Rogers, Buskirk and Zechman (2011) and Davis, Ge, Matsumoto and Zhang (2012), namely *TONE_OPTIMISM*, *TONE_H* and *TONE_LM*. *TONE_OPTIMISM* is a measure of net optimism[37] counted using a dictionary in Diction 6.[38] Liu, Taffler and John (2009) conduct content analysis of CEO speech in the context of merger and acquisitions and also use the optimism variable in Diction as a proxy for CEO overconfidence. More recently, Eshraghi and Taffler (2012) use *TONE_OPTIMISM* as a measure of fund manager overconfidence. *TONE_H* and *TONE_LM* are two wordlists developed by Henry (2008) and Loughran and McDonald (2011) respectively to measure positive and negative words especially in a financial context. In particular, *TONE_H* and *TONE_LM* are calculated as the ratio of the difference between positive and negative words to the sum of positive and negative words.[39]

Besides, we also use another three tone measures, all of which are positively related to optimism, including *TONE_CERTAIN1*, *TONE_CERTAIN2* and *TONE_EMOTION*.

[37] In Diction, optimism is defined as "language endorsing some person, group, concept or event, or highlighting their positive entailments".

[38] As a unique feature of Diction software, there is standardization procedure when calculating a particular item. In particular, we compare our collected Chairman's Statements to three alternative norms in Diction including (1) all cases, (2) corporate financial reports and (3) corporate public relations. Our empirical results are qualitatively similar using alternative norms.

[39] The terms "positive/negative" and "optimistic/pessimistic" are often used interchangeably in the literature (e.g., Davis, Piger and Sedor, 2012). Li (2010b) standardize the terms to "positive/negative" instead of "optimistic/pessimistic".

TONE_CERTAIN1 and *TONE_EMOTION* [40] are measured using dictionaries in Linguistic Inquiry and Word Count (LIWC) 2007. *TONE_CERTAIN2* is another measure of certainty[41] based on a dictionary in Diction 6. *TONE_CERTAIN2* has also been used to measure overconfidence of fund managers (Eshraghi and Taffler, 2012). Similarly, Li (2010b) includes "uncertain tone", which is highly associated with negative tone, in his tone measure.

3.2.2.4 Composite tone index: principal component analysis (PCA)

Principal component analysis (PCA) is a statistical technique that converts a set of correlated variables into a set of linearly independent variables (i.e. principal components). The first principal component captures the largest variance in the data (i.e. most information). The second principal component has the second highest variance and is orthogonal to the first component. In other words, the *N* component contains more information than *N+1* component. The last principal has the lowest variance (i.e. least information). The total number of principal components is less than the number of original variables. All the principal components contain the same information as the original variables. (see Jolliffe (2005) for a detailed description of the PCA)

a. Standardization

PCA is sensitive to the scaling of original variables (Jolliffe, 2005). In principle, if the differences in standard deviations of the original variables are large, those variables have to be standardized before conducting PCA. The original variables can be normalized as follows:

$$X^s = \frac{X - \bar{X}}{\sigma_X} \tag{3.8}$$

[40] An earlier version of LIWC has a category named "optimism", however in the 2007 version words are classified more broadly into "positive emotion" and "negative emotion".

[41] In Diction, certainty is defined as "language indicating resoluteness, inflexibility, and completeness and a tendency to speak ex cathedra".

where X is the original variable, X^s is the standardized variable X, $\bar{X}$ and σ_X are the mean and standard deviation of the variable X. X^s follows a standard normal distribution ($X^s \sim \mathcal{N}(0,1)$). All the original variables, X, have to be interval data.

b. Correlation-based PCA

In practice, the statistical software, Stata, calculates the correlation matrix, which is the default, instead of covariance matrix for the principal components. The relationship between correlation and covariance can be represented as follows:

$$COR_{ij} = \frac{COV_{ij}}{\sqrt{COV_{ii}}\sqrt{COV_{jj}}} \tag{3.9}$$

where COR_{ij} is the correlation between variables i and j; COV_{ij} is the covariance between variables i and j; $\sqrt{COV_{ii}}$ and $\sqrt{COV_{jj}}$ are the standard deviations of the variables i and j respectively. As can be seen from the above equitation, the use of the correlation matrix accounts for the problem that original variables are on different scales by standardizing those variables.

c. Orthogonalization

The original variables may be contaminated by firm-specific characteristics. To address this concern, we regress the original variables on a set of firm-specific variables ($x_{k,it}$) as follows:

$$X_{it} = \alpha_0 + \sum_{k=1}^{n} \beta_k x_{k,it} + \varepsilon_{it} \tag{3.10}$$

The error term (ε_{it}) is orthogonal to all firm-specific variables. In other words, the orthogonalized individual tone measure ($tone_{it}^{\perp}$) is the error term from the above regression, which can be used to form an orthogonalized tone index.[42]

[42] Baker and Wurgler (2006) construct an orthogonalized investor sentiment index following the same procedure, which is orthogonal to several macroeconomic factors.

$$tone_{it}^{\perp} = \varepsilon_{it} \tag{3.11}$$

In what follows, we briefly introduce how tone index is constructed using PCA.

d. Composite tone index

The main purpose we use PCA to construct composite tone index is to check the validity of our individual tone measures by examining whether they are driven by a common mechanism (i.e. managerial overconfidence). If this is the case, the first principal component is expected to explain a major proportion of the variance in the data (as indicated by eigenvalue). Using PCA, tone index can be represented as a linear combination of individual tone measures as follows:

$$TONE\ INDEX_{it} = \sum_{k=1}^{n} Loading_k tone_{k,it} \tag{3.12}$$

where $TONE\ INDEX_{it}$ is the composite tone index that consists of *n* individual tone measures (i.e. $tone_{k,it}$). $Loading_k$ is the loadings for each tone measure and the sum of squared loadings equals 1 (i.e. $Loading_1^2 + Loading_2^2 + \cdots + Loading_n^2 = 1$).

3.2.3 Insider trading-based measure

Following prior studies (e.g., John and Lang, 1991; Marciukaityte and Szewczyk, 2011) we construct the valued-based and volume-based net purchase ratio (NPR) using the value and volume of open market purchases and sales respectively as follows:

$$NPR1_{it} = \frac{Buy\_va_{it} - Sell\_va_{it}}{Buy\_va_{it} + Sell\_va_{it}} \tag{3.13}$$

where, $NPR1_{it}$ is the value-based NPR of all firm directors, executive or non-executive directors of firm i in fiscal year t. Buy_va_{it} is the aggregate value of insider purchases and $Sell\_va_{it}$ is the aggregate value of insider sales. Alternatively, the NPR based on the number of trades can be calculated as follows:

$$NPR2_{it} = \frac{Buy\_vol_{it} - Sell\_vol_{it}}{Buy\_vol_{it} + Sell\_vol_{it}} \quad (3.14)$$

where, $NPR2_{it}$ is the volume-based NPR of all firm directors, executive or non-executive directors of firm i in fiscal year t. Buy_vol_{it} is the aggregate volume of insider purchases. $Sell\_vol_{it}$ is the aggregate volume of insider sales. Besides, the value-based and volume-based NPRs for individual directors including Chairman (VA_CH_{it} and VOL_CH_{it}), CEO (VA_CEO_{it} and VOL_CEO_{it}) and CFO (VA_CFO_{it} and VOL_CFO_{it}) are also constructed. The NPR ranges from -1 to 1 and higher NPR indicates higher managerial overconfidence.

Next, we briefly compare volume-based and value-based NPR. Volume-based NPR is superior in the sense that it may capture the potential relation between the frequency of purchases and the level of overconfidence. Previous studies (Billett and Qian, 2008; Doukas and Petmezas, 2007) indicate that multiple acquisitions are associated with increasing overconfidence due to self-attribution. Similarly, multiple insider purchases may also contribute to overconfidence if the insiders attribute the success of previous purchases to their own (timing) ability.[43]

However, the volume-based NPR fails to reflect managers' perceived mispricing of their stocks. The value-based NPR takes the price of insider transactions into consideration. As noted earlier, overconfident managers tend to believe that their firm stocks are undervalued. Consequently, they are more likely to purchase at a higher price relative to their rational counterparts. The value-based NPR captures the perceived undervaluation which is an indicator of overconfidence.[44] In brief, the volume-based

[43] For example, overconfident directors buy one share at a time for three times for 10 p/share, while rational directors also buy one share at a time but for twice for 15 p/share. Both of them sell one share for 10 p/share. The volume-based NPRs for overconfident and rational directors are 1/2 and 1/3 respectively, while the value-based NPRs for them are both 1/2 (i.e. (30-10)/(30+10)). In this case, the volume-based NPR is able to capture the "endogenous" overconfidence of those directors with more frequent purchases.

[44] For example, if both overconfident and rational insiders buy and sell one share for 10p/share, their volume-based NPRs are both 0. Due to the perceived undervaluation, overconfident directors are more likely to buy at a relatively higher price (15 p/share). Therefore, the value-based NPR tends to be higher (i.e. (15-10)/(15+10)=0.2) for the

NPR plays a better role in gauging "endogenous overconfidence" developed from self-attribution, while the value-based NPR is a better measure of the degree of perceived undervaluation caused by overconfidence.

Interaction between managerial words and actions

To sum up, this thesis uses both managerial words (i.e. what managers say) and actions (i.e. what managers do) to gauge their overconfident beliefs. However, it is likely that managerial words may contradict their actions. For instance, managers may use many positive words (i.e. positive tone) in the Chairman's Statement, however, they may sell their firms' stocks. In this case, managers' trading may indicate their true belief that they are not optimistic about firm's future prospects, meaning that managers use positive words to intentionally disinform investors. Table 3.3 shows the interactions between managerial words and trading of their own firm's shares. An interesting empirical question is whether the effect of managerial words depends on their actions.

Table 3.3 Interaction between managerial optimistic words and actions

Words*Actions		Actions	
		Purchase	Selling
Words	Positive	Consistent	Inconsistent
	Negative	Inconsistent	Consistent

3.2.4 Caveats and conclusion

A common limitation of most of the overconfidence measures reviewed in this chapter is that they may not be able to distinguish between two distinct but closely related constructs: overconfidence and optimism. Gider and Hackbarth (2010) argue that a well-suited proxy should be able to "capture optimism and overconfidence separately". In addition, it is also important to examine the extent to which our overconfidence measures (especially the insider trading-based measure) is contaminated by information asymmetry. This is important because information asymmetry is often an alternative explanation for many empirical patterns related to firm financing. In conclusion, this chapter provides an overview of various major proxies of managerial overconfidence. We justify why we use tone and insider trading-based measures of overconfidence in this thesis and we further explain how those two measures are constructed.

---

overconfident directors. From this perspective, the value-based NPR is a more valid measure of overconfidence.

CHAPTER 4

Methodology: Estimation Methods of Unbalanced Panel Data

Chapter 4. Methodology: Estimation Methods of Unbalanced Panel Data

4.1 Introduction

This chapter discusses how and why certain econometric methods are selected to analyse the data and make inference. Importantly, relevant theories will be briefly mentioned in this chapter to justify our selection of econometric techniques. More detailed explanations of the theories related to specific empirical studies will be provided in the empirical chapters. To avoid unnecessary repetition, we also postpone the descriptions of empirical models and various alternative specifications to subsequent empirical chapters.

The empirical analysis of this thesis is based on panel data. Hsiao (2003) notes that

> "… although panel data offer many advantages, they are not panacea. The power of panel data analysis depends critically on the *compatibility of the assumptions of statistical tools with the data generating process*. Otherwise, misleading inference will follow".

The main purpose of this chapter is therefore to justify our selection of estimation methods based on both major characteristics of our panel data and of capital structure theories. Table 4.1 summarizes the major econometric methods used in our subsequent empirical analysis and corresponding theories and characteristics of data. Our discussion mainly focuses on five major aspects of methodological issues in this thesis:

(1) estimation methods for models with a fractional dependent variable,
(2) estimation methods for models with a binary dependent variable,
(3) estimation methods for models with a lagged dependent variable (i.e. dynamic panel),
(4) unobserved firm fixed effects and
(5) interaction effects and multicollinearity.

Table 4.1 Choices of methods based on the characteristics of data and theories

This table summarizes how we choose certain econometric techniques based on characteristics of our panel data and relevant theories. The first column summarizes the major characteristics of our panel data. The second column outlines relevant finance theories. The third column includes main econometric methods/techniques.

Characteristics of data	**Economic theory (mainly capital structure theories)**	**Choice of econometric techniques**
1. Fractional dependent variable [e.g. left-censored leverage ratio and right-censored debt maturity ratio]	Zero-leverage puzzle (some behavioural capital structure theory is only applicable to *levered* firms)	Tobit; Random-effect Tobit
2. Dynamic panel: lagged dependent variable [e.g. lagged leverage in partial adjustment model]	Dynamic trade-off theory; to avoid "dynamic misspecification"	Two-step system GMM
3. Discrete dependent variable [e.g. an indicator of zero/low leverage]	Debt conservatism; reverse pecking order preference	Pooled logit model
4. Unobserved firm fixed effects	Firm-specific time-invariant drivers of managerial overconfidence	Fixed effects estimator; GMM estimator
5. First differenced data	The effect of time-varying overconfidence	First difference estimator
6. Interaction terms [e.g. a) the interaction between tone and insider trading; b) the interaction between financing deficit and overconfidence measure]	a) Inconsistency between managerial words and actions, b) Heterogeneous pecking order coefficient	Demean the interaction term if there is a multicollinearity problem

4.2 Estimators for Models with Fractional Dependent Variable

This section introduces Tobit estimators that account for the fractional nature of dependent variables. Some dependent variables of this thesis are fractional in the sense that they are bounded between zero and one. For example, the leverage ratio (i.e. total debt divided by total assets) is especially left-censored, meaning that there are a large number of zero-leverage firm-year observations (around 15 percent in our sample). In this case, the linear probability model (LPM) (i.e. OLS) is problematic that there will be

negative predicted values for the dependent variable. Instead, we use Tobit model to overcome this problem.

4.2.1 Pooled Tobit model

Tobit estimator is developed by Tobin (1958) and has been used in the corporate finance literature to estimate models with a fractional dependent variable (e.g. leverage ratio and debt maturity ratio). The Tobit model can be expressed as follows:

$$y^* = \boldsymbol{X}'\beta + e \tag{4.1}$$

$$y = \begin{cases} y^* \; if \; 0 < y^* < 1 \\ 0 \; if \; y^* \leq 0 \\ 1 \; if \; y^* \geq 1 \end{cases} \tag{4.2}$$

where y^* is a latent variable and normally distributed. The observed dependent variable (y) is left-censored at zero and right-censored at one. However, if there is no censored observation, Tobit model is equivalent to OLS.

More specifically, the Tobit model is comprised of two separate models including a Probit regression and a truncated regression. First, the Probit model is used to estimate the discrete decision (e.g. whether a firm uses debt or not): $P(y^* > 0) = \Phi(\boldsymbol{X}'\beta)$. Second, the truncated regression is used to estimate the continuous decision (e.g. leverage decision of levered firms): $E(y|y^* > 0) = \boldsymbol{X}'\beta + \sigma\lambda\left(\frac{\boldsymbol{X}'\beta}{\sigma}\right)$. The Tobit model assumes that the coefficient estimates from the above two models are the same (i.e. β). In other words, it is assumed that a common set of explanatory variables have the same impacts on both discrete and continuous decisions.

4.2.2 Random-effect Tobit model

For panel data, one may use random-effects Tobit (RE-Tobit) model instead of the pooled Tobit. The RE-Tobit model can be represented as:

$$y_{it} = X_{it}\beta + v_i + e_{it} \quad (4.3)$$

where, v_i is random effects and is not correlated with the error term, e_{it}. The RE-Tobit estimation is based on quadrature approximation, the accuracy of which may be influenced by the number of integration points. Therefore, it is important to check whether the estimated coefficients are sensitive to different numbers of integration points.

4.2.3 Likelihood ratio test: pooled Tobit vs. RE-Tobit

We use likelihood ratio (LR) test to see whether pooled Tobit or RE-Tobit is more suitable for our data. The LR test compares the log-likelihood functions for the unrestricted and restricted models. More specifically, the LR statistic can be calculated as follows (see e.g. Wooldridge, 2009**)**:

$$Likelihood\ ratio\ statistic = 2(LL_{unrestricted} - LL_{restricted}) \quad (4.4)$$

where, $LL_{unrestricted}$ and $LL_{restricted}$ are the log-likelihood of unrestricted and restricted models respectively. The $LL_{unrestricted}$ is often greater than $LL_{restricted}$, meaning that the LR statistic is usually positive.

4.3 Estimators for Models with Binary Dependent Variable

Another type of limited dependent variable used in this thesis is binary. This section compares linear probability model (LPM) and two non-linear estimators including Logit and Probit models.

4.3.1 Linear probability model (LPM)

Linear probability model (i.e. OLS regression with a binary dependent variable) is often used in economics (Wooldridge, 2009). This is partly because the LPM is relatively easy to estimate and interpret. However, the LPM is subject to several important limitations. First, using OLS, predicted probabilities (i.e. fitted values) can be either below zero or above one. Second, the relationship between the probability and the

independent variables may not be linear. To avoid the above problems, we use more advanced non-linear binary response models (i.e. Logit and Probit) estimated using Maximum Likelihood Estimation (MLE), as described below.

4.3.2 Logit and Probit models

A binary response model can be represented as follows:

$$P(y = 1|\boldsymbol{X}) = f(\beta_0 + \boldsymbol{X}\beta) \tag{4.5}$$

where f is a function bounded between zero and one. $\boldsymbol{X}\beta$ refers to $\sum_{k=1}^{n} \beta_k x_k$. Equation 4.5 has two special cases including Logit and Probit models. In Logit model, f is logistic cumulative density function (CDF). The logistic function can be written as

$$P(y = 1|\boldsymbol{X}) = \frac{\exp(\beta_0 + \boldsymbol{X}\beta)}{1 + \exp(\beta_0 + \boldsymbol{X}\beta)} \tag{4.6}$$

In Probit model, f is standard normal cumulative density function (CDF). The Probit function is

$$P(y = 1|\boldsymbol{X}) = \int_{-\infty}^{\beta_0 + \boldsymbol{X}\beta} \emptyset(t)dt \tag{4.7}$$

Both Logit and Probit models ensure that the predicted probability is between zero and one (i.e. $\lim_{X \to -\infty} f(\beta_0 + \boldsymbol{X}\beta) = 0$ and $\lim_{X \to \infty} f(\beta_0 + \boldsymbol{X}\beta) = 1$). Some researchers prefer Probit because of the properties of normal distribution (Wooldridge, 2009). However, in practice Logit and Probit often produce similar results.

The interpretation of coefficient estimates from Logit and Probit regressions are less straightforward relative to linear probability model (LPM). In the LPM, the probabilities are linear in $\boldsymbol{X}$, which is not the case for Logit and Probit. In the case of Logit model,

we can rewrite Equation 4.6 as follows: $\ln(\frac{P}{1-P}) = \beta_0 + \boldsymbol{X}\beta$, where the log-odds ratio[45] ($\ln(\frac{P}{1-P})$) is linear in $\boldsymbol{X}$ while the probabilities (P) are not linear in $\boldsymbol{X}$. The slope coefficient (β) can be interpreted as the change of the log of odds ratio that is driven by one unit change of $\boldsymbol{X}$. Moreover, both Logit and Probit take all the explanatory variables into consideration when calculating the change in probability, while in the LPM only a particular explanatory variable is involved (Gujarati and Porter, 2009).

4.4 Estimators for Dynamic Panel

In a recent paper on the estimation of dynamic panel models in corporate finance, by Flannery and Hankins (2013) compare the performance of various estimators including OLS, fixed effects, GMM and LSDVC (i.e. dynamic FE model with correction for bias). Their results suggest that estimators' performance largely depend on the characteristics of data. In other words, the appropriate estimator can be chosen based on data's properties. Table 4.2 summarizes whether various estimation methods are suitable for data with certain features (e.g. unobserved heterogeneity, dynamic panel, autocorrelation and endogeneity). For example, system GMM can be used to estimate models with unobserved heterogeneity, lagged dependent variable (i.e. dynamic panel) and endogeneity but will not provide appropriate estimates in the presence of second order serial correlation.

This section first explains why it is theoretically and empirically more appropriate to examine the dynamic model of capital structure and then briefly reviews various estimation methods of dynamic panel data models. We first discuss problems with using pooled OLS, first-differencing, fixed effect (within) and Anderson and Hsiao IV technique to estimate dynamic panel and then introduce GMM as a more appropriate estimator. We will also compare different versions of GMM (e.g., difference vs. system GMM and one-step vs. two-step GMM).

[45] The log-odds ratio indicates the probability that an event happens relative to the probability that an event does not happen.

Table 4.2 Choice of estimators of dynamic panel based on data features

This table shows whether each estimation method is able to cope with certain data features including unobserved heterogeneity (column a), dynamic panel data (column b), second order serial correlation (column c) and endogenous variables (column d).

	(a)	(b)	(c)	(d)
	Unobserved heterogeneity	Dynamic panel data	Second order serial correlation	Endogenous variables
OLS	No	No	Yes	No
Fixed effects	Yes	No	Yes	No
Difference GMM	Yes	Yes	No	Yes
System GMM	Yes	Yes	No	Yes
LSDVC	Yes	Yes	Yes	No

Source: adapted from Table 2 in Flannery and Hankins (2013)

4.4.1 Dynamic capital structure model (partial adjustment model)

We first briefly describe the partial adjustment model widely used in the dynamic capital structure literature. The target capital structure can be estimated as:

$$Y_{it}^{*} = \sum_{k=1} \beta_k x_{kit} + \omega_{it} \tag{4.8}$$

where Y_{it}^{*} is the target leverage, x_{kit} represents a group of determinants of capital structure.

The degree of adjustment can be represented as (partial adjustment model):

$$Y_{it} - Y_{it-1} = \rho(Y_{it}^{*} - Y_{it-1}) \tag{4.9}$$

If $\rho = 1$, then the actual change will be equal to the desired change, which means full adjustment. If $\rho = 0$, no adjustments are made. If $0 < \rho < 1$, partial adjustment takes place. This is called two-step dynamic adjustment model, where the target leverage is estimated in the first stage.

Alternatively, we may use one-step dynamic capital structure model obtained by combining equation (4.8) and (4.9):

$$Y_{it} = (1-\rho)Y_{it-1} + \sum_{k=1} \rho\beta_k x_{kit} + \varepsilon_{it} \quad (4.10)$$

The speed of adjustment is ρ, which is measured by one minus the coefficient of the lagged debt maturity $(1-\rho)$. If the cost of deviation is higher (lower) than the cost of adjustment then ρ tend to be unity (zero).

4.4.2 Dynamic misspecification

Before discussing various dynamic panel estimators, we show, from an econometrics perspective, the importance of controlling for a lagged dependent variable. Static capital structure models (without controlling for the lagged leverage ratio) may suffer from "dynamic misspecification" problem, which is a particular type of omitted variable bias. More specifically, if the lagged dependent variable is omitted, the model is likely to be misspecified especially in terms of autocorrelation. One potential cause of the autocorrelation is that the error term includes the omitted lagged dependent variable that are serially correlated. More generally, it is methodologically sound to adopt the "general to specific" approach **(**Hendry and Richard, 1983**)** by starting with a general model and then (if necessary) proceeding to a more parsimonious specification. In our case, we include the lagged leverage variable to reduce the chance of "dynamic misspecification".

4.4.3 Estimation methods of dynamic panel

The inclusion of the lagged dependent variable as one of the regressors complicates the estimation. In particular, it is recognised that standard panel estimators including OLS, first differences OLS, and fixed effects within group estimators become inconsistent (see e.g., Cameron and Trivedi, 2005; Asteriou and Hall, 2007). In what follows, the bias related to each of those estimators will be briefly discussed.

4.4.3.1 Pooled OLS

First, the problem with OLS estimates based on equation (4.10) is that the lagged dependent variable $Y_{i,t-1}$ may be correlated with the unobservable fixed effects μ_i, and consequently the regressor $Y_{i,t-1}$ and the error term $\mu_i + \varepsilon_{it}$ are correlated. In addition, the fixed effects μ_i may also be correlated with other independent variables.

4.4.3.2 Fixed effect (within)

One may try to eliminate the bias associated with OLS estimator using the within transformed fixed effects model

$$Y_{it} - \bar{Y}_i = \beta_0(Y_{i,t-1} - \bar{Y}_{i,t-1t}) + \sum_{k=1}^{k} \beta_k(X_{kit} - \bar{X}_{kit}) + (\eta_t - \bar{\eta}_t) + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (4.11)$$

Although firm specific effects can be removed, the estimation is still subject to another bias caused by the correlation between $(Y_{i,t-1} - \overline{Y}_{i,t-1})$ and $(\varepsilon_{i,t-1} - \overline{\varepsilon}_{i,t-1})$. In this case, the OLS estimation of the within model can be consistent only if $\overline{\varepsilon}_{i,t-1}$ is very small relative to $\varepsilon_{i,t-1}$, which is only possible if T goes to infinity in long panels (Cameron and Trivedi, 2005, p764).

4.4.3.3 First difference

Another way of removing the fixed effects is the first differencing transformation

$$\Delta Y_{it} = \beta_0 \Delta Y_{i,t-1} + \sum_{k=1}^{k} \beta_k \Delta X_{kit} + \Delta \eta_t + \Delta \varepsilon_{it} \quad (4.12)$$

However, this first differenced OLS estimator is still inconsistent since $\Delta\varepsilon_{it}$ is correlated with $\Delta Y_{i,t-1}$ through the terms $\varepsilon_{i,t-1}$ and $Y_{i,t-1}$ (Ozkan, 2000, Antoniou et al., 2008). Furthermore, the random effect estimator is also inconsistent due to the correlation between the quasi-demeaned dependent variable and residuals (Asteriou and Hall, 2007).

4.4.3.4 Instrumental variable estimator

The standard method used to estimate the dynamic unobservable effects panel data model is the instrumental variable estimator first introduced by Anderson and Hsiao (1982) (hereafter, AH estimator). The AH estimator is based on first-differenced model (equation 4.12) and then $Y_{i,t-2}$ is used as an instrument for $\Delta Y_{i,t-1}$. $Y_{i,t-2}$ is considered as a valid instrument because it is correlated with $\Delta Y_{i,t-1}$ but uncorrelated with Δu_{it}. Alternatively, $\Delta Y_{i,t-2}$ can be used as an instrument for $\Delta Y_{i,t-1}$, which is found to be more efficient if the autoregressive parameter $\beta_0 > 0$ (Anderson and Hsiao, 1981). The AH estimator can be consistent as long as the errors u_{it} are not serially correlated. However, the AH estimator may not be efficient partly because of the fact that not all available moment conditions are used **(**Ozkan, 2000, Antoniou *et al*., 2008).

4.4.3.5 Generalised method of moment (GMM)

Having discussed the inconsistency of standard panel estimators and the inefficiency of AH estimator, more specialized methods for dynamic panel data, including Arellano and Bond's (1991) difference GMM (GMM-DIF) and Blundell and Bond's (1998) system GMM (GMM-SYS), will be considered[46]. Wooldridge (2001) suggests that GMM is indispensable for dynamic panel models with unobservable fixed effects. The GMM-DIF uses lagged levels dated $t-2$ and beyond as instruments for the first-differenced equation (equation 4.12), which can be regarded as an unbalanced instrument sets. This estimator provides consistent estimates of the autoregressive parameter as the number of observations, n, goes to infinity with fixed number of years t.

However, the GMM-DIF is subject to weak instrument problems due to the weak correlation between the lagged levels (i.e. the instruments) and subsequent first-differences **(**Blundell and Bond, 1998**)**. This problem of weak instrument becomes

[46] GMM estimators have been widely used to estimate dynamic capital structure models (see e.g. Antoniou et al., 2008). More recently, GMM estimator has also been used in corporate governance research to incorporate dynamic nature of corporate governance choices. For example, Wintoki, Linck and Netter (2012) apply GMM estimator to examine the effect of board structure on firm performance. They argue that other commonly used estimation methods that are unable to cope with dynamic relationship between current governance and past firm performance may be biased.

apparent either when the autoregressive parameter β_0 approaches unity or the variance of firm fixed-effects μ_i increases relative to the variance of the error term ε_{it}. Consequently, the coefficient of the lagged dependent variable is biased downwards.

a. Downward bias of difference GMM

Bond et al. (2001) suggest a way of detecting downward finite sample bias, associated with use of the first-differenced GMM estimator, by comparing the autoregressive parameters estimated using alternative methods. In particular, the OLS levels will provide an upwards-biased estimate of α, given the firm-specific effects **(**Hsiao, 1986). In contrast, the estimate of α from the Within Group (WG) estimator is downwards-biased in short panels (Nickell, 1981). In other words, the estimates of the OLS levels and WG may indicate the upper and lower bounds of a consistent estimate respectively. Therefore, the first-differenced GMM estimate is very likely to be biased downwards if it appears to be close to or even below the Within Group estimate (i.e. the lower bound).

b. System GMM

Blundell and Bond (1998) propose GMM-SYS under which instruments in levels and first differences are used in a system of first-differenced and levels equations respectively. By exploiting additional moment conditions from the level equations, the GMM-SYS has superior finite sample properties. Theoretically, Hayakawa (2007) derives the finite sample bias and show that GMM-SYS is more efficient than GMM-DIF and GMM level estimators. In particular, the analysis shows that the bias of GMM-SYS is "a weighted sum of the biases in opposite directions of the first differencing and the level GMM estimates". In addition, another advantage of using GMM is related to the normality condition. It should be noticed that our dependent variables, the leverage and debt maturity ratios, are bounded between zero and one and are therefore not normal. Fortunately, the GMM estimator is robust to non-normality.

c. Two step vs. one step GMM

On the other hand, it is recognized that two-step GMM is more efficient than one-step GMM. The two-step GMM uses the optimal weighting matrix obtained from the first-step estimation. Considering that the model is overidentified, the two-step GMM, also called the optimal GMM, is more efficient (Cameron and Trivedi, 2009). Nevertheless, considering that the asymptotic standard errors of the efficient two-step GMM can be

biased downwards especially for small samples, the one-step GMM is routinely used to make inferences before the Windmeijer (2005) correction was developed (Roodman, 2009). Therefore, our two-step GMM standard errors will be based on Windmeijer bias-corrected estimator. Hence, it seems that the two-step GMM-SYS is the optimal method for our dynamic panel data.

d. Robustness checks (sensitivity to lag structures) and specification tests

In practice GMM estimators suffer from the instrument proliferation problems (Roodman, 2009). More specifically, high instrument count can overfit endogenous variables and even weaken the Hansen test of instrument validity. To minimize those problems, we have to limit the number of instruments by using certain lags only rather than all available lags as instruments. Furthermore, Roodman (2009) emphasize that it is important to check the sensitivity of the GMM results to reductions in the number of instruments, in which case the number of instruments should be reported. In brief, given the combination of lagged dependent variable, fixed effects and short panel, a GMM estimator is more appropriate than other standard estimation methods. However, the validity of GMM models will be checked based on several specification tests including 1) Sargan test 2) Wald test and 3) Autocorrelation test.

4.4.3.6 Doubly-censored Tobit model

A recent paper by Elsas and Florysiak (2011) proposes the doubly-censored Tobit model, which is suitable for unbalanced dynamic panel with a fractional dependent variable. This estimator might be superior to the GMM estimator since it allows for the specification of a censored leverage ratio. Elsas and Florysiak (2011) find that the doubly-censored Tobit estimator is subject to the least bias in the context of dynamic adjustment of capital structure. A recent study (John, Kim and Palia, 2012) uses this estimator to examine capital structure adjustment.

4.5 Firm Fixed Effects

As argued by Wooldridge (2002), "a primary motivation for using panel data is to solve the omitted variables problem".[47] In this thesis, managerial overconfidence is likely to be correlated with unobserved firm fixed effects which are firm characteristics that vary across entities but remain constant over time. For example, overconfident managers might be attracted to growing firms partly because they overestimate future growth but underestimate risks. Therefore, it is important to control for fixed effects using a within or first difference estimator.

4.5.1 Potential fixed effects (omitted variables) as a source of endogeneity

Roberts and Whited (2012) provide a review of three major sources of endogeneity (i.e. omitted variable[48], reverse causality and measurement error). They discuss various techniques that can be applied in empirical corporate finance to mitigate the endogeneity concern including instrumental variable, difference-in-difference, regression discontinuity design, matching, panel data methods and higher order moments estimators. This section focuses on how to mitigate a particular type of endogeneity that is associated with fixed effects (omitted variable) using panel data methods. In general, fixed effects may exist if unobserved time-invariant firm/individual characteristics are not included in the empirical model. For example, unobserved time-invariant characteristics (e.g. education level, past experience, ability) of firm managers might be correlated with measures of managerial overconfidence. Consequently, the unobserved heterogeneity may drive both managerial overconfidence and the firm's financing decision, which leads to a spurious relationship. Therefore, it is important to address the above endogeneity problem by controlling for firm fixed effects.

[47] Another two solutions to omitted variable bias when the omitted variable is unobservable are instrumental variable approach and randomized controlled experiments (Stock and Watson, 2003). These two approaches however are less applicable for this thesis. Instead, we use panel data approach (i.e. fixed effects estimators) to control for unobserved omitted variables.

[48] This is regarded as one of the most common sources of endogeneity in corporate finance (Roberts and Whited, 2012). This is an important concern for our empirical analysis because capital structure regression often "contains a significant firm effect" (Peterson, 2009).

4.5.2 How and when to control for unobserved heterogeneity

A recent study (Gormley and Matsa, 2014) compares the estimates of models with unobserved heterogeneity across entities (e.g. firms, managers, industries) using four estimators including OLS, adjusted-Y estimation (*Adj*Y)[49], average effects estimation (*Avg*E)[50] and FE. They find that OLS, *Adj*Y and *Avg*E estimators can yield inconsistent estimates and be severely biased. To illustrate, they estimate a standard capital structure regression where book leverage is regressed on several standard capital structure determinants. As expected, the coefficient estimates from OLS, *Adj*Y and *Avg*E appear to be highly different from the FE estimates[51] in terms of magnitude and sometimes signs.[52] Gormley and Matsa (2014) conclude that FE estimator is the best way to control for unobserved heterogeneity (see **Table 4.3**).

More specifically, Gormley and Matsa (2014) suggest that FE should be used given the following conditions:

> Condition 1: The existence of unobserved group heterogeneity; there is potential correlation between the heterogeneity and a variable of interest
>
> Condition 2: Within group variation in the variable of interest
>
> Condition 3: Valid measurement of the variable of interest

Condition 1 refers to the motivation of using a FE estimator. In practice, the presence of fixed effects can be detected by comparing standard errors from different estimation methods. More specifically, if the standard errors clustered by firm are much (e.g. over

[49] The *Adj*Y estimation adjusts the dependent variable by demeaning the dependent variable with respect to the group. For example, industry mean can be removed from the dependent variable, which is often called "industry-adjusted". In this way, the effect of industry is removed from the dependent variable.

[50] The *Avg*E estimation adds the group's sample mean as an independent variable to control for unobserved heterogeneity, in which case the sample mean is used as a proxy for the unobserved variation.

[51] This is also the case in the examples of executive compensation, firm value and stock returns (Gormley and Matsa, 2014).

[52] Roberts and Whited (2012) also point out the reason why fixed effects estimation make significant differences in the estimated coefficients on the determinants of leverage is that leverage is a level not a change. They argue that if the dependent variable is a first differenced variable (e.g. investment that can be considered as the change of capital stock) and if the fixed effect is only correlated with the level of the dependent variable, estimated coefficients from fixed effects regressions will be qualitatively similar to pooled OLS.

three times) greater than White standard errors, fixed effects are highly likely to exist (Peterson, 2009). Condition 2 and 3 are related to two major limitations of the FE estimator, namely (1) time-invariant independent variable of interest and (2) measurement error of the variable of interest, which will be discussed in the subsequent section.

Table 4.3 Comparison of the performance of estimators in presence of unobserved heterogeneity

This table is based on Gormley and Matsa's (2014) study that compares the performance of four estimation methods in presence of unobserved heterogeneity (i.e. "common errors"). They point out that OLS, adjusted-Y estimation (*Adj*Y) and average effects estimation (*Avg*E) are all inconsistent and therefore only FE is recommended to control for unobserved heterogeneity.

	OLS	*Adj*Y	*Avg*E	FE
Description	Ordinary least squares	Demean the dependent variable within each group (e.g. industry adjusted)	Include the sample mean of the group's independent variable as a control variable	Either add dummy variables for each entity as control variables or demean all variables within entities
Property	Inconsistent	Inconsistent	Inconsistent	Consistent
Reasons why the estimator is inconsistent	Fail to control for unobserved heterogeneity	Omitted variable problem: the mean of independent variables may influence the demeaned dependent variable, which is not controlled for	Measurement error bias: sample mean may be a biased measure of the unobserved factor	NA

4.5.3 Limitations of fixed effects and how to address them

Although fixed effects can mitigate the endogeneity problem due to omitted variables, it has several limitations (see e.g. Gormley and Matsa, 2014; Roberts and Whited, 2012). First, fixed effects estimators are not able to estimate the effect of any time-invariant variables (e.g. gender, education, past experience). Fortunately, our main variable of interest is time-varying. One possible solution, as mentioned in Gormley and Matsa (2014), is the Hausman and Taylor's (1981) two-step instrumental variable (IV) approach in the FE estimation framework (i.e. the *XTHTAYLOR* in Stata).

Second, measurement error of the variable of interest may lead to attenuation bias. This might be a particular concern of this thesis considering the difficulty of measuring our

key independent variable (i.e. managerial overconfidence). To mitigate this attenuation bias, Gormley and Matsa (2014) outline the following three approaches: (i) use a GMM estimator (Erikson and Whited, 2000), (ii) use an instrumental variable approach (Biorn, 2000) and (iii) recover the true parameter by using different transformation of the data e.g. within transformation and first differences (e.g. McKinnish, 2008). Our empirical analysis uses both approaches (i) and (iii) mentioned above as robustness checks[53]. Next, we compare two alternative fixed effects estimators: within vs. first difference estimator.

4.5.3.1 Fixed effects (within) estimator vs. first difference estimator

Fixed effects (within) estimator and first difference estimator are two alternative ways to remove unobserved effects by time-demeaning and differencing the data respectively. The choice between the above two estimators for short panel data depends on the serial correlation of the residual: if the errors are serially uncorrelated, a within estimator is more efficient than first differencing; if the errors exhibit substantial positive serial correlation, first differencing is more efficient because the differenced error is serially uncorrelated (Wooldridge, 2009). In practice, it is difficult to choose between within and first difference. It is therefore advisable to check whether the results are sensitive to that choice. However, both within transformation and first-differencing transformation remove any long run components from the variables (Asteriou and Hall, 2011; Gujarati and Porter, 2009). Consequently, fixed effects regressions only examine the effects of short-run components of the explanatory variables.

4.5.4 Potential problem with unbalanced panel

The panel data used in this thesis is unbalanced (like many other empirical studies in finance). This is because our final sample is selected based on the availability of three main data sources: accounting data, insider trading data and digital annual reports of UK firms. However, when using fixed effects models to estimate unbalanced panel, it is important to understand the reasons why the panel is unbalanced (i.e. why some firm-year observations are missing). In particular, fixed effects estimation will be biased if the reason for missing data is correlated with the error term (Wooldridge, 2009). Common reasons for missing data include mergers and acquisitions, bankruptcy and leveraged buyouts. More specifically, firm-years without insider trading are excluded

[53] Approach (iii) is not adopted since it is difficult to find an instrument for managerial overconfidence.

from our sample. These reasons are likely to be correlated with the error term (i.e. unmeasured determinants of financing decisions). Consequently, our fixed effects estimations might be subject to sample selection bias. However, there will be no problem if these reasons are correlated with unobserved fixed effects.

4.5.5 Fixed effects vs. random effects

The coefficient estimates from FE and RE estimators can be considerably different especially in short panels (large cross-section dimension and small time dimension) (Gujarati and Porter, 2009). When choosing between FE and RE estimators, we need to consider the following aspects (Gujarati and Porter, 2009). First, if the error term and the independent variables are correlated, FE is unbiased while RE is biased. Second, in short panels, if RE is the true model, RE is more efficient than FE. Third, although FE controls for all unobservable time-invariant variables, FE is not able to estimate such time-invariant variables. This becomes a limitation of FE estimators especially when the main variable of interest (e.g. managerial traits) is highly persistent over time.

In practice, the Hausman test can be used to choose between FE and RE. In particular, a large Hausman statistic rejects the null hypothesis that RE is consistent (while FE is always consistent). In other words, Hausman test examines whether RE can be as good as FE. In contrast, a small Hausman statistic indicates that RE might be more appropriate. In addition, Breusch and Pagan Lagrange Multiplier test can be used to test whether there are random effects. (also see chapter 21 in Cameron and Trivedi (2005) and chapter 10 in Wooldridge (2002) for comparisons of FE and RE)

4.6 Interaction Effects and Multicollinearity

Interaction effect appears when the relationship between one independent variable and the dependent variable varies with the magnitude of another independent variable. Take our empirical test of the heterogeneous/conditional pecking order preference as an example, the pecking order coefficient, i.e. the sensitivity between financing deficit (independent variable) and net debt issues (dependent variable), depends on another independent variable (i.e. managerial overconfidence). In this case, we empirically

examine the interaction effects by adding an interaction term between financing deficit and managerial overconfidence.

To illustrate the interaction effects, the following is a regression model with interaction term:

$$Y_{it} = \alpha_0 + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \beta_3 X_{1,it} * X_{2,it} + \cdots + \beta_n X_{n,it} + \varepsilon_{it} \tag{4.13}$$

The partial effect of $X_{1,it}$ on Y_{it} can be represented as:

$$\frac{\Delta Y_{it}}{\Delta X_{1,it}} = \beta_1 + \beta_3 X_{2,it} \tag{4.14}$$

If β_3 is statistically significant, we may conclude that there is an interaction effect between $X_{1,it}$ and $X_{2,it}$.

In addition, testing the interaction effects can also help to verify the underlying mechanism/channel through which $X_{1,it}$ influences Y_{it}.

4.6.1 Reparameterization of the model with interaction terms

However, as mentioned in Wooldridge (2009), the interpretation of β_1 is tricky: β_1 is the partial effect of $X_{1,it}$ on Y_{it} when $X_{2,it}$ is zero. To have a meaningful partial effect, we can reparameterize as follows:

$$\begin{aligned} Y_{it} &= \alpha_0 + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \beta_3 \left(X_{1,it} - \overline{X_{1,it}}\right)\left(X_{2,it} - \overline{X_{2,it}}\right) + \cdots + \beta_n X_{n,it} \\ &\quad + \varepsilon_{it} \\ &= \left(\alpha_0 + \beta_3 \overline{X_{1,it} X_{2,it}}\right) + \left(\beta_1 - \beta_3 \overline{X_{2,it}}\right) X_{1,it} \\ &\quad + \left(\beta_2 - \beta_3 \overline{X_{1,it}}\right) X_{2,it} + \beta_3 X_{1,it} * X_{2,it} + \cdots + \beta_n X_{n,it} + \varepsilon_{it} \end{aligned} \tag{4.15}$$

where $\overline{X_{1,it}}$ and $\overline{X_{2,it}}$ are the sample means of $X_{1,it}$ and $X_{2,it}$ respectively.

After demeaning the interaction term, the interpretation of the coefficient on $X_{1,it}$ becomes useful: $(\beta_1 - \beta_3\overline{X_{2,it}})$ is the partial effect of $X_{1,it}$ on Y_{it} when $X_{2,it} = \overline{X_{2,it}}$. In addition, we can replace $\overline{X_{1,it}}$ and $\overline{X_{2,it}}$ with any other values of interest (e.g. the median of the explanatory variables) (Wooldridge, 2009).

Another problem with the model including interaction term is that the interaction term, $X_{1,it} * X_{2,it}$, will be, by construction, highly correlated with $X_{1,it}$ and/or $X_{2,it}$. One common way to avoid unreliable estimates due to multicollinearity is to demean interaction terms (see e.g. Balli and Sørensen, 2012).

4.6.2 Consequences of imperfect multicollinearity

As summarized in Asteriou and Hall (2011), imperfect multicollinearity has several consequences. First, multicollinearity is associated with high standard errors and low t-statistics. This will lead to the conclusion that a potentially important explanatory variable is statistically insignificant. Second, the signs of the coefficient estimates are also likely to be changed due to multicollinearity. Third, the estimated coefficients can be very sensitive to small changes in sample size.

4.6.3 An indicator of multicollinearity: variance inflation factor (VIF)

Empirical models with interaction terms are often subject to multicollinearity problem that will inflate standard errors. As a way to diagnose multicollinearity, variance inflation factor (VIF) of independent variable $X_{k,it}$ can be calculated as follows:

$$VIF = \frac{1}{(1 - R^2)} \tag{4.16}$$

where R^2 is obtained from the regression where the independent variable $X_{k,it}$ is regressed on all other independent variables. VIF measures the extent to which the variance (i.e. the square of standard error) of the coefficient on $X_{k,it}$ is inflated because of multicollinearity. If VIF is 1, it means that $X_{k,it}$ is orthogonal to all other independent variables. However, if VIF is 10, it means that all other explanatory variables explains 90% (i.e. R^2) of the variations of $X_{k,it}$. Consequently, the variance of the coefficient on

$X_{k,it}$ is 900% higher. In other words, the standard error of the coefficient on $X_{k,it}$ is 30% higher. As a rule of thumb, a VIF beyond 10 is often considered as an indication of high multicollinearity. As mentioned before, to alleviate potential multicollinearity problem, we can demean the independent variable $X_{k,it}$.

4.6.4 Another way to test interaction effects: subsample analysis

Alternatively, to examine the extent to which the effect of *X* (independent variable) on *Y* (dependent variable) is influenced by *Z* (independent variable), one can regress *Y* on *X* using several subsamples partitioned based on Z. For example, we can first divide the sample into two subsamples based on large *Z* (above the median) and small *Z* (below the median) and then compare the coefficient estimates on *X* from those two subsamples. If there is no significant difference between the above two coefficients, one may conclude that the relationship between *X* and *Y* is not sensitive to Z.

Compare coefficients across groups:

Subsample 1: small Z $$Y_{it} = \beta_0^{Small\ Z} + \beta_1^{Small\ Z} X_{it} + \varepsilon_{it} \quad (4.17)$$

Subsample 2: large Z $$Y_{it} = \beta_0^{Large\ Z} + \beta_1^{Large\ Z} X_{it} + \varepsilon_{it} \quad (4.18)$$

No interaction effects if: $$\beta_1^{Small\ Z} = \beta_1^{Large\ Z}$$

The advantage of using subsample analysis to examine interaction effects is that we do not need to use interaction term and therefore can avoid resulting multicollinearity problem. However, this approach is subject to several limitations. First, coefficients from different regressions based on subsamples might not be easily comparable (especially when the R-squared of those regressions are highly different). Second, dividing into subsamples may reduce consecutive firm-years, which makes it difficult to capture the effect of within firm variations and more importantly control for firm fixed effects.

4.7 Internal Validity: Components, Threats and Solutions

4.7.1 Finite sample and asymptotic properties of estimators

To compare finite/small sample properties of different estimators, we can use the mean squared error (MSE) of the model defined as follows (e.g. Wooldridge, 2009):

$$MSE(W) = E[(W-\theta)^2] = \underbrace{Var(W)}_{Efficiency} + [\underbrace{Bias(W)}_{Biasedness}]^2 \tag{4.19}$$

where, W is an estimator of a parameter θ, which can be represented as a function (f) of random variables (V): $W = f(V)$.

$Var(W)$ is the variance of the estimator.

$Bias(W)$ is the bias of the estimator (i.e. $Bias(W) = E(W) - \theta$, where $E(W)$ is the expected value of the probability distribution of W).

Unbiasedness and efficiency are two finite/small sample properties of the estimator. One can reduce the bias of an estimator by choosing an appropriate function (f). As an asymptotic property, consistency is considered as "the minimal requirement of an estimator" (Wooldridge, 2009). This is because an inconsistent estimator can be far from the parameter (θ) and may not be useful. Suppose W_n is an estimator of θ with a sample of n obervations. W_n is regarded as a consistent estimator if for every $\varepsilon > 0$, $P(|W_n - \theta| > \varepsilon)$ shrinks to zero as the sample size (n) goes to infinity. Table 4.4 compares the consistency of linear panel models. In particular, if the assumed/true model is fixed effects estimator, the pooled OLS, between and random effects estimators are inconsistent.

Table 4.4 Linear panel model: common estimators and models

This table shows whether the estimates from pooled OLS, between, within, first differences and random effects estimators are consistent given the true model is pooled OLS (column a), random effects (column b) or fixed effects (column c) respectively.

	Assumed/True Model		
	(a)	(b)	(c)
Estimator of β	Pooled	Random Effects	Fixed Effects
Pooled OLS	Consistent	Consistent	Inconsistent
Between	Consistent	Consistent	Inconsistent

Within (or Fixed Effects)	Consistent	Consistent	Consistent
First Differences	Consistent	Consistent	Consistent
Random Effects	Consistent	Consistent	Inconsistent

Source: Cameron and Trivedi (2005) p699.

4.7.2 Threats to internal validity and solutions[54]

To enhance the internal validity of our empirical analysis, we review major threats to internal validity and possible solutions (see Table 4.5). A statistical analysis is considered as internally valid "if the statistical inferences about casual effects are valid for the population being studied" (Stock and Watson, 2003). More specifically, according to Stock and Watson (2003), internal validity has the following three components: (1) unbiasedness, (2) consistency and (3) standard errors yield confidence intervals that have the desired confidence level.

Table 4.5 presents five sources of bias that make the coefficient estimates from OLS regression biased and inconsistent, namely omitted variable bias, functional form misspecification, measurement error, sample selection and simultaneous causality, *all of which can be attributed to the correlation between the independent variable and the error term in the population regression* (Stock and Watson, 2003). In addition, we also briefly discuss the estimation of standard errors in panel models.

Table 4.5 Threats to internal validity: definitions and solutions

This table presents six factors that may influence the internal validity. Possible solutions to each threat to internal validity are also outlined. * indicates the solutions that have been implemented in our thesis to enhance internal validity.

Threats to internal validity	Definitions	Solutions
Unobservable omitted variables	"a variable that *both* determines Y and is correlated with one or more of the included regression is omitted" (Stock and Watson, 2003)	a. Fixed effects estimator*
		b. Instrumental variable
		c. Randomized controlled experiment
Functional form misspecification	The true population regression function is nonlinear, however the terms reflecting nonlinear relationships are omitted in the estimated linear regression	a. Polynomial regression*
		b. Natural logarithm*
		c. Interaction terms*

[54] See chapter 7 in Stock and Watson (2003) for a more detailed discussion on this topic.

Errors in variable	Measurement error (measures of independent variables are not clean)	a. Find a more valid measure[55]*
		b. Instrumental variable[56]
		c. Mathematical model of measurement error
Sample selection	"availability of the data is influenced by a selection process that is related to the value of the dependent variable" (Stock and Watson, 2003)	a. Heckman sample selection model
Simultaneous causality	Reverse causality (causality runs from dependent variable to independent variables, which makes the independent variables correlated with the error term)	a. Instrumental variable
		b. Randomized controlled experiment
Inconsistent standard errors	Heteroskedasticity and serial correlation	a. Use robust standard errors*

Source: summarized based on chapter 7 in Stock and Watson (2003)

4.7.2.1 Omitted variable bias

Omission of a relevant explanatory variable will make the coefficient estimates of existing explanatory variables in the model biased and inconsistent. This omitted variable bias occurs when the omitted variable is correlated with other explanatory variables and determines the dependent variable. Consequently, omitted variable bias violates one of the least square assumptions that the correlation between independent variables and the error term should be zero. In Stock and Watson (2003), the omitted variable bias can be represented as follows:

$$\widehat{\beta_1} \xrightarrow{p} \beta_1 + \frac{cov(u_i, X_i)}{\sigma_X^2} = \beta_1 + \rho_{Xu}\frac{\sigma_u}{\sigma_X} \tag{4.20}$$

The above equation shows that $\widehat{\beta_1}$ is close to $\beta_1 + \rho_{Xu}\frac{\sigma_u}{\sigma_X}$ as the sample size increases. $\widehat{\beta_1}$ is therefore not a consistent estimator of β_1. $\rho_{Xu}\frac{\sigma_u}{\sigma_X}$ is the bias that will not decrease

[55] It is important to measure the data accurately as there are no satisfactory solutions to the "errors in variable" problem (Gujarati and Porter, 2009).

[56] As argued by Gujarati and Porter (2009), the instrumental variable approach is theoretically appealing but not always practical. This is also true in our empirical analysis considering that it is difficult (if not impossible) to find an instrument for managerial overconfidence.

as the sample size increases. The magnitude and the direction of the bias depend on the absolute value and sign of ρ_{Xu} respectively.

a. Exclusion of a relevant variable vs. inclusion of an irrelevant variable

Having shown the consequence of excluding a relevant variable (i.e. underfitting problem), one may ask what if an irrelevant variable is included (i.e. overfitting problem). Fortunately, the inclusion of an irrelevant variable still provides unbiased and consistent estimates. However, the only problem is that the estimated variances of the coefficients are inflated. After comparing the bias associated with underfitting and overfitting, Gujarati and Porter (2009) provide an "unwanted"[57] suggestion that "it is better to include irrelevant variables than to omit the relevant ones".

4.7.2.2 Functional form misspecification

There are various functional forms including linear, linear-log, reciprocal, quadratic, interaction, log-linear, log-reciprocal, log-quadratic, double-log and logistic functional forms (see e.g., Table 8.1 in Asteriou and Hall (2007)). This section focuses on two functional forms that can be used to model two types of non-linear relationships (i.e. inverted U-shaped and J-shaped relationships respectively): polynomial regression and logistic transformation. (Another commonly used functional form that includes interaction terms has been introduced in section 4.6.)

a. Polynomial regression

It is likely that the effect of $X_{1,it}$ on Y_{it} depends on the magnitude of $X_{1,it}$. In this case, the relationship between independent variable and dependent variable is not linear. For example, in our empirical analysis, moderate managerial overconfidence and extremely high levels of overconfidence may have different effects on managerial decisions (e.g. inverted U-shaped relationship). One way to model this non-linearity is to use a polynomial regression as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} + \beta_2 X_{1,it}^2 + \cdots + \beta_n X_{1,it}^n + \varepsilon_{it} \quad (4.21)$$

[57] This suggestion is regarded as "unwanted" because in an ideal world if the true model is known any irrelevant explanatory variables should be excluded.

However, the polynomial regression is still considered as a multiple linear regression where $X_{1,it}^{n}$ is considered as additional independent variables. One potential problem with this approach is that $X_{1,it}$ and $X_{1,it}^{n}$ can be highly correlated which leads to multicollinearity problem. In finance, a quadratic function, i.e. $Y_{it} = \beta_0 + \beta_1 X_{1,it} + \beta_2 X_{1,it}^2 + \varepsilon_{it}$, is often used. If β_1 is positive and β_2 is negative, one can conclude that $X_{1,it}$ has a diminishing effect on Y_{it}.

b. Natural logarithm

Another case where the relationship between independent variable and dependent variable is non-linear is that the effect of $X_{1,it}$ on Y_{it} may increase as the magnitude of $X_{1,it}$ increases (i.e. J-shaped relationship). If this is the case, taking logs will convert an exponential relationship to linear relationship, which therefore enables us to use linear estimation methods to model non-linear relationship. A linear-log model is shown as follows[58]:

$$Y_{it} = \beta_0 + \beta_1 \ln(X_{1,it}) + \varepsilon_{it} \tag{4.22}$$

In addition, logarithmic form has several other important benefits/purposes. First, taking logs can normalize the data, meaning that its distribution becomes less skewed. This makes the estimates less sensitive to extreme values of independent variables (i.e. outliers). Second, the coefficients on the logarithmic form of the independent variables are easier to interpret because those slope coefficients are invariant to the units of measurement. In addition, Wooldridge (2009) summarizes several rules of thumb for taking logs. Logarithmic form is often used when a variable is (a) a positive dollar amount (e.g. wages, firm size); (b) large integer value (e.g. number of employees); (c) measured in years (e.g. CEO tenure, firm age) and (d) a proportion or a percent (although there is a tendency to use them in level forms).

[58] If $X_{1,it}$ takes on positive and zero values, one can use $\ln(X_{1,it} + 1)$.

4.7.2.3 Measurement error in independent variable (errors-in-variables)[59]

Measurement error (i.e. errors-in-variables bias) can make the explanatory variable correlated with the error term, which in turn makes the OLS estimates biased and inconsistent. The measurement error problem can be illustrated as follows:

$$\begin{aligned} Y_i &= \beta_0 + \beta_1 \widetilde{X}_\iota + \left[\beta_1\left(X_i - \widetilde{X}_\iota\right) + \mu_i\right] \\ &= \beta_0 + \beta_1 \widetilde{X}_\iota + v_i \end{aligned} \tag{4.23}$$

As shown in the above equation, the error term contains $(X_i - \widetilde{X_\iota})$, which will be correlated with $\widetilde{X}_\iota$. If the regressor, $\widetilde{X}_\iota$, is correlated with the error term, $\widehat{\beta_1}$ will be biased and inconsistent. More specifically, the magnitude and direction of the bias in $\widehat{\beta_1}$ depends on the correlation between $\widetilde{X}_\iota$.and $(X_i - \widetilde{X_\iota})$. Put differently, the measured value $\widetilde{X}_\iota$ can be represented as the sum of the actual value X_i and a purely random component w with mean zero and variance σ_w^2: $\widetilde{X}_\iota = X_i + w$. $\widehat{\beta_1}$ has the probability limit: $\widehat{\beta_1} \xrightarrow{p} \frac{\sigma_X^2}{\sigma_X^2+\sigma_w^2}\beta_1$. $\widehat{\beta_1}$ is inconsistent and biased towards zero because the ratio of $\frac{\sigma_X^2}{\sigma_X^2+\sigma_w^2}$ is less than one.

4.7.2.4 Estimation of standard errors in panel models

To make appropriate statistical inference, it is important to use panel-robust standard errors (see section 21.2.3. in Cameron and Trivedi (2005) for more detailed discussion on panel-robust statistical inference). The estimation of default standard errors in statistical software (e.g. Stata) often assumes the error term is independent and identically distributed (i.i.d.). However, this assumption is often violated in practice. In particular, the errors may be correlated over time. This serial correlation can cause underestimation of standard errors. Moreover, the errors are likely to be heteroskedastic.

[59] This is especially a major concern of the empirical work on managerial overconfidence considering that it is challenging to measure cognitive bias which is not directly observable. As we discussed in Chapter 3, many overconfidence measures used in the literature are likely to be contaminated by other frictions (e.g. information asymmetry). It is therefore important to use relatively clean proxies for overconfidence and attempt to rule out alternative explanations.

Therefore, we need to use cluster-robust standard errors that are adjusted for both serial correlation and heteroskedasticity[60].

Peterson (2009) compares various approaches that can be used to estimate standard errors in finance panel data sets. Different methods may generate highly different standard errors. The choice of appropriate method of estimating standard errors depends on whether there is firm effect (i.e. time-series dependence, meaning that the residuals are correlated across years within a firm) and/or time effect (i.e. cross-sectional dependence, meaning that the residuals are correlated across firms within a year) in the data. Peterson (2009) suggests that in the presence of firm fixed effect, which is common in corporate finance data, robust standard errors clustered at the firm level are unbiased. Peterson (2009) reports that in capital structure regression White and Fama-MacBeth standard errors are significantly biased downwards. Furthermore, in terms of potential time effect in capital structure regression, Peterson (2009) finds that clustering by time has little effect on the standard errors, indicating that the time effect is small in the capital structure data. Therefore, standard errors clustered by firm seem to be the appropriate method to deal with firm effects in many corporate finance datasets.

In addition, Imbens and Kolesar (2012) argue that the commonly used (conventional) robust standard errors (i.e. Eicker-Huber-White (EHW) and Liang-Zeger (LZ)) are biased downward especially in relatively small samples. In other words, the validity of the EHW and LZ standard errors rely on large sample sizes. They suggest that empirical studies should implement Bell and McCaffrey's (BM) (2002) modification.

4.8 Conclusion and the Choice of the Methods of Our Empirical Analysis

This chapter describes and compares econometric methods that are suitable for our empirical analysis. The major implications can be summarized as follows. For models with a binary dependent variable, Logit/Probit model is superior to linear dependent

[60] As pointed out in Cameron and Trivedi (2005), in the presence of serial correlation and heteroskedasticity, it is not enough to only use either (a) heteroskedastic-robust standard errors or (b) cluster-robust standard errors with the assumption of homoscedasticity.

model (i.e. OLS). For models with a fractional dependent variable, Tobit model is more valid. For models with a lagged dependent variable as an explanatory variable (i.e. dynamic model), GMM is more suitable than standard panel data estimators (e.g. fixed effects). For models with unobserved firm fixed effects, fixed effects (within) or first difference estimator should be used to control for unobserved heterogeneity. For models with interaction terms, multicollinearity might be a potential concern, which can however be mitigated by demeaning the interaction terms.

More specifically, the methods which are used in our empirical analysis are described as follows. In the first empirical study (i.e. Chapter 5), we choose the following methods. First, to examine the effect of managerial overconfidence on leverage, we use the fixed effects estimator with the purpose of removing potential time-invariant firm specific effects that are correlated with managerial overconfidence. Considering that the dependent variable (i.e. leverage ratio) is left censored, meaning that there are quite a few observations with zero leverage, we use a random-effects Tobit estimator which is suitable for models with censored dependent variable. In addition, to examine the effects of the changes of managerial overconfidence on the changes of leverage, we use a first difference estimator. Furthermore, to test the joint effects of managerial optimistic words and actions, we add an interaction term to our empirical model. We also conduct subsample analysis to examine whether the relation between our measures of overconfidence and leverage is driven by information asymmetry. As robustness checks, we use system GMM to estimate partial dynamic adjustment model in which the lagged leverage ratio is included as a control variable. We also use logistic regression to examine the impact of managerial overconfidence on the probability of low and zero leverage respectively, in which case we have binary dependent variables.

In the second empirical study (i.e. Chapter 6), the following methods are used. First, to examine the effect of managerial overconfidence on the degree of pecking order preference, we interact managerial overconfidence with the financing deficit variable in the Shyam-Sunder and Myers (1999) (SSM) regression. This modified SSM regression is then estimated using a fixed effects estimator, considering that there might be some time-invariant firm specific effects that are correlated with managerial overconfidence. Furthermore, we conduct subsample analysis to see whether the relation between

managerial overconfidence and the pecking order preference is influenced by firm size and earnings volatility.

In the third empirical study (i.e. Chapter 7), we adopt the following methods. First, we use a fixed effects estimator to test the relation between managerial overconfidence and debt maturity structure. However, the dependent variable (i.e. the debt maturity ratio) is right censored, meaning that some firms only use long-term debt in a particular year. In other words, the upper limit of the debt maturity ratio is one. Given the fractional nature of the dependent variable, we use a random-effects Tobit estimator. In addition, we examine the impact of the changes of managerial overconfidence on the changes of debt maturity using a first difference estimator. Moreover, we conduct subsample analysis to see whether the relation between managerial overconfidence and debt maturity depends on firms' future investment opportunities and the level of leverage. The subsample analysis can help to understand the underlying channel through which managerial overconfidence affects debt maturity structure.

On the other hand, it is important to recognize that "*model building is an art as well as a science*" (Gujarati and Porter, 2009). In other words, econometric analysis is not purely technical, although this chapter is largely devoted to the technical aspects of panel data econometrics. The importance of the relatively less technical aspects of empirical analysis can never be overstated. We therefore conclude this chapter by outlining Kennedy's (2002) ten commandments of applied econometrics to guide our empirical work: (1) use common sense and theory; (2) ask the right question; (3) know the context; (4) inspect the data; (5) not worship complexity; (6) look long and hard at thy results; (7) beware the costs of data mining; (8) be willing to compromise; (9) not confuse significance with substance; and (10) confess in the presence of sensitivity. To sum up, this thesis aims to conduct analysis that is technically appropriate and apply appropriately Kennedy's commandments of applied econometrics.

CHAPTER 5

Empirical Study 1: Optimistic Disclosure Tone, Insider Trading and Capital Structure

Chapter 5. Empirical Study 1: Optimistic Disclosure Tone, Insider Trading and Capital Structure

5.1 Introduction

A growing literature demonstrates the importance of the effect of managers on corporate policies (e.g., Bertrand and Schoar, 2003; Cadenillas *et al*., 2004). In particular Frank and Goyal (2007) document a first order effect that the differences among CEOs and especially CFOs matter for firm's capital structure. More specifically, recent theoretical (Heaton, 2002; Hackbarth, 2008; Malmendier *et al*., 2011) and empirical studies (Graham *et al*., 2013; Ben-David *et al*., 2013; Malmendier *et al*., 2011; Malmendier and Zheng, 2012) examine how a particular trait of managers (i.e. managerial overconfidence) impacts financing decisions. One limitation of the above empirical tests of the role of managerial overconfidence is that their empirical measures of overconfidence are time-invariant. The reason why overconfidence can be time-varying is that people are subject to self-attribution bias,[61] described as "endogenous overconfidence" (Hillary and Hsu, 2011), and therefore will learn to be overconfident (Hirshleifer, 2001). With this in mind, this chapter empirically examines the impact of time-varying managerial overconfidence as a determinant of leverage whereas related prior literature examines static measures of overconfidence.

A unique feature of this study is that we use both words and actions of managers to gauge their time-varying overconfident beliefs. The words-based measure of overconfidence is constructed using computational content analysis of the tone of UK Chairman's Statement. To ensure the validity of our tone measures, we construct composite tone index using principal component analysis, which consists of six individual measures of optimistic tone.[62] The action-based measure is related to how firm managers trade their own firm's shares. The idea is that overconfident managers

[61] Self-attribution bias can be defined as a tendency to attribute good (bad) outcomes to own abilities (external factors) (Miller and Ross, 1975).

[62] These six tone measures are calculated using (1) the wordlists developed by finance and accounting researchers (Henry, 2008; Loughran and McDonald, 2011) for the analysis of financial narratives and (2) relevant dictionaries (i.e. wordlists used to define various dimensions of language) in two linguistic analysis software (Diction and LIWC) (e.g. optimism and certainty). More explanations on the tone measures are available in the methodology section.

are more likely to buy and less likely to sell. Interestingly, we can explore potential contradictions between managerial words and actions[63]. Recent work (Brockman, Li and Price, 2012) reports a reverse tone-insider trading pattern (i.e. positive (negative) conference call tone predicts net insider selling (purchase)). A key contribution of this study is to empirically examine the implications of this type of contradiction for leverage.

The theoretical relationship between managerial overconfidence and leverage can be either positive or negative (Malmendier *et al*., 2011). Heaton's (2002) model suggests that overconfident managers believe that equity is undervalued by outside investors and they are therefore reluctant to use equity financing. In other words, managerial overconfidence is associated with higher information costs, which in turn leads to higher leverage. Hackbarth (2008) incorporates managerial overconfidence in a trade-off framework and also predict that managerial overconfidence is positively related to leverage. This is because overconfident managers underestimate the bankruptcy cost of debt and consequently use more debt to take tax benefits. However, Malmendier *et al*. (2011) show that managerial overconfidence may lead to either a preference for debt over equity financing, as predicted by Heaton's (2002) model, or debt conservatism. They argue that the net effect of managerial overconfidence on leverage depends on manager's perceived financing costs and investment returns as well as the availability of internal financing (more discussions on this model will be presented in section 5.2). The main purpose of this study is to empirically test different channels through which managerial overconfidence affects leverage.

This study has two major findings. First, optimistic tone is negatively related to leverage. This finding is consistent with the proposition that managerial overconfidence may lead to conservative debt policy, especially when firms have sufficient retained earnings or perceived financing costs are higher than corresponding investment returns. Our subsample analysis further confirms that the negative tone-leverage relationship is not driven by either information asymmetry or impression management.

[63] For example, insider selling may contradict optimistic tone, suggesting the possibility that managers attempts to intentionally disinform investors. More discussions on the combined effects of tone and insider trading will be provided later.

Second, we find interesting joint effect of optimistic tone and insider trading. The coefficient on the interaction between tone and insider selling is negative, suggesting that high insider (especially CEOs) sales weaken the negative tone-leverage relationship. This observation can be attributed to the fact that insider selling contradicts optimistic tone which indicates that managers are not as confident as their words suggest. In contrast, insider purchase, which confirms that optimistic tone is a strong proxy for managerial overconfidence, enhances the negative tone-leverage relationship.

The contribution of this study is threefold. First, we develop a time-varying measure of managerial overconfidence using computational tone analysis and we are one of the first studies that examine the effects of optimistic tone in the corporate finance context. Second, to the best of our knowledge, we provide initial empirical evidence that managerial overconfidence may lead to lower leverage. This important evidence supports Malmendier *et al.*'s (2011) proposition that debt conservatism may be caused by managerial overconfidence. Third, we explore the empirical implications of the inconsistency between managerial words and actions, both of which provide useful windows into managerial beliefs.

We proceed as follows. Section 5.2 first reviews alternative explanations of optimistic tone and then develops hypotheses regarding the effects of managerial overconfidence on leverage. Section 5.3 describes our two measures of managerial overconfidence, namely tone of Chairman's Statement and insider trading of CEO and CFO, and our sample. Section 5.4 discusses main findings and alternative interpretations of our results and conducts robustness checks. Section 5.5 concludes.

5.2 Hypothesis Development

This section first discusses various alternative interpretations of corporate disclosure tone and then develops the link between tone and leverage. Finally, we show the joint effects of tone and insider trading on leverage.

5.2.1 Corporate disclosure tone - an overview

A growing body of accounting literature examines the tone (i.e. the use of optimistic/pessimistic or positive/negative language) of various corporate disclosures including Managerial Discussion and Analysis (MD&A) (Davies and Tama-Sweet, 2012), earnings press releases (Davis, Piger and Sedor, 2012; Demers and Vega, 2011) and conference calls (Price *et al*., 2012). However, the effects of disclosure tone on corporate financial decisions remain a neglected area of research. Interestingly, previous studies suggest that disclosure tone has multiple interpretations, namely "inform", "intentionally disinform" and "unintentionally disinform" investors. In particular, disclosure tone is subject to three major alternative interpretations from information asymmetry, impression management and overconfidence (hubris) perspectives respectively. [64]

5.2.1.1 Information asymmetry perspective: "inform investors"

First, positive disclosure tone can be interpreted as "incremental information" (Merkl-Davies and Brennan, 2011), which "inform" investors and therefore reduces information asymmetry between managers and investors. This information asymmetry interpretation of tone is based on the assumption that investors are rational and are able to undo reporting bias. Considering that reporting bias will reduce stock price performance and managerial reputation (Baginski *et al*., 2000), managers therefore have no incentive to engage in biased reporting. Lang and Lundholm (2000) investigate voluntary disclosure activities around equity offerings and their impacts on stock prices. They find that firms with a consistent level of disclosure experience relatively smaller price declines at the announcement date. This is because disclosure reduces the information costs associated with equity offering. Furthermore, Kothari, Li and Short (2009) find that positive management disclosure is negatively related to the equity cost of capital and return volatility, which supports the view that disclosures can mitigate

[64] See Merkl-Davies and Brennan (2011) for a comprehensive review on various explanations of narrative disclosures and a conceptual framework of impression management. They provide four explanations for corporate disclosure, namely incremental information, impression management, hubris and retrospective sense-making.

information asymmetry[65] (see e.g., Diamond and Verrecchia, 1991; Easley and O'Hara, 2004).

5.2.1.2 Impression management perspective: "intentionally disinform investors"

Second, disclosure tone can be regarded as a way of impression management. In other words, managers attempt to "intentionally disinform" investors or manipulate investors' perception of firm performance. More specifically, impression management can be caused by agency problems between managers and investors where biased reporting is a strategic choice of self-interested managers to maximize their personal wealth (e.g., Adelberg, 1979; Merkl-Davies and Brennan, 2007). Moreover, impression management may be used as another mechanism (in addition to "reducing information asymmetry") to reduce cost of equity, namely "hyping" (Lang and Lundhold, 2000). Empirically, Lang and Lundhold (2000) document that firms with a considerable increase of disclosure in the six months before their offering experience price increase prior to the equity offering. However, those firms have much larger negative returns at and subsequent to the announcement. This observation is consistent with the proposition that disclosure is used to "hype the stock".

5.2.1.3 Managerial overconfidence perspective: "unintentionally disinform investors"

Third, from behavioural/psychological perspective, optimistic disclosure tone can be a product of managerial overconfidence/hubris (Merkl-Davies and Brennan, 2011). In this case, irrational managers "unintentionally disinform" investors. However, this behavioural interpretation of tone is largely neglected by existing literature of corporate disclosure (Brennan and Conroy, 2013). Amernic and Craig (2007) emphasize the importance of monitoring excessive narcissist-like language used by narcissist CEOs, who are prone to be overconfident, in their letters to shareholders. Recent studies report evidences of cognitive bias (e.g. overconfidence) detected using manual and computational linguistic analysis of corporate disclosures. For example, Craig and Amernic (2011) detect destructive narcissism of CEOs of Enron, Starbucks and General Motors based on CEO's letter to shareholders. In a similar vein, Brennan and Conroy

[65] In particular, positive/favourable disclosures are associated with market makers' favourable evaluation of firm future value and risk, which in turn reduce the transaction cost of equity (i.e. adverse-selection component of the bid-ask spread).

(2013) also conduct manual content analysis of narratives in bank CEO letters to shareholders to reveal CEO personality traits (e.g. narcissism, hubris, overconfidence and CEO-attribution). Furthermore, computational content analysis of managerial statements are employed to measure overconfidence of CEO and fund managers (e.g., Liu, Taffler and John, 2009; Eshraghi and Taffler, 2012). Davis, Matsumoto and Zhang (2012) examine the effect of managerial style on the tone of earnings conference calls. This body of recent evidence supports the notion that "tone used in corporate disclosures is potentially influenced by unintentional, manager-specific tendencies[66] to be overly optimistic or pessimistic". From this perspective, optimistic tone can be regarded as a proxy for managerial overconfidence. This study makes an important contribution to this under-researched behavioural perspective of disclosure tone and tests the relationship between optimistic tone and leverage.

5.2.2 Testable hypotheses

This section first develops the link between "contemporaneous" optimistic tone, as a proxy for managerial overconfidence, and firm's leverage and then shows the combined effects of insider trading patterns and tone on leverage.

5.2.2.1 Optimistic tone and leverage

Before developing our hypotheses on the tone-leverage relationship, it is important to draw a difference between contemporaneous tone and lagged tone. In particular, given that Chairman's Statement is only available for investors to read (several weeks) after the fiscal year end, the only channel through which contemporaneous tone influences leverage is managerial overconfidence. In other words, the contemporaneous tone can be considered as an ex-post measure of managers' overconfident beliefs. Empirically, to directly examine the roles of the other two alternative channels, namely "reducing information asymmetry" and "hyping the stock", we have to use lagged tone measures. [67] In this case, the market reacts to the lagged tone of Chairman's Statement, which in turn influences firms' leverage. However, the problem is that the lagged tone can also be considered as a proxy for previous year's managerial overconfidence. Therefore,

[66] It is considered as managerial bias that is closely related to their personalities, experience and values (Davis, Matsumoto and Zhang, 2012).
[67] In an "inform" or "intentionally disinform" context, contemporaneous tone is *not* expected to influence firms' contemporaneous leverage.

because of the difficulties in disentangling lagged tone, our empirical tests focus on the behavioural perspective of disclosure tone, where we use contemporaneous tone to measure managerial overconfidence.[68]

Next, we discuss the effects of managerial overconfidence on leverage. Based on a recent model by Malmendier *et al*. (2011), the theoretical relationship between managerial overconfidence and firm leverage depends on the relation between "overestimated investment returns, cash holdings and perceived financing costs".

In particular, managerial overconfidence may lead to lower level of debt (i.e. debt conservatism) if the firm has sufficient internal finance (i.e. retained earnings), which is particularly true because overconfident managers may retain cash for future investment.[69] Huang-Meier, Lambertides and Steeley (2013) empirically examine the effect of CEO optimism on corporate cash holding policy. They find that optimistic managers hold more cash than their non-optimistic counterparts, which is consistent with the proposition that optimistic managers are reluctant to use external financing and therefore hold more cash. In brief, managerial overconfidence could make the firm forgo the tax benefits and therefore be underleveraged relative to the optimal target debt ratio. To empirically examine Malmendier *et al*.'s (2011) proposition that managerial overconfidence may lead to conservative debt policy, we test the following hypothesis:

> ***Hypothesis 1a (H1a):*** contemporaneous tone, as a measure of *managerial overconfidence*, is *negatively* related to leverage, if managerial overconfidence is associated with *debt conservatism*.

[68] One may argue that using lagged tone can reduce simultaneity bias and is therefore preferred. However, a recent study (Reed, 2013) shows that lagging a suspected endogenous independent variable does not help to avoid simultaneity problem especially when this variable is serially correlated.

[69] Another explanation for the negative overconfidence-leverage relationship is related to "perceived financing costs". More specifically, overconfident managers tend to overestimate the information costs associated with external financing including both debt and equity. In this case, it is possible that overconfident manager's perceived financing costs outweigh investment returns (Malmendier *et al*., 2011). Consequently, if internal financing is not sufficient, overconfident managers are likely to forgo investment opportunities. In brief, managerial overconfidence may lead to underinvestment and lower financing needs.

On the other hand, however, as pointed out by Malmendier *et al*. (2011), debt conservatism caused by overconfidence "can, but need not" lead to low leverage. This is because managerial overconfidence may enhance the preference for debt over equity financing. Put differently, overconfident managers tend to issue equity more conservatively than debt. Similarly, an earlier model by Heaton (2002) also suggests that optimistic managers believe that equity is undervalued by outside investors and therefore prefer debt to equity. Using Shyam-Sunder and Myers's (1999) financing deficit framework, Malmendier *et al*. (2011) and Malmendier and Zheng (2012) find supporting evidences that overconfident managers are more willing to use debt to meet external financing needs. Furthermore, from trade-off perspective, Hackbarth's (2008) model predicts that overconfident managers will underestimate financial distress costs associated with debt and hence tend to use more debt than their rational counterparts. Taken together, from these perspectives managerial overconfidence could be positively related to leverage.

> ***Hypothesis 1b (H1b):*** contemporaneous tone, as a measure of *managerial overconfidence*, is *positively* related to leverage, if managerial overconfidence is associated with *enhanced preference for debt over equity*.

5.2.2.2 Joint effect of tone and insider trading on leverage

One may argue that "contemporaneous tone" may also indirectly influence leverage through the other two channels considering the possibility that managers maintain similar level of optimistic tone throughout the fiscal year. For example, firm managers may have already delivered similar financial narratives to investors via other ways of business communication especially the mandatory quarterly reporting [70] (including interim management statements and quarterly results announcements). More specifically, the tone of Chairman's Statement might be similar to that of other narratives published earlier in the same fiscal year.

[70] UK government strongly supports European Commission's recent proposal that the requirement to publish quarterly financial reports under the EU Transparency Directive should become voluntary. The purpose is to reduce excessive focus on short-term earnings and encourage long-term decision-making, as a response to John Kay's Review of UK Equity Markets published in July, 2012.

One way to empirically distinguish alternative effects of tone is to compare managers' personal beliefs about firms' prospects gauged from their actions and words. More specifically, we double check managers' overconfidence beliefs as indicated by their optimistic tone using their insider trading patterns which serves as another window into their beliefs. The idea is that insider selling may indicate that optimistic tone is used to "hype the stock", while insider purchase may indicate that optimistic tone is driven by managerial overconfidence.

In particular, to further distinguish between "intentionally disinform" and "unintentionally disinform", we investigate the interaction between insider trading and tone. In the context of shareholder litigation, Rogers *et al*. (2011) find that litigation risk is greater when managers use optimistic language and engage in insider selling. This is because insider selling signals managers' intent to mislead investors using optimistic language. Following the same logic, we expect that insider selling and purchase may indicate "intentionally disinform" and "unintentionally disinform" respectively. Therefore, we expect the following combined effects of insider trading and tone on tone-leverage relationship.

> ***Hypothesis 2 (H2):*** the interaction between tone and insider selling will *weaken* the tone-leverage relationship, when insider selling *contradicts* optimistic tone and indicates that optimistic tone is used to "intentionally disinform" investors.

> ***Hypothesis 3 (H3):*** the interaction between tone and insider purchase will *enhance* the tone-leverage relationship, when insider purchase *confirms* optimistic tone and indicates that optimistic tone is used to "unintentionally disinform" investors.

5.3 Methodology and Data

This section first introduces our two measures of managerial overconfidence and then describes our sampling procedures and presents summary statistics and correlation

analysis. We postpone the description of various empirical model specifications until the next section.

5.3.1 Dependent variable: book leverage vs. market leverage

Like many previous empirical studies on capital structure, we uses both book and market leverage, partly because there is no consensus on which measure is more suitable. Book leverage is more related to asset in place (which supports debt financing) than to growth opportunities (Myers, 1977) and it also better resemble the relationship between investment and source of financing. However, book leverage is backward looking and moreover book equity is a "plug-number" that can be negative (Welch, 2004). In contrast, market leverage is forward looking. The limitation of market leverage is that it is driven by stock price changes and therefore is relatively more volatile than book leverage. Given the above differences between book and market leverage, it is expected that empirical results based on these two alternative measures of leverage will not be identical. (see e.g., Frank and Goyal (2009) and Bessler, Drobetz and Kazemieh (2011) for more discussions on the advantages and disadvantages associated with book and market leverage.)

5.3.2 Measurement of managerial overconfidence

We use both words-based and action-based measures of managerial overconfidence. In contrast to the static measures of overconfidence commonly employed in the literature, our overconfidence measures are time-varying. [71]

5.3.2.1 Words-based measure of overconfidence: optimistic tone

We construct two composite tone indices. One is based on the raw tone measures. The other is orthogonalized so that each component is not correlated with certain firm-specific variables (especially standard capital structure determinants).

[71] Existing behavioural finance studies (e.g., Malmendier and Tate, 2005; Malmendier, Tate and Yan, 2011) tend to model managerial overconfidence as a habitual behaviour which is static. This static approach can be problematic because other behavioural biases, especially self-attribution bias, may affect the confidence level. In other words, although the level of overconfidence can be quite persistent over time, we should not examine overconfidence in isolation.

a. Raw Tone Index

Our first measure of managerial overconfidence is based on tone analysis[72] of the Chairman's Statement. We construct optimistic tone measures by counting both optimism-increasing and optimism-decreasing words. We use six individual wordlists. Our first three wordlists are the same as those in Rogers, Buskirk and Zechman (2011) and Davis, Ge, Matsumoto and Zhang (2012), namely *TONE_OPTIMISM*, *TONE_H* and *TONE_LM*. *TONE_OPTIMISM* is a measure of net optimism[73] counted using a dictionary in Diction 6.[74] Liu, Taffler and John (2009) conduct content analysis of CEO speech in the context of mergers and acquisitions and also use the optimism variable in Diction as a proxy for CEO overconfidence. More recently, Eshraghi and Taffler (2012) use *TONE_OPTIMISM* as a measure of fund manager overconfidence. *TONE_H* and *TONE_LM* are two wordlists developed by Henry (2008) and Loughran and McDonald (2011) respectively to measure positive and negative words especially in a financial context. In particular, *TONE_H* and *TONE_LM* are calculated as the ratio of the difference between positive and negative words[75] (i.e. $\frac{Positive_{it}-Negative_{it}}{Positive_{it}+Negative_{it}}$).

Besides, we also use another three tone measures, all of which are positively related to optimism, including *TONE_CERTAIN1*, *TONE_CERTAIN2* and *TONE_EMOTION*. *TONE_CERTAIN1* and *TONE_EMOTION*[76] are measured using dictionaries in Linguistic Inquiry and Word Count (LIWC) 2007. *TONE_CERTAIN2* is another

[72] Tone analysis (and more generally textual analysis) is becoming increasingly popular in recent accounting and finance studies. For example, Rogers, Buskirk and Zechman (2011) examine the relation between disclosure tone and shareholder litigation. For a review on studies of corporate disclosures, please see Li (2010a).

[73] In Diction, optimism is defined as "language endorsing some person, group, concept or event, or highlighting their positive entailments".

[74] As a unique feature of Diction software, there is standardization procedure when calculating a particular item. In particular, we compare our collected Chairman's Statements to three alternative norms in Diction including (1) all cases, (2) corporate financial reports and (3) corporate public relations. Our empirical results are qualitatively similar using alternative norms.

[75] The terms "positive/negative" and "optimistic/pessimistic" are often used interchangeably in the literature (e.g., Davis, Piger and Sedor, 2012). Li (2010b) standardize the terms to "positive/negative" instead of "optimistic/pessimistic".

[76] An earlier version of LIWC has a category named "optimism", however in the 2007 version words are classified more broadly into "positive emotion" and "negative emotion".

measure of certainty[77] based on a dictionary in Diction 6. *TONE_CERTAIN2* has also been used to measure overconfidence of fund managers (Eshraghi and Taffler, 2012). Similarly, Li (2010b) includes "uncertain tone", which is highly associated with negative tone, in his tone measure.

To address potential endogeneity issues associated with the above six individual tone measures, we form a composite tone index using a principal component analysis (PCA). In particular, we define $Tone\ Index_{it}$ as the first principal components of the correlation matrix of six raw tone measures. The first component, with an eigenvalue of 2.609, [78] explains 43.5 percent of our sample variance.

$$\begin{aligned} Tone\ Index_{it} &= \sum_{j=1}^{6} Loading_{ij} * Tone\_X_{ijt} \\ &= 0.496 Emotion_{it} + 0.192 Certain1_{it} + 0.446 Optimism_{it} \\ &+ 0.027 Certain2_{it} + 0.480 Tone\_H_{it} + 0.536 Tone\_LM_{it} \end{aligned} \quad (5.1)$$

where, $Tone\_X_{ijt}$ represents individual tone measure *j* of firm *i* in fiscal year *t*. $Loading_{ij}$ is the loading for individual tone measure *j* of firm *i*. The loading for *Certain1* and *Certain2* is much lower compared with other tone measures. However, our empirical results are qualitatively similar when we exclude those two measures of certainty tone.

b. Orthogonalized Tone Index

To address the concern that the raw tone might be contaminated by firm-specific variables[79], a composite index of the orthogonalized tone measures is constructed as

[77] In Diction, certainty is defined as "language indicating resoluteness, inflexibility, and completeness and a tendency to speak ex cathedra".
[78] The eigenvalue of second component is close to one (i.e. 1.135).
[79] In terms of the determinants of tone (e.g., current performance, growth opportunities, operating risks and complexity), Huang, Teoh and Zhang (2011) find that tone, as measured using Loughran and McDonald (2011) wordlist, is positively related to market-to-book and volatility of stock returns and negatively related to firm size, age and number of business segments. Our first orthogonalized tone measure (*TONE_RES1*) controls for four standard determinants of capital structure (i.e. market-to-book, size, tangibility and profitability). Our second orthogonalized tone measure (*TONE_RES2*) further controls for stock price performance and firm age.

follows. First, we regress each individual tone measure on standard determinants of capital structure as follows:

$$Tone\_X_{ijt} = \alpha + \beta_1 Profit_{it} + \beta_2 MB_{it} + \beta_3 Size_{it} + \beta_4 Tangibility_{it} + \varepsilon_{ijt} \quad (5.2)$$

where, $Tone\_X_{ijt}$ represents six individual tone measures. ε_{ijt} is the corresponding orthogonalized individual tone measures.

Next, a composite index ($Tone\ Index_{it}^{\perp}$) is formed based on the first principal component of six residuals (i.e. $Tone\_X_{ijt}^{\perp} = \varepsilon_{ijt}$) from the above regressions. The first component explains 41.8 percent of the sample variance[80].

$$\begin{aligned} Tone\ Index_{it}^{\perp} &= \sum_{j=1}^{6} Loading_{ij} * Tone_{X}{}_{ijt}^{\perp} = \sum_{j=1}^{6} Loading_{ij} * \varepsilon_{ijt} \\ &= 0.495 Emotion_{it}^{\perp} + 0.154 Certain1_{it}^{\perp} + 0.440 Optimism_{it}^{\perp} \\ &+ 0.036 Certain2_{it}^{\perp} + 0.490 Tone\_H_{it}^{\perp} + 0.545 Tone\_LM_{it}^{\perp} \end{aligned} \quad (5.3)$$

The use of orthogonalized tone is also inspired by a paper on tone management by Huang, Teoh and Zhang (2011). They argue that disclosure tone can be used to either "inform" or "disinform" investors. On the one hand, positive tone may reflect firm's fundamental and thus can "inform". For example, more profitable firms may use more positive tone. On the other hand, tone can be regarded as a form of impression management or strategic choice (i.e. "abnormal tone"[81]) to manipulate investors' perception of firm performance and thus can "disinform". Such impression management can be complementary to earnings management.

c. Suitability of Chairman's Statement for tone analysis

We use the Chairman's Statement in the UK annual report as the source of narrative for tone analysis for several reasons. First, the Chairman's Statement is widely read by

[80] The eigenvalues of first and second components are 2.509 and 1.139 respectively.
[81] It is abnormal in the sense that the positive tone cannot be justified by firm's fundamentals.

investors and analysts (Bartlett and Chandler, 1997). According to Clatworthy and Jones (2003), the Chairman's Statement is "the most read of the UK's accounting narratives" and "the longest established". [82] Second, Chairman's Statement is largely unaudited and not heavily regulated. The language used in the Chairman's Statement is much less standard than Directors' Report which is subject to regulatory requirements. Third, disclosure-related litigation is rare in the UK relative to the US. Therefore, the UK accounting narratives (e.g. Chairman's Statement) are relatively less constrained compared with the MD&A in the US 10-K report. Finally, while Chairman's Statement is signed by chairman, who is often a non-executive director in the UK, existing literature[83] seems to agree that Chairman's Statement is an organizational rather than individual communication. This means that firm's key financial decision makers (e.g. CEO and CFO) also have significant influences on the choice of language in the Chairman's Statement.

5.3.2.2 Action-based measure of overconfidence: net purchase ratio

The insider trading patterns of the managers may reflect their perceptions of firms' prospects (Jenter, 2005). Overconfident managers tend to overestimate the firm value and hence are more willing to purchase their own stocks. This trading behaviour can be considered as managers' market timing in their personal portfolios. In the spirit of Jenter (2005) and Jin and Kothari (2008), we use insider trading-based measure of managerial overconfidence. In particular, following prior studies (e.g., John and Lang, 1991; Marciukaityte and Szewczyk, 2011) we construct the valued-based and volume-based net purchase ratio (NPR) using the value and volume of open market purchases and sales respectively as follows:

[82] Many previous studies on UK accounting narratives focus on Chairman's Statement (see e.g., Smith and Taffler, 2000, Clatworthy and Jones, 2003; Clatworthy and Jones, 2006). Smith and Taffler (2000) use Chairman's Statement to predict firm bankruptcy. A more recent study (Schleicher and Walker, 2010) conduct manual content analysis of the tone of forward-looking statements (i.e. outlook sections) in the UK annual report (most of which are located at the end of Chairman's Statement).

[83] For example, Clatworthy and Jones (2003) argue that accounting narratives such as UK Chairman's Statement allow "management" to describe corporate financial performance. In addition, Schleicher and Walker (2010) attribute the bias in the tone of outlook statements to "managers". In particular, they argue that "managers with a willingness to engage in impression management are likely to target forward-looking statements", while 73.5 percent of the forward-looking narratives are located in Chairman's Statement (Schleicher and Walker, 2010).

$$NPR\_VA_{it} = \frac{Buy\_va_{it} - Sell\_va_{it}}{Buy\_va_{it} + Sell\_va_{it}} \quad (5.4)$$

$$NPR\_VOL_{it} = \frac{Buy\_vol_{it} - Sell\_vol_{it}}{Buy\_vol_{it} + Sell\_vol_{it}} \quad (5.5)$$

where, NPR_VA_{it} and NPR_VOL_{it} are the value-based and volume-based NPRs respectively of CEO and CFO of firm i in fiscal year t. Buy_va_{it} and Buy_vol_{it} are the aggregate value and volume of insider purchases respectively and $Sell\_va_{it}$ and $Sell\_vol_{it}$ are the aggregate value and volume of insider sales respectively. The NPR ranges from -1 to 1 and higher NPR indicates higher managerial overconfidence.

a. Value-based NPR vs. volume-based NPR

Next, we briefly compare volume-based and value-based NPR. Volume-based NPR is superior in the sense that it may capture the potential relation between the frequency of purchases and the level of overconfidence. Previous studies (Billett and Qian, 2008; Doukas and Petmezas, 2007) indicate that multiple acquisitions are associated with increasing overconfidence due to self-attribution. Similarly, multiple insider purchases may also contribute to overconfidence if the insiders attribute the success of previous purchases to their own (timing) ability.[84] However, the volume-based NPR may fail to fully reflect managers' perceived mispricing of their stocks. The value-based NPR takes the price of insider transactions into consideration. As noted earlier, overconfident managers tend to believe that their firm stocks are undervalued. Consequently, they are more likely to purchase at a higher price relative to their rational counterparts. The value-based NPR captures the perceived undervaluation which is an indicator of

[84] For example, overconfident directors buy one share at a time for three times for 10 p/share, while rational directors also buy one share at a time but for twice for 15 p/share. Both of them sell one share for 10 p/share. The volume-based NPRs for overconfident and rational directors are 1/2 and 1/3 respectively, while the value-based NPRs for them are both 1/2 (i.e. (30-10)/(30+10)). In this case, the volume-based NPR is able to capture the "endogenous" overconfidence of those directors with more frequent purchases.

overconfidence.[85] In brief, the volume-based NPR plays a better role in gauging "endogenous overconfidence" developed from self-attribution, while the value-based NPR is a better measure of the degree of perceived undervaluation caused by overconfidence.

However, alternatively, managers may trade based on their private information. In this case, higher NPR is an indicator of a higher degree of information asymmetry. Our subsequent subsample analysis shows that the relationship between NPRs of CEO and leverage is stronger for smaller, intangible and younger firms[86]. This observation suggests that NPR might also capture information asymmetry.

5.3.3 The sample

Data used in this study are from the following sources. The UK firms' financial data is obtained from *Thomson Worldscope* database. Insider trading data is from *Hemmington Scott* database. Chairman's Statements are manually collected from the company annual reports which are downloaded either through *Northcote* website or directly from company websites.

Our sample of unbalanced panel data is constructed as follows. The selection of sample period is guided by data availability. All financial and utility firms are excluded. Firm observations with missing financial data are excluded. Observations with the length of fiscal period less than 11 months or over 13 months are excluded. To conduct tone analysis, we need the digital version of the UK company annual reports, so that the Chairman Statement can be readable by the content analysis software (i.e. *LIWC 2007* and *Diction 6*)[87]. In addition, to construct insider trading-based measure of

[85] For example, if both overconfident and rational insiders buy and sell one share for 10p/share, their volume-based NPRs are both 0. Due to the perceived undervaluation, overconfident directors are more likely to buy at a relatively higher price (15 p/share). Therefore, the value-based NPR tends to be higher (i.e. (15-10)/(15+10)=0.2) for the overconfident directors. From this perspective, the value-based NPR is a more valid measure of overconfidence.

[86] Firm size, tangibility and firm age are all negatively associated with information asymmetry.

[87] In terms of the procedure of content analysis, we first extract Chairman's Statements from annual report. Next, we detect transformation errors in the combined text file using the Spelling & Grammar function in Microsoft Word 2010. Finally, various types of errors are corrected before the texts are inputted in the LIWC and Diction.

overconfidence, only those firms with insider transactions in any year during our sample period are selected. All variables are winsorized at the 1st and 99th percentile to eliminate the effect of outliers. The final sample comprises 459 firms and 2283 observations during the period 1994-2011[88].

5.3.3.1 Descriptive statistics and correlation matrix

Table 5.1 presents summary statistics of our main variables. The means of book and market leverage are 0.180 and 0.140 respectively. The mean of firm size (i.e. logarithm of sales) is 12.320 with a standard deviation of 2.240. Our sample seems to be representative in terms of firm size. The mean of CEOs' NPRs are lower than those of CFOs, while CEOs' NPRs are relatively more volatile. We also report the distribution of the net purchase ratio (NPR) of CEO and CFO in Panel D. Over 60 percent of their NPRs are 1, indicating that insider purchases occur far more often than insider sales.

Table 5.2 shows the pairwise Pearson correlations matrix. Surprisingly, the correlation between tone-based measures of overconfidence (*TONE* and *TONE_RES*) and insider trading-based measures of CEO and CFO overconfidence (*VA_CEO, VOL_CEO, VA_CFO* and *VOL_CFO*) are negative and statistically significant. Therefore, this suggests that these two measures might capture different aspects of overconfidence. This is because either words-based or action-based measure is subject to alternative interpretations other than managerial overconfidence, which will be discussed later.

Regarding the correlations between overconfidence measures and leverage, both *TONE* and *TONE_RES* are negatively and significantly related to book and market leverage. In contrast, NPRs of CEO and CFO are positively and significantly related to book and especially market leverage. Market-to-book ratio is negatively related to leverage, while firm size, tangibility and profitability are positively related to leverage. Finally, multicollinearity is not a major concern given that the magnitudes of the correlations between independent variables are not large[89].

[88] Most of the observations are after 2000 because machine readable annual reports are almost not available in the 1990s.

[89] We also check potential multicollinearity by looking at variance inflation factor (VIF) of all explanatory variables and interaction terms. Their VIF values are all less than 10, indicating low degree of collinearity.

Table 5.1 Descriptive statistics

This table presents the descriptive statistics of the main dependent and independent variables.

Variable	Obs.	Mean	S.D.	Min.	Median	Max.
Panel A: standard dependent and independent variables						
Book leverage	2283	0.180	0.150	0.000	0.170	0.610
Market leverage	2283	0.140	0.130	0.000	0.110	0.520
PDEF_CF/NA	2283	0.110	0.310	0.000	0.000	2.030
NDEF_CF/NA	2283	-0.030	0.070	-0.430	0.000	0.000
MB	2283	1.760	1.260	0.560	1.400	8.790
Log(sales)	2283	12.320	2.240	6.140	12.510	16.870
Tangibility	2283	0.260	0.230	0.000	0.200	0.890
Profitability	2283	0.090	0.180	-0.880	0.120	0.390
Effective tax rate	2283	0.230	0.350	-1.620	0.280	1.640
Price performance	2283	0.000	0.530	-1.880	0.080	1.170
Firm age	2283	5.668	1.029	2.079	5.587	7.419
Panel B: words-based measures of managerial overconfidence (i.e. tone of Chairman's Statement)						
TONE	2283	-0.000	1.615	-5.693	0.150	3.676
TONE_RES	2283	-0.000	1.584	-5.034	0.165	4.988
NET_EMOTION	2283	0.740	0.170	0.220	0.760	1.000
CERTAIN1	2283	1.030	0.430	0.210	0.970	2.330
OPTIMISM	2283	53.520	2.070	49.430	53.330	60.160
CERTAIN2	2283	45.630	3.130	32.610	46.040	51.880
TONE_H	2283	0.720	0.230	-0.060	0.770	1.000
TONE_LM	2283	0.560	0.290	-0.290	0.600	1.000
Panel C: action-based measures of managerial overconfidence (i.e. net purchase ratio)						
VA_CEO	1327	0.330	0.890	-1.000	1.000	1.000
VA_CFO	1071	0.460	0.830	-1.000	1.000	1.000
VOL_CEO	1327	0.480	0.790	-1.000	1.000	1.000
VOL_CFO	1071	0.570	0.740	-1.000	1.000	1.000

Panel D: distribution of NPRs of CEO and CFO

	VA_CEO		VA_CFO		VOL_CEO		VOL_CFO	
Intervals	Obs.	Percentage	Obs.	Percentage	Obs.	Percentage	Obs.	Percentage
-1	249	18.76%	166	15.50%	249	18.76%	166	15.50%
(-1, -0.8]	104	7.84%	61	5.70%	0	0.00%	0	0.00%
(-0.8, -0.6]	34	2.56%	16	1.49%	5	0.38%	1	0.09%
(-0.6, -0.4]	24	1.81%	19	1.77%	6	0.45%	3	0.28%
(-0.4, -0.2]	22	1.66%	18	1.68%	26	1.96%	19	1.77%
(-0.2, 0]	20	1.51%	19	1.77%	84	6.33%	66	6.16%
(0, 0.2)	21	1.58%	12	1.12%	2	0.15%	3	0.28%
[0.2, 0.4)	13	0.98%	11	1.03%	48	3.62%	18	1.68%
[0.4, 0.6)	14	1.06%	14	1.31%	19	1.43%	17	1.59%
[0.6, 0.8)	9	0.68%	5	0.47%	31	2.34%	12	1.12%
[0.8, 1)	9	0.68%	7	0.65%	49	3.69%	43	4.01%
1	808	60.89%	723	67.51%	808	60.89%	723	67.51%
Total	1327	100%	1071	100%	1327	100%	1071	100%

Table 5.2 Correlation matrix

This table shows Pearson correlation coefficients between all pairs of our main variables, as defined in Appendix 5.A. ***, ** and * indicate that the correlation coefficient is significant at 1% 5% and 10% levels respectively.

		1	2	3	4	5	6	7	8	9	10		
1.	*PDEF_CF/NA*	1											
2.	*NDEF_CF/NA*	0.176***	1										
3.	*MB*	0.187***	-0.040*	1									
4.	*Log(sales)*	-0.260***	-0.118***	-0.179***	1								
5.	*Tangibility*	-0.126***	-0.018	-0.118***	0.238***	1							
6.	*Profitability*	-0.345***	-0.169***	-0.053**	0.460***	0.203***	1						
7.	*Effective tax rate*	-0.029	0.002	-0.002	0.183***	0.063***	0.171***	1					
8.	*Price performance*	0.038*	-0.092***	0.253***	0.104***	0.071***	0.275***	0.062***	1				
9.	*Book leverage*	-0.006	-0.025	-0.194***	0.409***	0.394***	0.135***	0.065***	-0.045**	1			
10.	*Market leverage*	-0.037*	0.007	-0.380***	0.295***	0.357***	0.026	0.014	-0.209***	0.883***	1		
11.	*TONE*	0.064***	-0.048**	0.197***	0.196***	-0.004	0.228***	0.058***	0.309***	-0.043**	-0.192***		
12.	*TONE_RES*	0.128***	0.011	0.000	0.000	0.000	0.000	0.001	0.204***	-0.076***	-0.150***		
13.	*NET_EMOTION*	0.025	-0.071***	0.110***	0.228***	0.013	0.261***	0.087***	0.242***	-0.021	-0.122***		
14.	*CERTAIN1*	-0.092***	-0.059***	0.021	0.261***	0.042**	0.117***	0.032	0.035*	0.090***	0.043**		
15.	*OPTIMISM*	0.023	-0.032	0.104***	0.229***	0.054***	0.155***	0.015	0.162***	0.051**	-0.044**		
16.	*CERTAIN2*	0.023	-0.011	-0.005	0.006	-0.013	-0.05**	-0.039*	0.010	0.000	-0.004		
17.	*TONE_H*	0.110***	0.012	0.227***	0.010	-0.052**	0.142***	0.035*	0.311***	-0.103***	-0.253***		
18.	*TONE_LM*	0.083***	-0.041**	0.194***	0.086***	-0.039*	0.151***	0.039*	0.282***	-0.093***	-0.216***		
19.	*VA_CEO*	0.058**	0.055**	-0.224***	-0.171***	-0.044	-0.182***	-0.038	-0.168***	0.017	0.120***		
20.	*VA_CFO*	0.060**	-0.029	-0.203***	-0.178***	-0.028	-0.171***	-0.033	-0.163***	0.056*	0.139***		
21.	*VOL_CEO*	0.040	0.065**	-0.217***	-0.058**	-0.032	-0.149***	-0.012	-0.149***	0.072***	0.140***		
22.	*VOL_CFO*	0.051*	-0.018	-0.204***	-0.087***	-0.017	-0.14***	-0.011	-0.148***	0.083***	0.136***		
		11	12	13	14	15	16	17	18	19	20	21	22
11.	*TONE*	1											
12.	*TONE_RES*	0.938***	1										
13.	*NET_EMOTION*	0.801***	0.740***	1									
14.	*CERTAIN1*	0.310***	0.235***	0.175***	1								
15.	*OPTIMISM*	0.721***	0.670***	0.451***	0.275***	1							
16.	*CERTAIN2*	0.043**	0.056***	0.000	0.128***	0.042**	1						
17.	*TONE_H*	0.774***	0.744***	0.503***	0.064***	0.353***	0.010	1					
18.	*TONE_LM*	0.865***	0.831***	0.600***	0.121***	0.505***	-0.009	0.657***	1				
19.	*VA_CEO*	-0.155***	-0.056**	-0.127***	-0.084***	-0.119***	0.008	-0.110***	-0.122***	1			
20.	*VA_CFO*	-0.141***	-0.047	-0.113***	-0.120***	-0.076**	-0.052*	-0.087***	-0.126***	0.670***	1		
21.	*VOL_CEO*	-0.145***	-0.071***	-0.110***	-0.073***	-0.108***	0.011	-0.098***	-0.130***	0.876***	0.644***	1	
22.	*VOL_CFO*	-0.142***	-0.068**	-0.108***	-0.099***	-0.078***	-0.029	-0.092***	-0.137***	0.595***	0.898***	0.723***	1

5.4 Results and Discussion

5.4.1 Univariate leverage regression

Table 5.3 summarizes univariate leverage regressions. We find that both *TONE* and *TONE_RES* explain a relatively large proportion of within firm variations in leverage (especially market leverage). The coefficients on both tone measures are negative and statistically significant at 1% level. In addition, the net purchases ratios (NPRs) of both CEO and CFO have positive and significant impacts on leverage. Firm size and tangibility are positively associated with leverage and account for a significant proportion of between firm variations in leverage (especially book leverage). Market-to-book ratio has negative coefficients and helps to explain the relatively high proportion of both within and between firm variations in market leverage. The signs and statistical significance of all explanatory variables will be further tested using subsequent multivariate regressions.

5.4.2 Multivariate leverage regression

This section examines the influence of managerial overconfidence on leverage, controlling for standard capital structure determinants. In particular, we use the following model to test the impact of the level of overconfidence on both market and book leverage:

$$LEV_{it} = a + b_1 MO_{it} + B_2 \boldsymbol{X}_{it} + v_i + e_{it} \quad (5.6)$$

where, LEV_{it} is book or market leverage ratio. $\boldsymbol{X}_{it}$ is a vector of firm-level control variables including *PDEF*, *NDEF*, market-to-book ratio, firm size, tangibility and profitability. v_i is time-invariant firm-specific effects. e_{it} is the error term. We use both fixed effects (FE) and random-effects Tobit (RE-Tobit) as the estimators. RE-Tobit estimator is superior in the sense that it accounts for the fractional nature of dependent variable (i.e. leverage ratio is bounded between zero and one).

Table 5.4 reports the results for leverage regressions (Equation 5.6). The coefficients on both *TONE* and *TONE_RES* are negative and statistically significant at 1% level in all

specifications.[90, 91] This observation is consistent with the proposition that managerial overconfidence may cause debt conservatism (***Hypothesis 1a***). From investors' perspective, this result is also in line with the argument that moderate managerial overconfidence makes equity investors more willing to buy firms' share (because of potential positive effects of overconfidence). Furthermore, our subsequent subsample analysis (see section 4.5.1) demonstrates that the observed negative tone-leverage relationship is unlikely to be due to either information asymmetry or impression management.

On the other hand, both insider trading-based measures of CEO (*VOL_CEO*) and especially CFO overconfidence (*VA_CFO* and *VOL_CFO*) are positively and significantly related to leverage. This finding appears, at face value, to be consistent with the prediction that managerial overconfidence may lead to the preference for debt over equity (because overconfident managers tend to use equity more conservatively than debt) (***Hypothesis 1b***). However, given a reverse tone-insider trading pattern that NPRs are negatively related to words-based proxy for managerial overconfidence (i.e. optimistic tone), NPR may not be a clean proxy for managerial overconfidence (our subsequent analysis in section 5.4.5.2 shows that NPR is likely to be contaminated by information asymmetry). There might be other channels through which NPRs lead to higher leverage. In fact, the positive relationship between NPRs and leverage can be explained by two well-documented patterns in standard finance including (1) insider selling prior to equity offerings (e.g., Karpoff and Lee, 1991) and (2) insider purchase

[90] The raw tone measure, *TONE*, is subject to endogeneity problem that positive tone might be driven by high profitability and good stock price performance. In this case, the negative coefficient on *TONE* can also be attributed to the negative effects of profitability and price performance on leverage. However, our finding that the coefficient on *TONE_RES* is also significantly negative can reduce the above endogeneity concern.

[91] One may ask whether the negative relationship between tone and leverage can be explained by reverse causality. In particular, high leverage (or overleveraged) firms, according to trade-off theory, will probably need to adjust down their leverage by issuing equity in the next fiscal year. In this case, overleveraged firms will use optimistic tone to reduce the information cost of equity. Another form of reverse causality is that overlevered firms, in order to counteract potential unfavourable analyst reports and credit rating downgrade associated with high leverage, will use optimistic tone. Both two forms of reverse causality imply that high leverage may cause more optimistic tone. However, this implication of reverse causality is not consistent with our empirical finding.

prior to equity repurchases (e.g., Lee *et al*., 1992). In addition, the positive NPR-leverage relationship might also be explained by overconfident managers' greater willingness to both buy their own shares and initiate share repurchase program relative to their rational counterparts.

Among the firm-level controls, the coefficients on tangibility and firm size are positive, while the coefficients on market-to-book ratio and profitability are negative. Tangibility is positively related to leverage, which can be explained by the fact that collateral makes debt financing easier. Firm size is also positively related to leverage, which is consistent with the notion that large firms have better reputation and lower bankruptcy risk and are therefore use more debt. However, this finding is inconsistent with pecking order prediction that firm size, as a proxy for information costs, should be positively related to equity issuance. The negative effect of the market-to-book ratio on leverage is consistent with market timing argument that firms prefer equity financing when firm stock is overvalued. The negative effect of profitability on leverage can be attributed to profitable firms' pecking order preference for internal financing over debt financing. The above results are robust to alternative measures of leverage (i.e. book leverage (see panel A) vs. market leverage (see panel B)).

Table 5.3 Univariate leverage regressions

This table reports estimated coefficients and within, between and overall R-squared of univariate fixed effects (FE) regressions where the dependent variables are book (Panel A) and market (Panel B) leverage respectively. All variables are defined in Appendix 5.A. Standard errors are adjusted for firm-level clustering. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	Panel A. Dependent variable: book leverage					*Panel B. Dependent variable: market leverage*				
Variables	Estimated coefficients	t-stat	R^2 (within)	R^2 (between)	R^2 (overall)	Estimated coefficients	t-stat	R^2 (within)	R^2 (between)	R^2 (overall)
TONE	-0.007***	-5.79	0.020	0.001	0.002	-0.015***	-11.26	0.101	0.029	0.037
TONE_RES	-0.006***	-4.99	0.015	0.004	0.006	-0.012***	-9.47	0.068	0.015	0.023
CEO_VA	0.001	0.13	0.000	0.001	0.001	0.008**	2.50	0.007	0.020	0.015
CEO_VOL	0.003	0.97	0.001	0.006	0.005	0.011***	3.29	0.012	0.024	0.020
CFO_VA	0.007**	2.11	0.005	0.001	0.003	0.009**	2.49	0.008	0.018	0.018
CFO_VOL	0.005	1.34	0.002	0.005	0.007	0.011**	2.50	0.009	0.021	0.018
PDEF/NA	0.035***	4.26	0.020	0.008	0.000	0.010	1.37	0.002	0.015	0.001
NDEF/NA	0.176***	5.00	0.029	0.009	0.001	0.137***	5.12	0.017	0.003	0.000
MB	-0.004	-1.12	0.003	0.048	0.038	-0.023***	-6.02	0.078	0.152	0.144
Firm size	0.013*	1.70	0.007	0.171	0.168	0.025***	3.93	0.022	0.091	0.087
Tangibility	0.083	1.53	0.006	0.210	0.156	0.028	0.59	0.001	0.179	0.128
Profitability	-0.089***	-3.44	0.018	0.016	0.018	-0.152***	-5.62	0.051	0.004	0.001

Table 5.4 Leverage

This table presents fixed effect (FE) and random-effect Tobit (RE-Tobit) regressions with book and market leverage as dependent variables in Panel A and B respectively. All the variables are defined in Appendix 5.A. Standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Panel A. Dependent variable: book leverage

Variables	(1) FE	(2) RE-Tobit	(3) FE	(4) RE-Tobit	(5) FE	(6) RE-Tobit	(7) FE	(8) RE-Tobit	(9) FE	(10) RE-Tobit	(11) FE	(12) RE-Tobit
TONE	-0.006***	-0.006***										
	(0.000)	(0.000)										
TONE_RES			-0.005***	-0.006***								
			(0.000)	(0.000)								
VA_CEO					0.000	0.001						
					(0.883)	(0.798)						
VOL_CEO							0.002	0.004				
							(0.502)	(0.229)				
VA_CFO									0.006**	0.010***		
									(0.050)	(0.005)		
VOL_CFO											0.005	0.009**
											(0.211)	(0.020)
PDEF	0.035***	0.048***	0.035***	0.048***	0.043***	0.053***	0.043***	0.053***	0.055***	0.060***	0.055***	0.060***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
NDEF	0.276***	0.246***	0.276***	0.246***	0.168***	0.149***	0.167***	0.148***	0.170***	0.155***	0.169***	0.155***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.002)	(0.000)
MB	-0.002	-0.004*	-0.003	-0.006***	-0.001	-0.004	0.000	-0.004	0.000	-0.002	-0.001	-0.002
	(0.653)	(0.064)	(0.334)	(0.008)	(0.908)	(0.167)	(0.974)	(0.219)	(0.956)	(0.539)	(0.947)	(0.556)
Firm size	0.019***	0.032***	0.019**	0.031***	0.017	0.034***	0.018*	0.034***	0.009	0.031***	0.008	0.030***
	(0.009)	(0.000)	(0.012)	(0.000)	(0.111)	(0.000)	(0.093)	(0.000)	(0.481)	(0.000)	(0.529)	(0.000)
Tangibility	0.110*	0.196***	0.112**	0.198***	0.039	0.186***	0.038	0.184***	0.102	0.241***	0.106	0.243***
	(0.051)	(0.000)	(0.047)	(0.000)	(0.628)	(0.000)	(0.633)	(0.000)	(0.208)	(0.000)	(0.190)	(0.000)
Profitability	-0.069***	-0.073***	-0.077***	-0.082***	-0.106**	-0.099***	-0.105**	-0.098***	-0.165***	-0.149***	-0.165***	-0.148***
	(0.005)	(0.000)	(0.001)	(0.000)	(0.019)	(0.000)	(0.020)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Constant	-0.077	-0.262***	-0.066	-0.250***	-0.027	-0.285***	-0.039	-0.289***	0.079	-0.265***	0.091	-0.260***
	(0.405)	(0.000)	(0.481)	(0.000)	(0.844)	(0.000)	(0.775)	(0.000)	(0.617)	(0.000)	(0.561)	(0.000)
R^2 (within)	0.100		0.097		0.088		0.089		0.123		0.120	
R^2 (between)	0.303		0.303		0.173		0.177		0.095		0.090	
Log-likelihood		1800.010		1799.985		1027.310		1027.999		826.417		825.255
Obs.	2283	2283	2283	2283	1327	1327	1327	1327	1071	1071	1071	1071
Firms	459	459	459	459	377	377	377	377	340	340	340	340

Table 5.4 Leverage (Continued)

Panel B. Dependent variable: market leverage

Variables	(1) FE	(2) RE-Tobit	(3) FE	(4) RE-Tobit	(5) FE	(6) RE-Tobit	(7) FE	(8) RE-Tobit	(9) FE	(10) RE-Tobit	(11) FE	(12) RE-Tobit
TONE	-0.012***	-0.012***										
	(0.000)	(0.000)										
TONE_RES			-0.011***	-0.011***								
			(0.000)	(0.000)								
VA_CEO					0.003	0.003						
					(0.235)	(0.244)						
VOL_CEO							0.005*	0.006*				
							(0.081)	(0.081)				
VA_CFO									0.009***	0.010***		
									(0.009)	(0.001)		
VOL_CFO											0.008*	0.011***
											(0.052)	(0.005)
PDEF	0.021***	0.030***	0.021***	0.030***	0.018**	0.025**	0.018**	0.025**	0.027**	0.031***	0.027**	0.031***
	(0.003)	(0.000)	(0.003)	(0.000)	(0.021)	(0.012)	(0.021)	(0.012)	(0.015)	(0.007)	(0.015)	(0.007)
NDEF	0.109***	0.092***	0.109***	0.092***	0.123***	0.101***	0.123***	0.100***	0.130***	0.108***	0.130***	0.108***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.003)	(0.001)	(0.004)	(0.002)	(0.004)	(0.003)	(0.004)
MB	-0.016***	-0.028***	-0.020***	-0.032***	-0.021***	-0.033***	-0.020***	-0.033***	-0.026***	-0.038***	-0.026***	-0.038***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size	0.024***	0.026***	0.022***	0.024***	0.039***	0.028***	0.039***	0.028***	0.028***	0.025***	0.026***	0.025***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.005)	(0.000)
Tangibility	0.073*	0.145***	0.077*	0.149***	0.062	0.154***	0.060	0.152***	0.095	0.191***	0.100	0.193***
	(0.093)	(0.000)	(0.075)	(0.000)	(0.294)	(0.000)	(0.302)	(0.000)	(0.176)	(0.000)	(0.151)	(0.000)
Profitability	-0.096***	-0.092***	-0.113***	-0.110***	-0.171***	-0.148***	-0.171***	-0.148***	-0.247***	-0.194***	-0.247***	-0.193***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.139*	-0.170***	-0.115	-0.145***	-0.313***	-0.187***	-0.317***	-0.189***	-0.160	-0.154***	-0.147	-0.150***
	(0.100)	(0.000)	(0.175)	(0.000)	(0.002)	(0.000)	(0.001)	(0.000)	(0.210)	(0.000)	(0.250)	(0.000)
R^2 (within)	0.203		0.204		0.210		0.212		0.263		0.260	
R^2 (between)	0.274		0.275		0.218		0.218		0.226		0.230	
Log-likelihood		1983.342		1983.904		1106.644		1107.490		919.337		918.252
Obs.	2283	2283	2283	2283	1327	1327	1327	1327	1071	1071	1071	1071
Firms	459	459	459	459	377	377	377	377	340	340	340	340

5.4.3 Multivariate leverage regression in first differences

Next, to examine the impacts of changes in managerial overconfidence (especially the time-varying component of optimistic tone) on the changes of leverage, we run Equation 5.6 in first differences[92] as follows:

$$\Delta LEV_{it} = a + b_1 \Delta MO_{it} + B_2 \Delta \boldsymbol{X_{it}} + v_i + \varepsilon_{it} \quad (5.7)$$

where, all variables are fiscal year-on-year changes of the level variables in Equation 5.6.

Table 5.5 reports the results from leverage regression in first differences (Equation 5.7). The coefficients on both Δ*TONE* and Δ*TONE_RES* are negative and significant at 1% level. This finding confirms the negative relationship between the level of tone and leverage ratio. However, the coefficients on changes of net purchase ratio (NPR) of CEO and CFO are all statistically insignificant and their signs vary across model specifications. This could be attributed to small within-firm variations of NPRs and a majority (i.e. more than 60 percent) of value and volume-based NPRs of CEO and CFO are one. We find consistent results with our previous findings (in Section 5.4.2) for most of the control variables including Δ*PDEF/NA* (+), Δ*NDEF/NA* (+), Δ*MB* (-), Δfirm size (+) and Δprofitability (+), except Δtangibility which becomes less stable in terms of statistical significance and signs.

5.4.4 Interaction between optimistic tone and insider trading

Section 5.4.1 and 5.4.2 show that optimistic tone and insider trading (i.e. net purchase ratio) have different direct impacts on leverage. This section further explores the empirical implication of the interaction between optimistic tone and insider trading for leverage.

[92] Similarly, Frank and Goyal (2003) also run leverage regressions in first differences. However, they point out that this specification may bias the coefficient estimates towards zero and has a lower R^2.

Table 5.5 Leverage regressions in first differences

This table presents fixed effect (FE) leverage regressions in first differences with book and market leverage as dependent variables. All the variables are defined in Appendix 5.A. Standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	Panel A. Dependent variable: book leverage change (model 1-6)						*Panel B. Dependent variable: market leverage change (model 7-12)*					
	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE	(7) FE	(8) FE	(9) FE	(10) FE	(11) FE	(12) FE
Δ*TONE*	-0.002***						-0.007***					
	(0.008)						(0.000)					
Δ*TONE_RES*		-0.002***						-0.007***				
		(0.008)						(0.000)				
Δ*VA_CEO*			-0.005						-0.001			
			(0.114)						(0.712)			
Δ*VOL_CEO*				-0.005						0.000		
				(0.309)						(0.965)		
Δ*VA_CFO*					0.002						0.003	
					(0.513)						(0.437)	
Δ*VOL_CFO*						0.002						0.004
						(0.708)						(0.463)
Δ*PDEF/NA*	0.034***	0.034***	0.038***	0.037***	0.042**	0.042***	0.024***	0.024***	0.022**	0.022**	0.020*	0.020*
	(0.000)	(0.000)	(0.004)	(0.005)	(0.011)	(0.009)	(0.000)	(0.000)	(0.029)	(0.029)	(0.069)	(0.070)
Δ*NDEF/NA*	0.191***	0.191***	0.207***	0.206***	0.143**	0.143**	0.173***	0.173***	0.151***	0.151***	0.117***	0.118***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.045)	(0.045)	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)	(0.005)
Δ*MB*	-0.006***	-0.007***	-0.011*	-0.010*	-0.006	-0.006	-0.019***	-0.022***	-0.033***	-0.033***	-0.027***	-0.027***
	(0.006)	(0.002)	(0.059)	(0.069)	(0.172)	(0.176)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ*Firm size*	0.021*	0.021*	0.043**	0.044**	0.043	0.044	0.039***	0.038***	0.099***	0.100***	0.104***	0.105***
	(0.058)	(0.061)	(0.026)	(0.022)	(0.157)	(0.155)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ*Tangibility*	0.158**	0.159**	-0.018	-0.016	0.106	0.104	0.100**	0.103**	0.077	0.079	0.078	0.077
	(0.021)	(0.020)	(0.840)	(0.858)	(0.434)	(0.440)	(0.039)	(0.035)	(0.263)	(0.252)	(0.437)	(0.442)
Δ*Profitability*	-0.079***	-0.083***	-0.103***	-0.103***	-0.208***	-0.209***	-0.089***	-0.100***	-0.140***	-0.139***	-0.289***	-0.288***
	(0.000)	(0.000)	(0.004)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Constant	-0.003**	-0.003**	-0.004**	-0.004**	-0.003	-0.003	-0.004***	-0.004***	-0.007***	-0.007***	-0.007***	-0.007***
	(0.014)	(0.014)	(0.012)	(0.012)	(0.204)	(0.198)	(0.000)	(0.000)	(0.002)	(0.002)	(0.005)	(0.004)
R^2 (within)	0.173	0.173	0.196	0.193	0.196	0.195	0.233	0.233	0.243	0.242	0.284	0.284
R^2 (between)	0.132	0.132	0.115	0.113	0.142	0.139	0.139	0.139	0.141	0.142	0.088	0.087
Firms	421	421	256	256	206	206	421	421	256	256	206	206
Obs.	1645	1645	754	754	569	569	1645	1645	754	754	569	569

The main purpose of examining the interaction between optimistic tone and insider trading is to empirically distinguish between "intentionally disinform" and "overconfidence (unintentionally disinform)" perspectives of tone. We follow the empirical strategies of Staw *et al*. (1983) and Abrahamson and Park (1994), in which the association between impression management and insider sales is examined. Specifically, if positive tone is associated with subsequent stock sales by firm directors, it is highly likely that positive tone is used *consciously* to manipulate investors' perception. On the other hand, the interaction between positive tone and high net purchase is an indication of managerial overconfidence, meaning that managerial overconfidence contributes to both positive tone and insider purchases. Put differently, a combination of highly optimistic tone and high net purchase indicates overconfidence. In this case, managerial overconfidence makes managers disinform investors *unconsciously* by using optimistic tone.

In particular, to test the joint effect of optimistic tone of Chairman's Statement and insider trading, similar to Rogers, Buskirk and Zechman (2011)[93] we interact tone measures with an indicator of abnormal insider trading as follows:

$$LEV_{it} = a + b_1 TONE_{it} + b_2 NPR(-1)\_Dummy_{it} + b_3 TONE_{it} * NPR(-1)\_Dummy_{it} + B_4 \boldsymbol{X}_{it} + v_i + e_{it} \quad (5.8)$$

$$LEV_{it} = a + b_1 TONE_{it} + b_2 NPR(1)\_Dummy_{it} + b_3 TONE_{it} * NPR(1)\_Dummy_{it} + B_4 \boldsymbol{X}_{it} + v_i + e_{it} \quad (5.9)$$

where, $NPR(-1)\_Dummy_{it}$ is an indicator of pure insider selling that takes the value one if the net purchase ratio is -1 and zero otherwise. $NPR(1)\_Dummy_{it}$ is an indicator of pure insider purchase that takes the value one if the net purchase ratio is 1 and zero otherwise. We check variance inflation factors (VIFs) for the above regression models with interaction terms, multicollinearity is not a problem.

[93] Rogers, Buskirk and Zechman (2011) examine the combined effects of optimistic tone of earnings announcements and insider trading in the context of shareholder litigation. They report that the interaction between optimism and abnormal insider selling will increase litigation risk. The reason for the increased likelihood of being sued is that insider selling contradicts optimistic disclosure tone.

Table 5.6 reports the results for leverage regressions with interaction effects of tone and an indicator of pure insider selling (Equation 5.8). *CEO_NPR(-1)* and *CFO_NPR(-1)* are two dummy variables take on the value one if NPRs of CEO and CFO respectively are -1 and zero otherwise. Both *CEO_NPR(-1)* and *CFO_NPR(-1)* are negatively correlated with leverage, while only the coefficients on *CFO_NPR(-1)* are statistically significant in all specifications. In terms of the combined effects, the interaction between *CEO_NPR(-1)* and tone measures are positive and statistically significant in most of the specifications. In brief, the above findings suggest that CEO selling could weaken the negative effects of optimistic tone on leverage, while CFO selling has a direct and significantly negative impact on leverage.

Table 5.7 reports the results for the leverage regressions with interaction effects of tone and an indicator of pure insider purchase (Equation 5.9). *CEO_NPR(1)* and *CFO_NPR(1)* are two dummy variables take on the value one if NPRs of CEO and CFO respectively are 1 and zero otherwise. Both *CEO_NPR(1)* and *CFO_NPR(1)* are positively correlated with leverage, while the coefficients on *CFO_NPR(1)* are statistically more significant. Regarding interaction effects, the interaction between *CEO_NPR(1)* and tone measures are negative and statistically significant in all specifications. This finding suggests that optimistic tone has more negative impacts on leverage especially when CEOs engage in pure purchase of their firm's stocks. The interaction between *CFO_NPR(1)* and tone measures are also negative but statistically insignificant.

Overall, the negative coefficients on the interaction between insider purchase dummy and tone also support the managerial overconfidence channel: high insider purchase activities suggest that optimistic tone is a strong indicator of managerial overconfidence, that is, high insider purchase is associated with enhanced debt conservatism caused by managerial overconfidence (***Hypothesis 3***). On the other hand, the positive coefficients on the interaction between insider selling dummy and tone are consistent with the managerial overconfidence story: high insider selling activities suggest that optimistic tone is a weak indicator of managerial overconfidence. Consequently, the presence of high insider selling is associated with weaker debt conservatism caused by managerial overconfidence (i.e. the negative relationship between optimistic tone and leverage)

(***Hypothesis 2***). In brief, insider trading patterns indicates how strong optimistic tone is as a measure of overconfidence.

Nevertheless, one may contend that the above interaction effects may also be explained by information asymmetry and impression management channels. In particular, insider (especially CEO) selling, which contradicts optimistic tone, will make equity investors less willing to buy the firm's shares. In contrast, when high CEO purchase, as another indicator of managerial belief, confirms optimistic tone, investors are more willing to buy firm's stocks. The above two mechanisms only work when investors react to the tone. However, this is less likely given that we measure tone using the contemporaneous Chairman's Statement which is only available for the readers (e.g. investors) after fiscal year end. To further rule out the above two alternative channels, we conduct more formal analysis in the next section.

5.4.5 Subsample analysis: alternative interpretations of optimistic tone and insider trading

This section investigates whether our two measures of managerial belief are subject to alternative interpretations, especially information asymmetry, by conducting subsample analysis.

5.4.5.1 Sensitivity of tone-leverage relationship to information asymmetry

To distinguish between rational (i.e. information asymmetry and impression management) and irrational (i.e. managerial overconfidence (hubris)) interpretations of optimistic tone, we examine the extent to which the significance of tone-leverage relationship varies with proxies for information asymmetries. Firm size is an important indicator of information asymmetries. Small firms have higher information asymmetry problem and are followed by fewer analysts. Lang and Lundholm (2000) examine whether voluntary disclosure prior to equity offerings are used to reduce information asymmetry or hype the stock. For this research purpose, their sample is limited to small firms. The reason is that small firms are followed by fewer analysts and are more likely to use disclosure to "influence market

Table 5.6 Leverage regression with interaction effects of tone and insider selling

This table presents fixed effect (FE) regressions with book and market leverage as dependent variables. Interactions between indicators of pure insider selling (i.e. *CEO_NPR(-1)* and *CFO_NPR(-1)*) and tone are included in all regressions. All the variables are defined in Appendix 5.A. Standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	Panel A. Dependent variable: market leverage				*Panel B. Dependent variable: book leverage*			
	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE	(7) FE	(8) FE
TONE	-0.011***		-0.011***		-0.007***		-0.006***	
	(0.000)		(0.000)		(0.000)		(0.006)	
TONE_RES		-0.011***		-0.010***		-0.007***		-0.005***
		(0.000)		(0.000)		(0.000)		(0.007)
CEO_NPR(-1)	-0.011**	-0.008*			-0.002	-0.001		
	(0.040)	(0.100)			(0.716)	(0.908)		
*CEO_NPR(-1)*TONE*	0.011***				0.010***			
	(0.001)				(0.008)			
*CEO_NPR(-1)*TONE_RES*		0.007**				0.008**		
		(0.046)				(0.038)		
CFO_NPR(-1)			-0.017**	-0.015*			-0.009	-0.008
			(0.033)	(0.051)			(0.247)	(0.331)
*CFO_NPR(-1)*TONE*			0.007				0.006	
			(0.148)				(0.230)	
*CFO_NPR(-1)*TONE_RES*				0.003				0.006
				(0.464)				(0.236)
PDEF/NA	0.023***	0.023***	0.032***	0.031***	0.046***	0.046***	0.058***	0.058***
	(0.007)	(0.007)	(0.005)	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)
NDEF/NA	0.138***	0.136***	0.147***	0.149***	0.177***	0.176***	0.175***	0.176***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.002)	(0.002)
MB	-0.017***	-0.019***	-0.022***	-0.024***	0.001	0.000	0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.841)	(0.947)	(0.894)	(0.994)
Firm size	0.033***	0.032***	0.023**	0.022**	0.015	0.014	0.005	0.005
	(0.000)	(0.000)	(0.013)	(0.018)	(0.180)	(0.201)	(0.653)	(0.675)
Tangibility	0.035	0.034	0.078	0.083	0.026	0.024	0.096	0.097
	(0.543)	(0.551)	(0.250)	(0.227)	(0.740)	(0.761)	(0.217)	(0.213)
Profitability	-0.135***	-0.151***	-0.208***	-0.224***	-0.086*	-0.095**	-0.147***	-0.155***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.081)	(0.048)	(0.007)	(0.004)
Constant	-0.241**	-0.220**	-0.103	-0.087	0.004	0.014	0.120	0.127
	(0.015)	(0.027)	(0.414)	(0.495)	(0.974)	(0.917)	(0.439)	(0.414)
R^2 (within)	0.258	0.254	0.298	0.298	0.109	0.107	0.130	0.130
R^2 (between)	0.230	0.226	0.225	0.226	0.138	0.128	0.056	0.058
Firms	377	377	340	340	377	377	340	340
Obs.	1327	1327	1071	1071	1327	1327	1071	1071

Table 5.7 Leverage regression with interaction effects of tone and insider purchase

This table presents fixed effect (FE) regressions with book and market leverage as dependent variables. Interactions between indicators of pure insider purchase (i.e. *CEO_NPR(1)* and *CFO_NPR(1)*) and tone are included in all regressions. All the variables are defined in Appendix 5.A. Standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	Dependent variable: market leverage				*Dependent variable: book leverage*			
	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE	(7) FE	(8) FE
TONE	-0.006***		-0.008***		-0.002		-0.004	
	(0.004)		(0.003)		(0.422)		(0.239)	
TONE_RES		-0.007***		-0.009***		-0.003		-0.004
		(0.001)		(0.001)		(0.191)		(0.186)
CEO_NPR(1)	0.004	0.003			0.000	0.000		
	(0.437)	(0.538)			(0.948)	(0.927)		
*CEO_NPR(1)*TONE*	-0.007***				-0.006***			
	(0.004)				(0.007)			
*CEO_NPR(1)*TONE_RES*		-0.004*				-0.004*		
		(0.077)				(0.081)		
CFO_NPR(1)			0.010	0.010			0.011*	0.011*
			(0.120)	(0.129)			(0.069)	(0.070)
*CFO_NPR(1)*TONE*			-0.003				-0.001	
			(0.380)				(0.705)	
*CFO_NPR(1)*TONE_RES*				-0.002				-0.001
				(0.566)				(0.754)
PDEF/NA	0.024***	0.024***	0.032***	0.032***	0.046***	0.046***	0.057***	0.057***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.000)	(0.000)	(0.001)	(0.001)
NDEF/NA	0.137***	0.137***	0.146***	0.146***	0.177***	0.176***	0.178***	0.178***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.002)	(0.002)
MB	-0.017***	-0.020***	-0.022***	-0.025***	0.001	0.000	0.002	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.852)	(0.996)	(0.848)	(0.982)
Firm size	0.034***	0.032***	0.025***	0.024**	0.015	0.014	0.008	0.008
	(0.000)	(0.000)	(0.007)	(0.011)	(0.177)	(0.209)	(0.496)	(0.530)
Tangibility	0.033	0.035	0.082	0.084	0.023	0.023	0.095	0.096
	(0.553)	(0.535)	(0.233)	(0.219)	(0.767)	(0.764)	(0.222)	(0.219)
Profitability	-0.134***	-0.151***	-0.210***	-0.226***	-0.084*	-0.094*	-0.148***	-0.156***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.089)	(0.051)	(0.006)	(0.003)
Constant	-0.252***	-0.227**	-0.141	-0.119	0.002	0.016	0.075	0.086
	(0.010)	(0.021)	(0.267)	(0.351)	(0.990)	(0.908)	(0.629)	(0.584)
R^2 (within)	0.255	0.252	0.296	0.297	0.107	0.105	0.132	0.132
R^2 (between)	0.227	0.225	0.226	0.226	0.137	0.131	0.081	0.081
Firms	377	377	340	340	377	377	340	340
Obs.	1327	1327	1071	1071	1327	1327	1071	1071

perceptions"[94] (Lang and Lundholm, 2000). In contrast, large firms followed by many analysts are expected to provide more transparent and high-quality disclosures (Osma and Guillamón-Saorín, 2011). This proposition is supported by Osma and Guillamón-Saorín's (2011) empirical evidences that firm size and number of analysts following the firm, as proxies for information environment, are negatively associated with impression management (e.g. manually coded disclosure tone).

In sum, small firms have more incentive to not only reduce information asymmetry but also to manipulate investors' impression, using unbiased and biased reporting respectively. Therefore, if our optimistic tone influences leverage through the above two rational channels, we would expect that the negative relationship between tone and leverage will be stronger for small firms. However, our results in Table 5.8 do not support this conjecture. In particular, we find that both economic and statistical significance of the negative relationship between tone and leverage are extremely similar for small (i.e. bottom quartile) and large (i.e. top quartile) firms (see Panel A in Table 5.11). As a robustness check, we compare small firms in the bottom decile and large firms in the top decile. The results are qualitatively similar. The results are also robust to alternative measures of information asymmetry, namely tangibility, firm age and market-to-book (see Panel B, C and D in Table 5.8 respectively)[95]. Therefore, we may conclude that the observed tone-leverage relationship is less likely to be driven by

[94] Another reason why small firms are more likely to engage in impression management is related to Baker and Wurgler's (2006) proposition that smaller firms are relatively more "hard-to-value" and are therefore more influenced by investor sentiment. The implication is that investment decisions of irrational investors with high sentiment are more easily influenced by impression management. This is because irrational investors are less able to undo biased reporting, which offers small firms more scope for impression management.

[95] First, the economic and statistical significance of the coefficients on tone measures are extremely similar for intangible and tangible firms. Second, the tone-leverage relationships are also similar for young and old firms. When we compare young and old firms in bottom decile and large firms in top decile, the tone measures are only statistically significant for old firms. Third, we divide our sample into high and low growth firms. The economic and statistical significance of tone-leverage relationships are weaker for firms with high market-to-book ratio. This finding is also inconsistent with information asymmetry channel. Taken together, the above observations that the tone-leverage relationships are similar across subsamples split based on proxies for information asymmetry and information environment suggest that the significant tone-leverage relationship is less likely due to either information asymmetry or impression management.

either information asymmetry or impression management. In other words, our empirical results favour the managerial overconfidence channel.[96]

5.4.5.2 Sensitivity of NPR-leverage relationship to information asymmetry

Next, to see whether NPR also captures information asymmetry as well as managerial overconfidence, we examine the sensitivity of the NPR-leverage relationship to firm characteristics (including firm size, tangibility, firm age and market-to-book) related to information asymmetry. As shown in Table 5.9[97], the coefficients on value-based NPRs of CEO are both statistically and economically more significant for smaller, intangible and younger firms which have higher information costs. This finding suggests that NPR could be more related to information asymmetry rather than managerial overconfidence. Therefore, we may conclude that the positive NPR-leverage relationship might reflect information asymmetry.

To sum up, the above subsample analysis shows that (1) the negative tone-leverage relationship is less likely to be driven by either information asymmetry or impression management, while (2) the positive NPR-leverage relationship could be due to information asymmetry. Put differently, optimistic tone seems to be a more reliable and cleaner proxy for managerial overconfidence, while NPR is contaminated by information asymmetry. This important observation can explain why the words-based and action-based measures of managerial beliefs have differing effects on leverage.

[96] Bodnaruk, Loughran and McDonald's (2013) study suggests that the frequency of negative words can be used as a proxy for financial constraints. However, our subsample analysis shows that our key results (i.e. the negative relation between tone and leverage) are not sensitive to various firm characteristics that are related to financial constraints (e.g. firm size, firm age, etc.). Therefore, we may conclude that our findings regarding the tone-leverage relation are not entirely consistent with tone proxying for financial constraints.

[97] We use OLS instead of fixed effect (within) estimator because the subsample analysis of NPR-leverage relationship is based on smaller samples (and shorter panels) and more importantly our key variable (i.e. NPRs) has small within variations.

Table 5.8 Subsample analysis: sensitivity of tone-leverage relationship to information asymmetry

This table presents fixed effect (FE) regressions with book and market leverage as dependent variables. Subsamples split based on firm size, tangibility, firm age and market-to-book are estimated to examine the impacts of information asymmetry and information environment on the tone-leverage relationship. "Small Quartile" and "Large Quartile" consist of the smallest and largest (in terms of total assets) observations from the bottom and top quartile respectively. "Intang. Quartile" and "Tang. Quartile" consist of the most intangible and tangible observations from the bottom and top quartile respectively. "Young Quartile" and "Old Quartile" consist of the youngest and oldest observations from the bottom and top quartile respectively. "LowMB Quartile" and "HighMB Quartile" consist of observations with lowest and highest MB ratio from the bottom and top quartile respectively. Six control variables are also included but not reported to save space. All the variables are defined in Appendix 5.A. Standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	Dependent variable: market leverage (column 1-4)				*Dependent variable: book leverage (column 5-8)*			
	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE	(7) FE	(8) FE
Panel A: firm size	Small Quartile	Small Quartile	Large Quartile	Large Quartile	Small Quartile	Small Quartile	Large Quartile	Large Quartile
TONE	-0.010***		-0.011***		-0.006**		-0.007**	
	(0.001)		(0.000)		(0.015)		(0.011)	
TONE_RES		-0.009***		-0.010***		-0.006**		-0.006**
		(0.001)		(0.000)		(0.015)		(0.011)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
R^2 (within), R^2 (between)	0.106, 0.179	0.106, 0.180	0.367, 0.383	0.367, 0.384	0.045, 0.027	0.044, 0.028	0.154, 0.283	0.154, 0.283
Firms	163	163	112	112	163	163	112	112
Obs.	571	571	570	570	571	571	570	570
Panel B: tangibility	Intang. Quartile	Intang. Quartile	Tang. Quartile	Tang. Quartile	Intang. Quartile	Intang. Quartile	Tang. Quartile	Tang. Quartile
TONE	-0.014***		-0.011***		-0.007***		-0.007***	
	(0.000)		(0.000)		(0.007)		(0.000)	
TONE_RES		-0.013***		-0.011***		-0.007***		-0.007***
		(0.000)		(0.000)		(0.007)		(0.000)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
R^2 (within), R^2 (between)	0.155, 0.176	0.156, 0.177	0.281, 0.295	0.282, 0.295	0.065, 0.003	0.065, 0.003	0.091, 0.204	0.091, 0.204
Firms	171	171	135	135	171	171	135	135
Obs.	570	570	570	570	570	570	570	570
Panel C: firm age	Young Quartile	Young Quartile	Old Quartile	Old Quartile	Young Quartile	Young Quartile	Old Quartile	Old Quartile
TONE	-0.008***		-0.008***		-0.006*		-0.003	
	(0.001)		(0.000)		(0.056)		(0.133)	
TONE_RES		-0.008***		-0.007***		-0.005*		-0.003
		(0.001)		(0.000)		(0.057)		(0.137)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
R^2 (within), R^2 (between)	0.156, 0.264	0.156, 0.264	0.394, 0.285	0.394, 0.285	0.105, 0.230	0.104, 0.231	0.157, 0.186	0.157, 0.187
Firms	171	171	91	91	171	171	91	91
Obs.	567	567	570	570	567	567	570	570
Panel D: market-to-book	HighMB Quartile	HighMB Quartile	LowMB Quartile	LowMB Quartile	HighMB Quartile	HighMB Quartile	LowMB Quartile	LowMB Quartile
TONE	-0.003**		-0.013***		-0.005**		-0.011***	
	(0.037)		(0.000)		(0.026)		(0.000)	
TONE_RES		-0.003**		-0.013***		-0.005**		-0.011***
		(0.037)		(0.000)		(0.028)		(0.000)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
R^2 (within), R^2 (between)	0.130, 0.321	0.130, 0.321	0.214, 0.095	0.215, 0.096	0.079, 0.274	0.079, 0.275	0.141, 0.146	0.141, 0.146
Firms	189	189	243	243	189	189	243	243
Obs.	570	570	570	570	570	570	570	570

Table 5.9 Subsample analysis: sensitivity of value-based NPR-leverage relationship to information asymmetry

This table presents OLS regressions with book and market leverage as dependent variables. Subsamples split based on firm size, tangibility, firm age and market-to-book are estimated to examine the impacts of information asymmetry and information environment on the NPR-leverage relationship. "Small Quartile" and "Large Quartile" consist of the smallest and largest (in terms of total assets) observations from the bottom and top quartile respectively. "Intang. Quartile" and "Tang. Quartile" consist of the most intangible and tangible observations from the bottom and top quartile respectively. "Young Quartile" and "Old Quartile" consist of the youngest and oldest observations from the bottom and top quartile respectively. "LowMB Quartile" and "HighMB Quartile" consist of observations with lowest and highest MB ratio from the bottom and top quartile respectively. Six control variables are also included but not reported to save space. All the variables are defined in Appendix 5.A. Robust standard errors are used. P-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	Dependent variable: market leverage (column 1-4)				*Dependent variable: book leverage (column 5-8)*			
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
Panel A: firm size	Small Quartile	Small Quartile	Large Quartile	Large Quartile	Small Quartile	Small Quartile	Large Quartile	Large Quartile
VA_CEO	0.021***		0.012**		0.023***		0.005	
	(0.000)		(0.030)		(0.000)		(0.475)	
VA_CFO		0.012		0.021***		0.019**		0.018**
		(0.125)		(0.001)		(0.020)		(0.046)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.205	0.212	0.436	0.429	0.178	0.143	0.239	0.221
Obs.	271	167	429	339	271	167	429	339
Panel B: tangibility	Intang. Quartile	Intang. Quartile	Tang. Quartile	Tang. Quartile	Intang. Quartile	Intang. Quartile	Tang. Quartile	Tang. Quartile
VA_CEO	0.010*		0.010		0.006		0.005	
	(0.083)		(0.141)		(0.362)		(0.529)	
VA_CFO		0.012*		0.018**		0.011		0.023**
		(0.075)		(0.026)		(0.179)		(0.025)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.191	0.191	0.343	0.365	0.140	0.133	0.230	0.218
Obs.	316	234	364	282	316	234	364	282
Panel C: firm age	Young Quartile	Young Quartile	Old Quartile	Old Quartile	Young Quartile	Young Quartile	Old Quartile	Old Quartile
VA_CEO	0.008		0.000		0.001		-0.002	
	(0.218)		(0.976)		(0.950)		(0.795)	
VA_CFO		0.023***		0.007		0.022*		0.008
		(0.010)		(0.296)		(0.085)		(0.398)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.337	0.340	0.344	0.365	0.387	0.350	0.223	0.189
Obs.	317	228	357	295	317	228	357	295
Panel D: market-to-book	HighMB Quartile	HighMB Quartile	LowMB Quartile	LowMB Quartile	HighMB Quartile	HighMB Quartile	LowMB Quartile	LowMB Quartile
VA_CEO	0.001		0.018*		0.003		0.015	
	(0.752)		(0.097)		(0.646)		(0.127)	
VA_CFO		0.001		0.017		0.010		0.015
		(0.882)		(0.154)		(0.218)		(0.160)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.401	0.387	0.267	0.273	0.406	0.372	0.310	0.311
Obs.	327	279	334	257	327	279	334	257

5.4.6 Robustness checks

We conduct several robustness checks using alternative model specifications, estimators and subsamples.

5.4.6.1 System-GMM

Our tone measures might be endogenous. We attempt to alleviate this concern using the system Generalized Method of Moments (sys-GMM) to estimate the following dynamic partial adjustment model: $LEV_{it} = a + b_1 MO_{it} + b_2 LEV_{it-1} + B_3 \boldsymbol{X}_{it} + v_i + e_{it}$. We include a lagged dependent variable (i.e. LEV_{it-1}) to avoid potential "dynamic misspecification". We report the results from GMM regressions in Table 5.10. All the explanatory variables as treated as endogenous. Our main empirical results are robust to this alternative estimator[98].

5.4.6.2 Logistic analysis of low/zero-leverage

Furthermore, we further examine the relationship between managerial overconfidence and debt conservatism. More specifically, we use logit models to test the impact of managerial overconfidence on the likelihood of firm-years with low leverage (i.e. below 5%) or zero leverage. This specification is closely related to recent studies on "zero-leverage puzzle" (e.g., Strebulaev and Yang, 2012; Devos *et al*., 2012). In our sample, around 34.3 and 14.3 percent of the firm-years have low and zero leverage respectively. We use the following logit models:

$$\Pr(LOW_{LEV\,it} = 1) = f(a + b_1 MO_{it} + B_2 \boldsymbol{X}_{it} + v_i + e_{it}) \quad (5.10)$$

$$\Pr(ZERO_{LEV\,it} = 1) = f(a + b_1 MO_{it} + B_2 \boldsymbol{X}_{it} + v_i + e_{it}) \quad (5.11)$$

where, LOW_LEV_{it} is a dummy variable that equals one if the market leverage of a particular firm-year is less than 5% and zero otherwise. $ZERO\_LEV_{it}$ is a dummy variable that equals one if the leverage of a particular firm-year is zero and zero otherwise. $\boldsymbol{X}_{it}$ is a vector of firm-level control variables including market-to-book ratio,

[98] We check our model specifications using autocorrelation tests and Hansen test. In particular, the null of no second order autocorrelation fails to be rejected. Hansen test fails to reject the null of instrument validity.

firm size, tangibility and profitability. v_i is time-invariant firm-specific effects. e_{it} is the error term.

Table 5.11 reports logistic analysis of the determinants of the probability of low leverage (Equation 5.10). We find that insider trading-based measures of CEO and especially CFO overconfidence have negative and significant impacts on the probability of low leverage. In contrast, both *TONE* and *TONE_RES* are positively and significantly related to the probability of low leverage.

Table 5.12 reports logistic analysis of the determinants of the probability of zero leverage (Equation 5.11). Only CFO overconfidence has a negative and significant impact on the probability of zero leverage. The signs of the coefficients on *TONE* and *TONE_RES* are sensitive to estimation methods and statistically insignificant. To conclude, the results from logistic analysis further confirm our previous findings from leverage regressions (Equation 5.6) that tone-based measures of overconfidence is negatively associated with leverage, while insider trading-based measures of CEO and CFO overconfidence are positively associated with leverage.

5.4.6.3 Non-linear effect

We examine the non-linear effect of optimistic tone by including a quadratic term of tone in Equation 5.6. The relationship between optimistic tone and leverage could be non-linear if the effects of moderate overconfidence differ from extremely high overconfidence [99]. We find some evidence that support this proposition. Both *TONE*TONE* and *TONE_RES*TONE_RES* have positive and statistically significant (at 5% level) effects on market leverage using OLS estimator. However, this non-linear relationship becomes insignificant when using book leverage and fixed effects estimator. Consistent with our previous findings, both tone measures have negative and significant impacts on leverage in all specifications.

[99] Campbell *et al*. (2011) is the first study that examines different effects of low, moderate, and high levels of CEO optimism in the context of forced turnover. They find a non-linear (i.e. inversed-U) relationship between optimism and the probability of forced turnover.

Table 5.10 Dynamic leverage adjustment: system GMM

This table presents leverage regressions with book and market leverage as dependent variables. All the variables are defined in Appendix 5.A. The models are estimated using two-step system GMM. All explanatory variables are treated as endogenous, which are instrumented using lags 2 or 3. Asymptotic standard errors robust to heteroscedasticity are used. P-values are given in parentheses. AR(1) and AR(2) are first and second order autocorrelation of residuals, asymptotically distributed as standard normal under the null of no serial correlation. Hansen test is a test of instrument validity. F test is a test of overall model fit. P-values of the above diagnostic tests are reported. Number of instruments is also reported. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	Panel A. Dependent variable: book leverage (model 1-2)		*Panel B. Dependent variable: market leverage (model 3-4)*	
	(1) SYS-GMM	(2) SYS-GMM	(3) SYS-GMM	(4) SYS-GMM
Lagged leverage	0.842***	0.843***	0.627***	0.627***
	(0.000)	(0.000)	(0.000)	(0.000)
TONE	-0.005**		-0.016***	
	(0.028)		(0.000)	
TONE_RES		-0.004**		-0.013***
		(0.027)		(0.000)
PDEF/NA	0.006	0.007	0.021	0.034**
	(0.565)	(0.562)	(0.121)	(0.014)
NDEF/NA	0.308***	0.308***	0.225***	0.318***
	(0.000)	(0.000)	(0.000)	(0.000)
MB	0.001	0.000	-0.017***	-0.014***
	(0.663)	(0.846)	(0.000)	(0.000)
Firm size	0.009***	0.008***	0.008***	0.015***
	(0.000)	(0.001)	(0.006)	(0.000)
Tangibility	0.060**	0.062**	0.018	0.016
	(0.021)	(0.017)	(0.524)	(0.571)
Profitability	-0.015	-0.022	-0.082***	-0.061**
	(0.537)	(0.350)	(0.002)	(0.016)
Constant	-0.092***	-0.082***	-0.036	-0.101***
	(0.001)	(0.002)	(0.274)	(0.001)
AR(1) (*p-value*)	0.000***	0.000***	0.000***	0.000***
AR(2) (*p-value*)	0.835	0.837	0.292	0.722
Hansen test (*p-value*)	0.628	0.637	0.389	0.464
F test (*p-value*)	0.000***	0.000***	0.000***	0.000***
Number of instruments	284	284	284	284
Firms	421	421	421	421
Obs.	1645	1645	1645	1645

Table 5.11 Logistic analysis of low leverage

This table presents fixed effect logit (FE-logit) and pooled logit (P-logit) regressions where coefficients reported as log odds ratios. The dependent variable is low leverage dummy that equals one if market leverage is less than 5% and zero otherwise. All the variables are defined in Appendix 5.A. Standard errors are adjusted for firm-level clustering. Log-likelihood and log pseudolikelihood are reported for FE-logit and P-logit respectively. P-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	Dependent variable: low leverage dummy=1 if market leverage is below 5%.											
	(1) FE-logit	(2) P-logit	(3) FE-logit	(4) P-logit	(5) FE-logit	(6) P-logit	(7) FE-logit	(8) P-logit	(9) FE-logit	(10) P-logit	(11) FE-logit	(12) P-logit
VA_CEO	-0.043	**-0.277*** **										
	(0.853)	**(0.001)**										
VOL_CEO			-0.266	**-0.350*** **								
			(0.334)	**(0.000)**								
VA_CFO					**-0.607***	**-0.399*** **						
					(0.056)	**(0.000)**						
VOL_CFO							**-0.753***	**-0.409*** **				
							(0.087)	**(0.000)**				
TONE									**0.231*** **	**0.086** **		
									(0.008)	**(0.016)**		
TONE_RES											**0.223*** **	**0.083** **
											(0.007)	**(0.015)**
MB	2.669***	1.033***	2.571***	1.032***	2.709***	0.858***	2.772***	0.873***	1.688***	0.882***	1.754***	0.908***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size	-0.946	-0.525***	-1.042*	-0.518***	0.570	-0.504***	0.590	-0.491***	-0.755**	-0.501***	-0.725**	-0.491***
	(0.103)	(0.000)	(0.077)	(0.000)	(0.302)	(0.000)	(0.282)	(0.000)	(0.011)	(0.000)	(0.014)	(0.000)
Tangibility	-7.426	-2.837***	-7.637*	-2.863***	1.553	-2.639***	1.365	-2.665***	-3.765**	-2.239***	-3.853**	-2.270***
	(0.101)	(0.000)	(0.092)	(0.000)	(0.689)	(0.000)	(0.728)	(0.000)	(0.044)	(0.000)	(0.039)	(0.000)
Profitability	3.234	0.642	3.623	0.619	0.303	0.811	0.174	0.815	1.283	0.883**	1.630	1.016***
	(0.277)	(0.254)	(0.228)	(0.270)	(0.912)	(0.207)	(0.949)	(0.207)	(0.343)	(0.025)	(0.222)	(0.009)
Constant		4.701***		4.687***		4.586***		4.453***		4.340***		4.161***
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Log-likelihood	-74.486	-571.006	-74.030	-569.151	-49.612	-473.518	-49.866	-474.371	-196.607	-1067.232	-196.538	-1067.158
Obs.	300	1327	300	1327	201	1071	201	1071	656	2283	656	2283
Firms	64	377	64	377	43	340	43	340	111	459	111	459

Table 5.12 Logistic analysis of zero leverage

This table presents fixed effect logit (FE-logit) and pooled logit (P-logit) regressions where coefficients reported as log odds ratios. The dependent variable is zero leverage dummy that equals one if market leverage is 0% and zero otherwise. All the variables are defined in Appendix 5.A. Standard errors are adjusted for firm-level clustering. Log-likelihood and log pseudolikelihood are reported for FE-logit and P-logit respectively. P-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	Dependent variable: zero leverage dummy=1 if market leverage is 0%.											
	(1) FE-logit	(2) P-logit	(3) FE-logit	(4) P-logit	(5) FE-logit	(6) P-logit	(7) FE-logit	(8) P-logit	(9) FE-logit	(10) P-logit	(11) FE-logit	(12) P-logit
VA_CEO	0.036	-0.134										
	(0.916)	(0.248)										
VOL_CEO			-0.121	-0.110								
			(0.710)	(0.381)								
VA_CFO					**-1.089***	**-0.379*****						
					(0.089)	**(0.003)**						
VOL_CFO							**-1.418***	**-0.327****				
							(0.080)	**(0.015)**				
TONE									0.100	-0.008		
									(0.317)	(0.865)		
TONE_RES											0.097	-0.008
											(-0.311)	(0.855)
MB	-0.076	0.191***	-0.093	0.198***	-0.626	0.248***	-0.760	0.256***	-0.142	0.224***	-0.112	0.221***
	(0.759)	(0.003)	(0.704)	(0.003)	(0.161)	(0.003)	(0.127)	(0.002)	(0.302)	(0.000)	(-0.402)	(0.000)
Firm size	-1.641**	-0.522***	-1.652**	-0.518***	-0.323	-0.511***	-0.188	-0.495***	-0.699**	-0.561***	-0.686**	-0.561***
	(0.035)	(0.000)	(0.034)	(0.000)	(0.762)	(0.000)	(0.863)	(0.000)	(0.017)	(0.000)	(-0.019)	(0.000)
Tangibility	2.726	-1.270***	3.066	-1.274***	14.804**	-1.028	15.318**	-1.047*	-2.326	-1.189***	-2.367	-1.187***
	(0.565)	(0.007)	(0.518)	(0.007)	(0.038)	(0.104)	(0.04)	(0.097)	(0.315)	(0.003)	(-0.307)	(0.003)
Profitability	2.161	1.236**	1.978	1.251**	6.355*	0.852	6.210*	0.888	1.085	1.558***	1.237	1.546***
	(0.328)	(0.024)	(0.354)	(0.023)	(0.094)	(0.236)	(0.086)	(0.216)	(0.304)	(0.000)	(-0.232)	(0.000)
Constant		4.194***		4.131***		3.969***		3.779***		4.354***		4.37***
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Log-likelihood	-37.993	-420.333	-37.930	-420.637	-22.836	-311.907	-22.605	-313.335	-118.848	-740.171	-118.835	-740.169
Obs.	115	1327	115	1327	80	1071	80	1071	317	2283	317	2283
Firms	26	377	26	377	18	340	18	340	54	459	54	459

5.4.6.4 Year and industry effects

We control for year and industry effects on leverage by including year and industry dummies. The results are qualitatively similar.

5.5 Conclusions

This study contributes to the finance and accounting literature by examining the impact of disclosure tone on capital structure. In particular, we provide new evidence that managerial optimistic words, as a proxy for managerial overconfidence, may lead to conservative debt policy. This important finding provides initial empirical evidence supporting Malmendier *et al.*'s (2011) proposition that managerial overconfidence is associated with debt conservatism.

We also document that when managerial actions (i.e. insider trading) contradict their words (i.e. tone), the tone-leverage relationship is weakened. This new insight is in line with previous evidences in the accounting literature that the combined effect of optimistic tone and abnormal insider selling is associated with higher litigation risk (Rogers *et al.*, 2011). In contrast, we find that insider purchase, which confirms optimistic tone, enhances negative tone-leverage relationship.

Moreover, our further analysis finds that optimistic tone is a more reliable and valid proxy for managerial overconfidence than insider trading measures. Insider trading seem to also capture information asymmetry. Overall, the major implication of this study is that time-varying managerial overconfident belief, gauged from their words, is an important determinant of leverage.

There are two major implications for future studies. First, our composite tone-based measure of overconfidence can be adopted in studies on time-varying managerial overconfidence. Second, it will be interesting to examine the joint effect of managerial "words" and "actions" on other corporate financial policies and events, especially when there is a discrepancy between their words and actions.

CHAPTER 6

Empirical Study 2: Managerial Overconfidence and Reverse Pecking Order Preference

Chapter 6. Empirical Study 2: Managerial Overconfidence and Reverse Pecking Order Preference

6.1 Introduction

The pecking order theory of capital structure suggests that firms "prefer"[100] internal to external financing and if the internal funds are not sufficient debt is preferred to equity (Donaldson, 1961; Myers, 1984; Myers and Maljuf, 1984). Although numerous empirical studies (e.g., Shyam-Sunder and Myers, 1999; Frank and Goyal, 2003; Lemmon and Zender, 2010) have been devoted to test the pecking order theory, the underlying driving forces of pecking order behaviour receives much less attention[101]. There is a strand of literature that uses Shyam-Sunder and Myers (SSM) (1999) financing deficit framework to examine various drivers of pecking order preference, including information asymmetry (Bharath *et al*., 2009), mispricing (Elliott *et al*., 2007), market conditions (Huang and Ritter, 2009) and managerial overconfidence (Malmendier, Tate and Yan, 2011; Malmendier and Zheng, 2012). An important empirical modification made to the SSM framework is that firm-years with financing deficit and financing surplus (i.e. negative financing deficit) are tested separately, which is based on a more realistic assumption of an *asymmetric* pecking order coefficient (Kayhan and Titman, 2007; De Jong *et al*., 2010).

Empirical evidence on the pecking order predictions are mixed. Shyam-Sunder and Myers (1999) propose a test of pecking order theory and find it outperforms the static trade-off theory. In contrast, using a larger sample, Frank and Goyal (2003) do not find strong evidence for the pecking order theory. They report a "pecking order puzzle (size

[100] Frank and Goyal (2008) argue that there are two alternative interpretations of the preference: strict vs. "other things equal" version. They point out that the strict interpretation of pecking order preference is more refutable and is in fact refuted. The "other things equal" interpretation therefore becomes more popular and recent empirical studies examine different versions of "other things equal". This important distinction between two alternative interpretations of pecking order preference suggests that pecking order theory is a conditional theory. Accordingly, it is more important to empirically examine various conditions driving pecking order preference rather than the pecking order itself.

[101] According to Frank and Goyal (2008), "no one [to date] has tried to distinguish among the alternative possible sources of pecking order behavior".

anomaly)" [102] that larger firms, which are relatively less subject to the information asymmetry, exhibit more pecking order behaviour. This finding is inconsistent with the pecking order model based on information asymmetry. The main purpose of this study is to examine whether managerial overconfidence is a potential driver of pecking order preference, which in turn may shed light on the pecking order puzzle.

To reconcile the above contrasting findings, it is important to recognize that pecking order theory is a conditional theory[103] (Myers, 2001). In the capital structure literature, perhaps the most commonly cited condition for pecking order is Myers and Majluf's (1984) adverse selection[104]. However, pecking order theory can be regarded as a "funding preference theory" rather than a pure adverse selection problem (Welch, 2006). In particular, the pecking order may arise if issuing more junior securities is relatively more costly. In other words, the adverse selection costs associated with information sensitive securities is only one of the potential driving forces.[105] In brief, information asymmetry is neither a necessary nor sufficient condition of pecking order behaviour.

From behavioural finance perspective, managerial overconfidence can also serve as a driver of pecking order preference (Shyam-Sunder and Myers, 1999; Graham and Harvey, 2001; Heaton, 2002; Hackbarth, 2008; Malmendier, Tate and Yan, 2011). However, the theoretical relationship between managerial overconfidence and pecking order is somewhat controversial due in large part to different modelling approaches of

[102] De Jong *et al*. (2010) refer to Frank and Goyal's (2003) finding that firm size is positively related to the degree of pecking order as pecking order puzzle or size anomaly.

[103] A good description of conditional theory is as follows: "… the theory finds support when its basic assumptions hold in the data, as should reasonably be expected of any theory" (Bharath *et al*., 2009).

[104] The Myers-Majluf (1984) type model shows that the pecking order is conditional on the asymmetric information between managers and outside investors. Managers with more inside information are reluctant to use external financing, especially the equity, which is undervalued by the outsiders.

[105] Similarly, Fama and French's (2005) study suggests that asymmetric information problems are neither the only nor perhaps even an important determinant of capital structure. They further argue that "any forces that cause firms to systematically deviate from pecking order financing imply that the pecking order, as the complete model of capital structure proposed by Myers (1984) and Myers and Majluf (1984), is dead". Other potential conditions of pecking order include agency costs (Myers, 2003; Leary and Roberts, 2010), corporate taxes (Stiglitz, 1973; Hennessy and Whited, 2005) and transaction costs (Welch, 2006).

overconfidence. Heaton's (2002) model shows that firms with overconfident managers tend to believe that firm stock is undervalued by the outsiders and thus are reluctant to issue equity, which leads to an enhanced pecking order. Put differently, overconfident managers believe that they have positive inside information (i.e. perceived asymmetric information). Therefore, Heaton's (2002) model provides a re-interpretation of the traditional Myers-Maljuf (1984) model from actual information asymmetry to simply perceived information asymmetry being a driver of pecking order (Malmendier and Tate, 2005).[106] However, Hackbarth's (2008) model predicts an either standard or reverse pecking order for firms subject to two types of managerial overconfidence, namely growth perception bias and risk perception bias respectively. The reason why overconfident managers in Hackbarth's (2008) model may not follow a standard pecking order is that those managers especially with risk perception bias (i.e. underestimate the riskiness of earnings) believe that the equity (debt) is overvalued (undervalued). In short, whether managerial overconfidence enhances or weakens pecking order preference is an empirical question.[107]

In terms of empirical strategy, we use the modified versions of Shyam-Sunder and Myers (SSM) (1999) regression. In particular, our modified model is asymmetric so that we can differentiate the impacts of managerial overconfidence on issuance and repurchase decisions.[108] Regarding managerial overconfidence measures, we employ computational linguistic analysis of Chairman's Statement to construct composite tone indices. Industry-adjusted investment rate is also used as a proxy for managerial overconfidence. In addition, we gauge CEO and CFO overconfidence based on how they trade their own firms' shares.

[106] Similarly, Malmendier, Tate and Yan (2011) develop a model of capital structure with overconfident managers who overestimate firms' mean future cash flow and therefore believe that their firms are undervalued by the market. Their model also predicts a pecking order preference arised from managerial overconfidence, conditional on raising risky external capital.

[107] Importantly, Hackbarth (2008) argue that the ambiguous effects of managerial overconfidence on the pecking order may shed light on the inconclusive cross-sectional findings on the standard pecking order prediction.

[108] Our empirical strategies are slightly different from recent studies by Malmendier, Tate and Yan (2011) and Malmendier and Zheng (2012). In particular, we distinguish between firms with financing deficit and financing surplus (i.e. negative financing deficit), which are related to issuance and repurchase decisions respectively. More discussions on the asymmetric pecking order behaviour and corresponding empirical models are available in the hypothesis development and methodology sections.

We find that both optimistic tone and industry-adjusted investment have significant and negative impacts on the pecking order coefficient in the Shyam-Sunder and Myers (1999) regression framework, especially when there is financing deficit. These findings suggest that overconfident managers prefer equity to debt to meet external financing needs, meaning that managerial overconfidence leads to a reverse pecking order preference. This new evidence supports Hackbarth's (2008) proposition that overconfident managers, who underestimate the riskiness of earnings ("risk perception bias"), tend to believe that debt is undervalued but equity is overvalued (because of the convexity of equity) and therefore prefer equity to debt financing.[109] This observed overconfidence-induced reverse pecking order preference also corroborates our earlier finding that optimistic tone is negatively associated with leverage. Further support for our main hypothesis is provided by showing that the relationship between managerial overconfidence and reverse pecking order preference is more pronounced for firms with higher earnings volatility. This observation confirms that "risk perception bias" is the underlying channel through which overconfidence leads to reverse pecking order preference, as predicted by Hackbarth (2008).

Furthermore, we find that the effect of overconfidence on reverse pecking order preference is especially strong for small firms. In other words, overconfident managers in those small firms are reluctant to follow standard pecking order behaviour, in which case managerial overconfidence contributes to the pecking order puzzle/size anomaly (i.e. small firms with higher information asymmetry surprisingly exhibit weaker pecking order preference relative to large firms). In addition, the effects of insider trading-based measures of managerial overconfidence are, however, relatively weak and less consistent, which is probably because insider (especially CEO) trading is driven by information asymmetry and thus is not a perfect proxy for managerial overconfidence. Overall, this study supports the proposition that managerial overconfidence is an underlying driver of the reverse pecking order preference especially for small firms, which partly explain the pecking order puzzle.

[109] This finding is in contrast to studies by Malmendier, Tate and Yan (2011) and Malmendier and Zheng (2012) which document that managerial overconfidence of US firms, measured by executive stock options and media portrayal, lead to enhanced pecking order behaviour.

We proceed as follows. Section 6.2 describes pecking order tests and provides a review of tests of various pecking order conditions using modified Shyam-Sunder and Myers (1999) regression. Section 6.3 develops the hypotheses. Section 6.4 presents methodology and data. Section 6.5 discusses the empirical findings and section 6.6 concludes.

6.2 Related Literature

This section reviews empirical tests of pecking order theory, with particular focus on various modified versions of Shyam-Sunder and Myers (SSM) (1999) financing deficit regression. The common purpose of those modified SSM regressions is to test various conditions of pecking order behaviour, including information asymmetry, mispricing and market conditions. We postpone a discussion of theoretical and empirical studies on manager overconfidence, as a behavioural condition of a pecking order, until the hypothesis development section.

6.2.1 Pecking order tests

In the capital structure literature, there are two types of pecking order tests (Fama and French, 2005): (1) profitability-leverage relationship and (2) SSM regression. First, as a general test of pecking order behaviour, many empirical studies of capital structure (e.g., Fama and French, 2002) examine the relationship between profitability and leverage. In particular, pecking order theory predicts a negative relationship between profitability and leverage. However, Frank and Goyal (2009) point out that in dynamic trade-off theory profitability can also be inversely related to leverage. This means that even if trade-off theory works more profitable firms may have lower leverage in the presence of leverage adjustment costs. In addition, from agency perspective, profitability may be a signal of investment opportunity (Frank and Goyal, 2003) which lowers the firm's debt level because of agency conflict between shareholders and debt holders. Thus, the profitability-leverage relationship is not a perfect test of the pecking order theory because pecking order is not the only explanation of this relationship.

6.2.1.1 Shyam-Sunder and Myers (SSM) test of pecking order theory

Shyam-Sunder and Myers (SSM) (1999) propose a more specific method to test the pecking order theory. In particular, they examine to what extent net debt issues are driven by firm financing deficit (DEF). According to the static pecking order theory, firms with external financing needs use only debt to fund their deficit. The SSM regression can be written as follows:

$$\Delta D_{it} = a + b_{PO} DEF_{it} + e_{it} \tag{6.1}$$

where, ΔD_{it} is the amount of debt issued or retired, b_{PO} is the pecking order coefficient, DEF_{it} is the financing deficit[110]. b_{PO} is expected to be close to one under the strict pecking order theory.

A positive DEF suggests that there is a need for external financing, while a negative DEF means that internal funds are sufficient. It should be noted that the model is estimated over both positive and negative financing deficits, assuming a homogeneous and symmetric pecking order coefficient. Put differently, the simple pecking order suggests that the firm only issues or repurchases equity as a last resort. For firms with negative DEF_{it}, it is also expected that $a = 0$ and $b_{PO} = 1$. However, the validity of the assumption of a homogeneous and symmetric pecking order coefficient in the SSM empirical model is questionable, which will be discussed in section 6.4.1.

6.2.1.2 Pecking order puzzle

However, Shyam-Sunder and Myers's (1999) empirical findings are not supported by a subsequent study by Frank and Goyal (2003) based on a much larger sample. Frank and Goyal (2003) report a puzzling result that large firms are more likely to follow pecking order behaviour. This result is inconsistent with the standard pecking order theory based on information asymmetry, since firm size is perceived to be negatively related to information asymmetry problem. This puzzling result is referred to pecking order puzzle or size anomaly (De Jong *et al*., 2010). However, as pointed out by Malmendier, Tate and Yan (2011), this puzzle may be explained by managerial overconfidence.

[110] The DEF is calculated, using accounting cash flow identity, as the sum of dividend payments, capital expenditures, net increases in working capital and the current portion of long-term debt at start of period minus operating cash flows after interest and taxes.

Specifically, managers of those large firms become overconfident due to good past performance and thus have a more pronounced pecking order preference. An alternative explanation might be that overconfident managers in small firms have reverse pecking order preference (more discussions on effects of overconfidence on pecking order preference will be presented in section 6.3). One major motivation of this study is therefore to see whether managerial overconfidence can partly explain the pecking order puzzle.

6.2.2 Tests of pecking order conditions: modified SSM (1999) framework

It has been recognized that pecking order theory is a conditional theory, meaning that its performance largely depends on various underlying assumptions. Using modified SSM regressions where the pecking order coefficient is treated as heterogeneous, a growing body of literature examines various conditions including (1) information asymmetry, (2) mispricing and (3) market conditions.

6.2.2.1 Information asymmetry

Bharath *et al*. (2009) examine the impact of information asymmetry, using market microstructure proxies, on the degree of pecking order preference. Following the SSM framework, the interaction between information asymmetry and financing deficit is tested. Bharath *et al*. (2009) find that firms with higher information asymmetry are more likely to exhibit the pecking order behaviour. This finding supports Myers and Majluf's (1984) pecking order model based on information asymmetry. From a behavioural perspective, Malmendier and Tate (2005) note that managerial overconfidence may provide a re-interpretation of the Myers-Maljuf (1984) pecking order model based on information asymmetry. Similarly, in a recent review paper Baker and Wurgler (2013) argue that existing evidence on pecking order theory is in accordance with the managerial overconfidence argument. In other words, perceived information asymmetry, raised from managerial overconfidence, may serve as a substitute of the real information asymmetry. Thus, it becomes vital to test the effect of managerial overconfidence as a potential condition of the pecking order.

6.2.2.2 Market timing (firm level): equity mispricing

Besides, the pecking order coefficient may also be influenced by market timing behaviour. In particular, Baker and Wurgler's (2002) market timing theory predicts that overvalued (undervalued) firms are more likely to use equity (debt) to fund the financing deficit. Elliott *et al*. (2007) test the market timing theory of capital structure using the SSM framework. Their main purpose is to examine the impact of mispricing on the pecking order behaviour. Empirically, they interact an equity valuation-based measure of firm mispricing with the financing deficit in the SSM framework. Their empirical results suggest that the degree of overvaluation (undervaluation) is positively related to the proportion of the firm's financing deficit that is funded with equity (debt). This finding supports the proposition that market timing affects the type of security used to fund the financing deficit.[111]

6.2.2.3 Market timing (market level): time-varying cost of capital

As discussed above, Elliott *et al*. (2007) document the impact of market timing, as motivated by equity misvaluation of each individual firms, on the pecking order coefficient. Their evidence of the interaction between market timing and pecking order is in line with Huang and Ritter (2009). Huang and Ritter (2009) empirically capture the market timing opportunity at the market level (i.e. time-varying cost of capital), as opposed to the firm-level measures of misvaluation in Elliott *et al*. (2007). More specifically, Huang and Ritter (2009) interact the implied market-level equity risk premium (ERP) with the pecking order coefficient. The market timing theory predicts a positive coefficient on the interaction term between the ERP and the positive financing deficit. Notably, their empirical test only focuses on the positive financing deficit, since

[111] However, Baker and Wurgler's (2002) market timing theory might be incomplete. Their theory follows the rational manager-irrational investor approach, assuming that only investors are irrational but managers are rational. This approach fails to recognise that managers tend to be overconfident which has been the key assumption of growing behavioural corporate finance literature (see e.g., Heaton, 2002; Hackbarth, 2008; Malmendier, Tate and Yan, 2011). We articulate that managerial overconfidence may play an important role in market timing. More specifically, considering that mispricing can be regarded as a perception (since the intrinsic value is not observable), this perception might be biased due to managerial overconfidence. Consequently, overconfident managers may engage in market mistiming, which is motivated by "perceived mispricing" of their firm stocks. It is therefore reasonable to argue that not only market timing but market mistiming may influence the pecking order behaviour. In brief, from market mistiming perspective, managerial overconfidence may also drive the pecking order preference.

the effect of market conditions on a negative financing deficit is unclear. Consistent with the market timing theory, they find that firms with a positive financing deficit tend to use more external equity when the cost of equity capital is low. Taken together, previous literature suggests that pecking order preference is likely to be driven by various conditions including information asymmetry, firm-level and market-level market timing. In the next section, we focus on managerial overconfidence as a driver of pecking order preference.

6.3 Hypothesis Development

This section develops two competing hypotheses based on behavioural financing theories which suggest that managerial overconfidence can either enhance or weaken pecking order preference.

6.3.1 Managerial overconfidence enhances pecking order preference

It has been recognized that the existing empirical evidence on pecking order preference can be almost, at face value, explained by managerial optimism (Baker and Wurgler, 2011). However, the theoretical relationship between managerial overconfidence and pecking order behaviour is sensitive to modelling framework. Heaton's (2002) model shows that optimistic managers prefer debt to equity since the latter is perceived to be undervalued. Malmendier and Tate (2005) argue that Heaton's (2002) model provides a re-interpretation of the information asymmetry-based pecking order model by Myers-Maljuf (1984). The idea is that managerial optimism is associated with perceived positive information. In a similar vein, Malmendier, Tate and Yan (2011) develop a model[112] of overconfidence and financing decisions and also empirically test its main predictions. Their major prediction is that overconfident managers only use external finance if overestimated returns to investment are greater than the perceived costs of

[112] Their model allows for two frictions including tax benefit of debt and financial distress cost. Overconfidence is defined as "the overestimation of mean returns to investment". Managerial overconfidence can lead to either overinvestment or underinvestment, depending on the availability of internal funds or riskless debt financing. In particular, overconfident managers with sufficient internal or riskless financing are prone to overinvest. Another implication of overconfidence is that overconfident manager may have a biased perception of the cost of external financing. For this reason, if there is financing deficit, overconfident managers may underinvest.

external financing. However, when they do use external financing, overconfident managers, who believe that debt is less subject to mispricing relative to equity, tend to use more debt than their rational counterparts. In brief, their main prediction regarding the pecking order behaviour is also consistent with Heaton (2002).

> ***Hypothesis 1a:*** *Managerial overconfidence enhances the preference for debt over equity.*

Empirically, Malmendier, Tate and Yan (2011) find that managerial overconfidence, as measured by executive stock options and media portrayal, is positively related to the pecking order coefficient. In other words, overconfidence leads to more pronounced pecking order behaviour. Furthermore, Malmendier and Zheng (2012) empirically compare the roles of CEO and CFO overconfidence and find that only CFO overconfidence has a positive and significant impact on pecking order coefficient.

6.3.2 Managerial overconfidence weakens pecking order preference

In contrast to the predictions of Heaton (2002) and Malmendier, Tate and Yan (2011), Hackbarth's (2008) model shows that managerial overconfidence may lead to a reverse pecking order. This proposition is inconsistent with Heaton's (2002) model, which can be attributed to the different modelling approaches of managerial overconfidence. In particular, in Hackbarth's (2008) model, overconfidence is modelled as risk perception bias (i.e. underestimation of the riskiness of earnings) which makes overconfident managers believe that debt is undervalued by the market because their perceived default risk is lower. In contrast, overconfident managers who underestimate the riskiness of earnings believe that their firms' equity is overvalued because of the convexity of equity. Put differently, equity can be viewed as a call option[113] on firm's assets and the value of this call option is partly determined by the risks of the firm's project. In particular, the

[113] Shareholders have a call option on the firm with an exercise price of *X*. In a call-option graph where the horizontal axis is cash flow to firm and vertical axis is cash flow to shareholders, if firm's cash flow is beyond *X*, shareholders will exercise the option by buying the firm from the debt holders (i.e. owner of the firm) for the price *X*. If firm's cash flow is below *X*, shareholders will not exercise the call option and debt holders receive entire firm's cash flow. (see e.g., Hillier *et al*. (2010) for more descriptions on equity and call option)

value of call option is positively related to project risk[114]. Therefore, overconfident managers who underestimate the project risk believe that equity is overvalued. Taken together, Hackbarth's (2008) model suggests that overconfident managers with risk perception bias believe that debt is undervalued but equity is overvalued and hence surprisingly have a reverse pecking order preference.

> ***Hypothesis 1b:*** *Managerial overconfidence (especially Hackbarth's (2008) risk perception bias) weakens the preference for debt over equity.*

To sum up, as argued by Malmendier and Tate (2005), managerial overconfidence can be a potential explanation for the pecking order type behaviour and its variation across firms and within firms. Nevertheless, the theoretical relation between overconfidence and the pecking order can be either positive (Heaton, 2002; Malmendier, Tate and Yan, 2011) or negative (Hackbarth, 2008), depending on the way overconfidence is modelled[115]. Put differently, Hackbarth (2008) concludes that both "the magnitude and the combination" of two managerial biases, namely growth perception bias and risk perception bias, determine the pecking order preference (especially preference for debt vs. equity financing). Therefore, it becomes an empirical question whether overconfidence enhances or weakens the pecking order preference.

6.4 Methodology and Data

6.4.1 The model

To test the effect of managerial overconfidence on the pecking order preference for debt over equity financing, we adopt the modified Shyam-Sunder and Myers (SSM) (1999) regression framework where the pecking order coefficient (i.e. the coefficient on the financing deficit (DEF)) is not only heterogeneous but also asymmetric. In what follows, we briefly describe two important dimensions of our empirical model, namely heterogeneity and asymmetry of the pecking order coefficient.

[114] As shown in Black-Scholes model, the value of call option is positively related to the variance of the continuous stock returns.
[115] Moreover, it is a daunting task to measure overconfidence in a way that can reflect different modelling approaches.

6.4.1.1 Heterogeneity of the pecking order coefficient

On one hand, the original SSM (1999) test assumes that the pecking order coefficient is homogeneous. However, there might be cross-sectional differences in terms of the degree of the pecking order preference. As discussed earlier, the empirical performance of the pecking order theory depends on the underlying conditions (e.g., information asymmetry, mispricing, market conditions and managerial overconfidence). Therefore, it is more appropriate to assume that the pecking order coefficient is heterogeneous, meaning the pecking order theory is conditional. Empirically, one may interact the DEF with potential conditions of the pecking order preference. For example, a closely related study by Malmendier, Tate and Yan (2011) adds an interaction term between managerial overconfidence the DEF to the SSM (1999) regression to examine the influence of managerial overconfidence on the pecking order preference. However, their empirical model does not distinguish between firms with financing deficit and surplus, which is based on the questionable assumption that the pecking order coefficient is symmetric. In what follows, we discuss why the pecking order coefficient in the SSM (1999) regression is likely to be asymmetric.

6.4.1.2 Asymmetry of the pecking order coefficient

On the other hand, the original SSM (1999) test and many subsequent studies (e.g., Frank and Goyal, 2003; Bharath *et al*., 2009) do not distinguish between negative and positive financing deficit (DEF). According to Shyam-Sunder and Myers (1999), pecking order behaviour is assumed to be symmetric, meaning that "the simple pecking order's predictions do not depend on the sign of DEF". In other words, they believe that "the Myers-Majluf reasoning works in reverse when the company has a surplus and wants to return cash to investors".

However, Kayhan and Titman (2007) point out that Shyam-Sunder and Myers's (1999) approach fails to account for asymmetry between positive and negative DEF. They argue that this asymmetry exists because equity issuance and repurchase are associated with different information issues. To empirically capture this asymmetric effect, Kayhan and Titman (2007) interact the DEF with a dummy variable indicating the sign of the DEF (e.g. the dummy variable equals one if the DEF is positive and zero otherwise). De Jong *et al*. (2010) empirically examine the asymmetry between the effects of financing deficits and surpluses. In terms of the role of managerial

overconfidence, they argue that "the level of optimism of a firm's manager is not required to explain issuance decisions, while it is an essential part of the pecking order theory for repurchase decisions". De Jong *et al*. (2010) suggest that a correct pecking order specification should differentiate between financing deficits and financing surpluses[116].

6.4.2 Measurement of financing deficit (DEF)

In principle, financing deficit can be defined using either balance sheet data (e.g., Fama and French, 2005; Chang and Dasgupta; 2009) or cash flow data (e.g., Shyam-Sunder and Myers, 1999; Frank and Goyal, 2003). Although the cash flow approach is commonly adopted, balance sheet approach is probably superior for the following two reasons. First, cash flow data suffers from relatively large amounts of missing observations[117]. Second, and more importantly, the cash flow approach understates equity issued "because the statement of cash flow does not show stock issued in mergers or outright grants of stock to employees because such issues produce no cash flows" (Fama and French, 2005).

6.4.2.1 Balance sheet approach

Following the balance sheet approach adopted by Chang and Dasgupta (2009) and Huang and Ritter (2009), net debt issues is calculated as the difference between the change in total assets and the change in book equity; net equity issues is calculated as the difference between the change in book equity and the change in retained earnings. Financing deficit is defined as the sum of net equity issues and net debt issues, which is therefore equivalent to the change in total assets minus the change in retained earnings. The balance sheet approach can be shown as follows:

---

[116] They propose the following model to capture the asymmetric pecking order behaviour:

$$\Delta D_{it} = \alpha + \beta_1 d_{it} + \beta_{po} DEF_{it} + \beta_{sur} d_{it} * DEF_{it}$$

where, d_{it} is a dummy variable that equals one if $DEF_{it} < 0$, and zero otherwise. The pecking order coefficient is β_{po} and $(\beta_{po} + \beta_{sur})$ respectively for the firms with financing deficits and financing surpluses. They find that the estimated pecking order coefficient is 0.90, 0.74 and 0.09 respectively for financing surpluses, normal deficits and large deficits.

[117] Baker and Wurgler (2002) prefer balance sheet approach because of poor availability of cash flow data in *Compustat*.

$$DEF\_BS_{it} = \underbrace{(\Delta A_{it} - \Delta BE_{it})}_{\Delta D_{it}} + \underbrace{(\Delta BE_{it} - \Delta RE_{it})}_{\Delta E_{it}} = \Delta A_{it} - \Delta RE_{it} \quad (6.2)$$

where, ΔA_{it} is the change in total assets. ΔBE_{it} is the change in book value of equity. ΔRE_{it} is the change in retained earnings. ΔD_{it} and ΔE_{it} are the net debt and equity issues respectively.

6.4.2.2 Cash flow approach

Alternatively, Frank and Goyal (2003) use detailed positions of cash flow items to construct the DEF and recode missing values to be zero. In particular, they construct the DEF as follows:

$$DEF\_CF_{it} = DIV_{it} + I_{it} + \Delta WC_{it} - CF_{it} = \Delta D_{it} + \Delta E_{it} \quad (6.3)$$

where, DIV_{it} is dividend payments. I_{it} is capital expenditures. ΔWC_{it} is net increases in working capital and the current proportion of long-term debt at start of period. CF_{it} is the operating cash flows after interest and taxes.

To avoid recoding, similar to Bessler, Drobetz and Grüninger (2011), we use aggregated cash flow items. [118] In particular, following previous studies using *Worldscope* data (e.g., Seifert and Gonenc, 2010; Bessler, Drobetz and Grüninger, 2011), net debt is measured as long term borrowings minus reduction in long term debt. Net equity is measured as net proceeds from sale/issue of common and preferred stock [119] minus common/preferred redeemed, retired and converted. The above variables are scaled by net assets (i.e. total assets minus current liabilities).

6.4.3 Measurement of managerial overconfidence

We use one words-based measure and two action-based measures of managerial overconfidence. Words-based overconfidence measure is based on tone analysis of Chairman's Statement. Two action-based measures are overconfidence beliefs revealed

[118] See Appendix A in Bessler *et al*. (2011) for a detailed discussion on the calculation of the DEF. Bessler *et al*. (2011) also use *Worldscope* data for their international study.
[119] This can also be calculated as the sum of proceeds from stock options and other proceeds from sale/issue of common/preferred stock.

from firm's investment activity and insider trading behaviour respectively. Different from the static measures of overconfidence commonly employed in the literature, our overconfidence measures are time-varying[120].

6.4.3.1 Words-based measure of overconfidence: optimistic tone

We construct two composite tone indices. One is based on the raw tone measures. The other is orthogonalized so that each component is not correlated with certain firm-specific variables (especially standard capital structure determinants). (see section 5.3.2.1 for detailed descriptions of how raw tone index (*TONE*) and orthogonalized tone index (*TONE_RES*) are constructed)

6.4.3.2 Action-based measure of overconfidence: overinvestment

Our first action-based measure of overconfidence is industry-adjusted investment rate (IAIR). The idea is that overconfidence managers tend to overestimate the present value of future investment, which in turn leads to overinvestment. Therefore, higher IAIR may indicate that the manager of a particular firm is overconfident. More specifically, we construct the IAIR as the difference between a firm's investment rate and the median investment rate of the firms in the same Datastream's Level 4 (INDM4) industry as follows:

$$IAIR_{it} = IR_{it} - \overline{IR_{s,it}} \tag{6.4}$$

where, IR_{it} is the investment rate of firm i. $\overline{IR_{s,it}}$ is the average investment rate of industry s. The investment rate is defined as the ratio of capital expenditures to beginning of year property, plant and equipment (*IAIR1*).[121] Alternatively, we define investment rate as the ratio of capital expenditures to beginning of year sales (*IAIR2*).

[120] Existing behavioural finance studies (e.g., Malmendier and Tate, 2005; Malmendier, Tate and Yan, 2011) tend to model managerial overconfidence as a habitual behaviour which is static. This static approach can be problematic because other behavioural biases, especially self-attribution bias, may affect the confidence level. In other words, although the level of overconfidence can be quite persistent over time, we should not examine overconfidence in isolation.

[121] Campbell, *et al*. (2011) classify CEOs as overconfident if their firm is in the top quintile of firms based on industry-adjusted investment rates for two consecutive years. However, we believe that managerial overconfidence is time-varying and therefore we

6.4.3.3 Action-based measure of overconfidence: net purchase ratio

We also gauge overconfidence based on how managers trade their own firms' shares. In particular, net purchase of the CEO and CFO are used as indicators of their overconfidence. (see section 5.3.2.2 of Chapter 5 for detailed descriptions of how volume-based and value-based net purchase ratio (NPR) of CEO and CFO are constructed)

6.4.4 The sample

Data used in this study are from the following sources. The UK firms' financial data is obtained from *Thomson Worldscope* database. Insider trading data is from *Hemmington Scott* database. Chairman's Statements are manually collected from the company annual reports which are downloaded either through *Northcote* website or directly from company websites. Our sample of unbalanced panel data is constructed as follows. The selection of sample period is guided by data availability. All financial and utility firms are excluded. Firm observations with missing financial data are excluded. Observations with the length of fiscal period less than 11 months or over 13 months are excluded. To conduct tone analysis, we need the digital version of the UK company annual reports, so that the Chairman Statement can be readable by the content analysis software (i.e. *LIWC 2007* and *Diction 6*)[122]. In addition, to construct an insider trading-based measure of overconfidence, only those firms with insider transactions in any year during our sample period are selected. All variables are winsorized at the 1st and 99th percentile to eliminate the effect of outliers. The final sample comprises 459 firms and 2283 observations during the period 1994-2011[123].

---

create a dummy variable (*IAIRD*) that takes the value of one if the *IAIR1* is in the top quintile in a particular fiscal year and zero otherwise.

[122] In terms of the procedure of content analysis, we first extract Chairman's Statements from annual report. Next, we detect transformation errors in the combined text file using the Spelling & Grammar function in Microsoft Word 2010. Finally, various types of errors are corrected before the texts are inputted in the content analysis software (LIWC and Diction).

[123] Most of the observations are after 2000 because machine readable annual reports are almost not available in the 1990s.

6.4.4.1 Descriptive statistics

Table 6.1 provides descriptive statistics for the UK firms in our sample. The mean of *DEF_CF* is 0.080, which is the sum of ΔD_CF (0.020) and ΔE_CF (0.060), while the means of *PDEF_CF* and *NDEF_CF* are 0.110 and -0.030 respectively[124]. The net equity issues contribute to around 75 percent[125] of the *DEF_CF*, which is not in line with SSM's pecking order hypothesis. However, using balance sheet data, the means of *DEF_BS*, *PDEF_BS* and *NDEF_BS* are 0.190, 0.250 and -0.060 respectively, and the means of ΔD_BS and ΔE_BS are 0.120 and 0.070 respectively. We can see that less than 37 percent of the *DEF_BS* is covered by net equity issues. Therefore, we expect that empirical evidences based on balance sheet approach will be relatively more close to the pecking order prediction. Importantly, we find that the percentage of firm-years with negative DEF should not be neglected. In particular, using aggregate cash flow data, the percentage of observations with negative DEF is 37.3[126], while 8.9 and 53.8 percent of the observations have zero and positive DEF respectively. Similarly, using balance sheet data, around 39 percent of the observations have negative DEF. Given the large amount of observations with financing surplus, it becomes important to empirically investigate whether the magnitude of the pecking order coefficient in SSM framework will depend on the sign of DEF. The mean of firm size (i.e. logarithm of sales) is 12.320 with a standard deviation of 2.240. The means of book and market leverage are 0.180 and 0.140 respectively. The majority of our sample firms seem not have extremely high leverage (the maximum book and market leverages are 0.610 and 0.520 respectively), and thus their financing decisions are more likely to be motivated by pecking order preference[127].

[124] Huang and Ritter (2009) exclude firm year observations where the absolute values of ΔD_{it} or ΔE_{it} are greater than 400%. In our sample, the maximum absolute values of our winsorized measures of ΔD_{it} and ΔE_{it} are around 200%.

[125] Similarly, Seifert and Gonenc (2010) document that 62.5% and 83.6% of financing deficit is financed by equity in 23 emerging market countries and the US respectively.

[126] This is consistent with 36.2 percent in Lin *et al*.'s (2008) Taiwan firm sample.

[127] Take debt capacity into consideration, the financing decisions of firms with "low to moderate" leverage are more likely to follow pecking order behaviour, while dynamic trade-off theory becomes the primary explanation for the financing behaviour of firms with "high" leverage (and consequently high financial distress costs) (Lemmon and Zender, 2010).

Table 6.1 Descriptive statistics

This table presents the descriptive statistics of the main dependent and independent variables.

Variable	Obs.	Mean	S.D.	Min.	Median	Max.
Panel A: dependent variables and financing deficit measures						
DEF_BS/NA	2283	0.190	0.560	-1.110	0.060	3.040
Δ D_BS/NA	2283	0.120	0.370	-0.630	0.040	2.030
Δ E_BS/NA	2283	0.070	0.310	-0.790	0.010	1.950
DEF_CF/NA	2283	0.080	0.330	-0.430	0.000	2.030
Δ D_CF/NA	2283	0.020	0.140	-0.310	0.000	0.790
Δ E_CF/NA	2283	0.060	0.260	-0.310	0.000	1.800
Panel B: firm-level control variables						
MB	2283	1.760	1.260	0.560	1.400	8.790
Log(sales)	2283	12.320	2.240	6.140	12.510	16.870
Tangibility	2283	0.260	0.230	0.000	0.200	0.890
Profitability	2283	0.090	0.180	-0.880	0.120	0.390
Effective tax rate	2283	0.230	0.350	-1.620	0.280	1.640
Price performance	2283	0.000	0.530	-1.880	0.080	1.170
Book leverage	2283	0.180	0.150	0.000	0.170	0.610
Market leverage	2283	0.140	0.130	0.000	0.110	0.520
Panel C: words-based measures of managerial overconfidence (i.e. tone of Chairman's Statement)						
TONE	2283	-0.000	1.615	-5.693	0.150	3.676
TONE_RES	2283	-0.000	1.584	-5.034	0.165	4.988
NET_EMOTION	2283	0.740	0.170	0.220	0.760	1.000
CERTAIN	2283	1.030	0.430	0.210	0.970	2.330
OPTIMISM	2283	53.520	2.070	49.430	53.330	60.160
CERTAINTY	2283	45.630	3.130	32.610	46.040	51.880
TONE_H	2283	0.720	0.230	-0.060	0.770	1.000
TONE_LM	2283	0.560	0.290	-0.290	0.600	1.000
Panel D: action-based measures of managerial overconfidence						
VA_CEO	1327	0.330	0.890	-1.000	1.000	1.000
VA_CFO	1071	0.460	0.830	-1.000	1.000	1.000
VOL_CEO	1327	0.480	0.790	-1.000	1.000	1.000
VOL_CFO	1071	0.570	0.740	-1.000	1.000	1.000
IAIR1_L4	2283	0.060	0.310	-0.350	0.000	1.860
IAIRD	2283	0.100	0.300	0.000	0.000	1.000
IAIR2_L4	2283	0.030	0.160	-0.240	0.000	1.190

6.4.4.2 Correlation analysis

Table 6.2 shows the pairwise Pearson correlation matrix. We first compare balance sheet approach and cash flow approach by looking at the correlations between net debt issues, net equity issues and financing deficit (i.e. the sum of net debt and equity issues). The correlation between Δ*D_BS/NA* (Δ*E_BS/NA*) and Δ*D_CF/NA* (Δ*E_CF/NA*) is 0.605 (0.773). In addition, the correlation between *DEF_BS/NA* and *DEF_CF/NA* is 0.746. *PDEF_BS/NA* is highly correlated with *PDEF_CF/NA* (0.801), however, the correlation between *NDEF_BS/NA* and *NDEF_CF/NA* is much lower (0.313). The correlation between tone-based measures of overconfidence (*TONE* and *TONE_RES*) and the insider trading-based measures of CEO and CFO overconfidence (*VA_CEO*, *VOL_CEO*, *VA_CFO* and *VOL_CFO*) are negative. This is probably because the insider trading-based measure is likely to be contaminated by information asymmetry and might not be a perfect proxy for managerial overconfidence.

Regarding the correlations between net debt and equity issues and independent variables, both *TONE* and *TONE_RES* are positively related to net debt issues and net equity issues. NPRs of CEO and CFO (including *VA_CEO*, *VOL_CEO*, *VA_CFO* and *VOL_CFO*) are positively and significantly related to net equity issues (Δ*E_CF/NA*). Market-to-book ratio is positively and significantly related to both Δ*E_BS/NA* and Δ*E_CF/NA*, consistent with market timing proposition that firms prefer equity financing when its stock is overvalued. Firm size is positively (negatively) and significantly related to Δ*D_BS/NA* and Δ*D_CF/NA* (Δ*E_BS/NA* and Δ*E_CF/NA*). Tangibility and profitability are especially negatively and significantly correlated with Δ*E_BS/NA* and Δ*E_CF/NA*. Both book and market leverage are positively (negatively) and significantly related to Δ*D_BS/NA* and Δ*D_CF/NA* (Δ*E_BS/NA* and Δ*E_CF/NA*). The correlations among independent variables are not high enough to raise concerns about multicollinearity.

Table 6.2 Correlation matrix

This table shows Pearson correlation coefficients between all pairs of our main variables, as defined in Appendix 6.A. ***, ** and * indicate that the correlation coefficient is significant at 1% 5% and 10% levels respectively.

		1	2	3	4	5	6	7	8	9	10	11	12
1.	*DEF_BS/NA*	1											
2.	*Δ D_BS/NA*	0.776***	1										
3.	*Δ E_BS/NA*	0.742***	0.2***	1									
4.	*DEF_CF/NA*	0.746***	0.475***	0.696***	1								
5.	*Δ D_CF/NA*	0.468***	0.605***	0.085***	0.539***	1							
6.	*Δ E_CF/NA*	0.617***	0.224***	0.773***	0.872***	0.081***	1						
7.	*MB*	0.165***	0.033	0.239***	0.168***	0.018	0.194***	1					
8.	*Log(sales)*	-0.121***	0.063***	-0.278***	-0.270***	0.043**	-0.347***	-0.179***	1				
9.	*Tangibility*	-0.103***	-0.044**	-0.130***	-0.123***	0.029	-0.166***	-0.118***	0.238***	1			
10.	*Profitability*	-0.187***	0.031	-0.350***	-0.361***	0.002	-0.432***	-0.053**	0.460***	0.203***	1		
11.	*TONE*	0.127***	0.149***	0.032	0.050**	0.094***	0.005	0.197***	0.196***	-0.004	0.228***	1	
12.	*TONE_RES*	0.148***	0.132***	0.084***	0.122***	0.091***	0.093***	0.000	0.000	0.000	0.000	0.938***	1
13.	*NET_EMOTION*	0.089***	0.113***	0.005	0.008	0.085***	-0.037*	0.110***	0.228***	0.013	0.261***	0.801***	0.740***
14.	*CERTAIN*	-0.051**	0.001	-0.086***	-0.100***	-0.023	-0.107***	0.021	0.261***	0.042**	0.117***	0.310***	0.235***
15.	*OPTIMISM*	0.066***	0.085***	0.012	0.014	0.053**	-0.013	0.104***	0.229***	0.054***	0.155***	0.721***	0.670***
16.	*CERTAINTY*	0.022	-0.003	0.046**	0.019	-0.024	0.037*	-0.005	0.006	-0.013	-0.050**	0.043**	0.056***
17.	*TONE_H*	0.147***	0.153***	0.063***	0.107***	0.108***	0.068***	0.227***	0.010	-0.052**	0.142***	0.774***	0.744***
18.	*TONE_LM*	0.131***	0.136***	0.054***	0.069***	0.075***	0.038*	0.194***	0.086***	-0.039*	0.151***	0.865***	0.831***
19.	*VA_CEO*	-0.006	-0.006	-0.011	0.067**	0.002	0.079***	-0.224***	-0.171***	-0.044	-0.182***	-0.155***	-0.056**
20.	*VA_CFO*	-0.005	-0.034	0.036	0.048	-0.033	0.086***	-0.203***	-0.178***	-0.028	-0.171***	-0.141***	-0.047
21.	*VOL_CEO*	-0.007	0.000	-0.020	0.052*	0.007	0.056**	-0.217***	-0.058**	-0.032	-0.149***	-0.145***	-0.071***
22.	*VOL_CFO*	-0.006	-0.019	0.013	0.043	-0.010	0.062**	-0.204***	-0.087***	-0.017	-0.14***	-0.142***	-0.068**
23.	*IAIR1_L4*	0.256***	0.207***	0.206***	0.262***	0.138***	0.240***	0.174***	-0.180***	-0.169***	-0.110***	0.026	0.029
24.	*IAIR2_L4*	0.142***	0.077***	0.159***	0.200***	0.139***	0.163***	0.106***	-0.250***	0.183***	-0.179***	-0.043**	0.017
		13	14	15	16	17	18	19	20	21	22	23	24
13.	*NET_EMOTION*	1											
14.	*CERTAIN*	0.175***	1										
15.	*OPTIMISM*	0.451***	0.275***	1									
16.	*CERTAINTY*	0.000	0.128***	0.042**	1								
17.	*TONE_H*	0.503***	0.064***	0.353***	0.010	1							
18.	*TONE_LM*	0.600***	0.121***	0.505***	-0.009	0.657***	1						
19.	*VA_CEO*	-0.127***	-0.084***	-0.119***	0.008	-0.110***	-0.122***	1					
20.	*VA_CFO*	-0.113***	-0.120***	-0.076**	-0.052*	-0.087***	-0.126***	0.670***	1				
21.	*VOL_CEO*	-0.110***	-0.073***	-0.108***	0.011	-0.098***	-0.130***	0.876***	0.644***	1			
22.	*VOL_CFO*	-0.108***	-0.099***	-0.078***	-0.029	-0.092***	-0.137***	0.595***	0.898***	0.723***	1		
23.	*IAIR1_L4*	0.006	-0.041**	-0.027	0.040*	0.061***	0.054***	0.006	0.020	-0.015	0.004	1	
24.	*IAIR2_L4*	-0.044**	-0.073***	-0.071***	0.018	-0.010	0.005	0.042	0.016	0.008	-0.014	0.376***	1

6.5 Results and Discussion

To examine the effect of managerial overconfidence on the pecking order preference, we use a modified Shyam-Sunder and Myers (1999) financing deficit regression framework as follows:

$$\Delta D_{it} = a + \beta_1 DEF_{it} + \beta_2 MO_{it} + \beta_3 MO_{it} * DEF_{it} + B_4 \Delta \boldsymbol{X}_{it} + v_i + e_{it} \qquad (6.5)$$

where, ΔD_{it} is net debt issues as a percentage of beginning-of-year net assets. DEF_{it} is a measure of financing deficit scaled by beginning-of-year net assets (i.e. total assets minus current liabilities). MO_{it} is managerial overconfidence. We use both words-based (i.e. tone) and action-based (i.e. insider trading and firm investment) measures of managerial overconfidence. e_{it} is the error term. $\Delta \boldsymbol{X}_{it}$ is a vector of firm-level controls including changes in market-to-book ratio, firm size, tangibility and profitability (see Frank and Goyal, 2003). Standard errors are adjusted for clustering at the firm level. v_i is time-invariant firm-specific effects. e_{it} is the error term.[128]

6.5.1 Optimistic tone and pecking order preference

Table 6.3 reports the effects of optimistic tone on the pecking order coefficient (i.e. the coefficient on the *DEF*) in the Shyam-Sunder and Myers (1999) financing deficit regression. An increase in the pecking order coefficient indicates an enhanced pecking order preference, while a decrease in pecking order coefficient indicates a reverse/weakened pecking order preference. The coefficients on *DEF* are around 0.55 in most models in Panel A and B and are even much lower in Panel C (below 0.25). This observation that pecking order coefficient is far below one is in contrast to the static pecking order prediction, meaning that firms in our sample do not have a strong preference for debt over equity financing. Moreover, both tone index (*TONE*) and orthogonalized tone index (*TONE_RES*) have negative impacts on the pecking order coefficient. More specifically, the interaction between *TONE_RES* and *DEF* is negative and statistically significant. This negative coefficient on *TONE_RES***DEF* suggests that

[128] Another way to test the impact of managerial overconfidence on the preference for debt over equity financing is logistic analysis which examines the probability of debt issues relative to equity issues. However, this approach fails to control for firm fixed effects.

managerial overconfidence, as measured by optimistic tone, leads to a reverse pecking order preference.

As a robustness test, Table 6.4 reports the effects of optimistic tone dummies on the pecking order coefficient. *TONE_DUM* and *TONE_RES_DUM* are binary variables that take the value of 1 if *TONE* and *TONE_RES* are above their sample median and 0 otherwise. We find that both *TONE_DUM* and *TONE_RES_DUM* have negative and statistically significant effects on the pecking order coefficient especially in Panel B (model 3-4) which is the subsample including firm-year observations with financing deficit (i.e. *DEF*>0). In contrast, in Panel C (model 5-6) which is the subsample including firm-year observations with financing surplus (i.e. *DEF*<0), the tone dummies have positive and statistically insignificant impacts on the pecking order coefficient.

To sum up, the above results suggest that tone leads to a reverse pecking order preference. One major concern related to this words-based managerial overconfidence measure is that tone might be contaminated by information asymmetry. In other words, rational managers use optimistic tone intentionally to reduce information asymmetry. However, if this is the case, tone that is contaminated by information asymmetry will enhance pecking order preference, which is not consistent with our empirical findings. Therefore, we may conclude that the negative relationship between tone and pecking order coefficient is not likely to be driven by information asymmetry.

6.5.2 Industry-adjusted investment rate and pecking order preference

Table 6.5 reports the effects of the action-based managerial overconfidence measure (i.e. industry-adjusted investment rate) on pecking order preference. We find that both *IAIRD* and *IAIR2_L4* have negative and statistically significant effects on the pecking order coefficient in model 2-3 and model 5-6. This finding suggests that managerial overconfidence, as measured by firms' overinvestment, leads to reverse pecking order preference especially for firms with financing deficit (i.e. *DEF*>0). To sum up, the results based on industry-adjusted investment further confirms our earlier findings that optimistic tone (see section 6.5.1) is related to a weakened preference for debt over equity financing (i.e. a reverse pecking order preference).

Table 6.3 Tone and pecking order preference

This table examines the effect of optimistic tone index (*TONE*) and orthogonalized tone index (*TONE_RES*) on the pecking order preference by looking at the interaction between tone and financing deficit (*DEF*) in the Shyam-Sunder and Myers (1999) financing deficit regression framework. The dependent variable is net debt issues scaled by net assets. Panel A is based on the full sample, while Panel B and C focus on firm-years observations with financing deficit (i.e. *DEF*>0) and financing surplus (i.e. *DEF*<0) respectively. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

	Dependent variable: net debt issues scaled by net assets								
	Panel A. Full sample (model 1-3)			*Panel B. DEF_BS>0 (model 4-6)*			*Panel C. DEF_BS<0 (model 7-9)*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEF	0.548***	0.549***	0.558***	0.554***	0.559***	0.568***	0.242***	0.228***	0.230***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
TONE		0.009***			0.003			0.004	
		(0.010)			(0.505)			(0.483)	
TONE_RES			0.011***			0.009*			0.001
			(0.001)			(0.088)			(0.773)
*TONE*DEF*		-0.007			-0.011			-0.045	
		(0.550)			(0.427)			(0.144)	
*TONE_RES*DEF*			**-0.023****			**-0.023***			**-0.052***
			(0.027)			**(0.077)**			**(0.096)**
Δ *MB*	-0.005	-0.006	-0.007	0.002	0.002	0.001	0.000	-0.004	-0.002
	(0.641)	(0.522)	(0.479)	(0.862)	(0.862)	(0.923)	(0.999)	(0.751)	(0.873)
Δ *Firm size*	0.147***	0.142***	0.138***	0.124**	0.122**	0.116**	0.164***	0.160***	0.160***
	(0.000)	(0.000)	(0.000)	(0.015)	(0.013)	(0.017)	(0.003)	(0.003)	(0.003)
Δ *Tangibility*	-0.009	0.005	0.000	0.297	0.291*	0.281*	-0.206	-0.148	-0.138
	(0.944)	(0.967)	(1.000)	(0.104)	(0.096)	(0.095)	(0.217)	(0.341)	(0.368)
Δ *Profitability*	-0.271***	-0.283***	-0.268***	-0.339***	-0.34***	-0.331***	-0.199***	-0.214***	-0.210***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.005)	(0.005)	(0.003)	(0.001)	(0.001)
Constant	-0.001	0.000	0.001	0.012	0.011	0.011	-0.071***	-0.069***	-0.070***
	(0.847)	(0.974)	(0.837)	(0.329)	(0.355)	(0.375)	(0.000)	(0.000)	(0.000)
Within R^2	0.683	0.684	0.687	0.655	0.655	0.658	0.205	0.228	0.230
Between R^2	0.437	0.442	0.445	0.456	0.452	0.460	0.190	0.170	0.198
Obs.	2283	2283	2283	1451	1451	1451	832	832	832
Firms	459	459	459	433	433	433	363	363	363

Table 6.4 Tone dummies and pecking order preference

This table examines the effect of optimistic tone dummies (i.e. *TONE_DUM* and *TONE_RES_DUM* that are one if tone index and orthogonalized tone index are above their median respectively and zero otherwise) on the pecking order preference by looking at the interaction between tone dummies and financing deficit (*DEF*) in the Shyam-Sunder and Myers (1999) financing deficit regression framework. The dependent variable is net debt issues scaled by net assets. Panel A is based on the full sample, while Panel B and C focus on firm-years observations with financing deficit (i.e. *DEF*>0) and financing surplus (i.e. *DEF*<0) respectively. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

	Dependent variable: net debt issues scaled by net assets					
	Panel A. Full sample (model 1-2)		*Panel B. DEF_BS>0 (model 3-4)*		*Panel C. DEF_BS<0 (model 5-6)*	
	(1)	(2)	(3)	(4)	(5)	(6)
DEF	0.603***	0.591***	0.643***	0.612***	0.24***	0.228***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)
TONE_DUM	0.012		0.018		0.014	
	(0.307)		(0.247)		(0.354)	
TONE_RES_DUM		0.022*		0.028		0.022
		(0.062)		(0.126)		(0.115)
*TONE_DUM*DEF*	**-0.085****		**-0.122*****		0.000	
	(0.024)		**(0.006)**		(0.999)	
*TONE_RES_DUM*DEF*		**-0.070***		**-0.087***		0.025
		(0.099)		**(0.098)**		(0.782)
Δ *MB*	-0.006	-0.006	0.003	0.001	-0.002	-0.002
	(0.555)	(0.542)	(0.821)	(0.899)	(0.866)	(0.846)
Δ *Firm size*	0.140***	0.143***	0.116**	0.120**	0.161***	0.163***
	(0.000)	(0.000)	(0.013)	(0.018)	(0.004)	(0.003)
Δ *Tangibility*	-0.026	-0.010	0.271	0.277*	-0.195	-0.189
	(0.826)	(0.930)	(0.103)	(0.099)	(0.243)	(0.254)
Δ *Profitability*	-0.259***	-0.262***	-0.318***	-0.326***	-0.204***	-0.205***
	(0.002)	(0.003)	(0.004)	(0.005)	(0.002)	(0.002)
Constant	-0.006	-0.011	-0.003	-0.004	-0.077***	-0.081***
	(0.412)	(0.118)	(0.863)	(0.761)	(0.000)	(0.000)
Within R^2	0.687	0.686	0.664	0.659	0.206	0.208
Between R^2	0.416	0.439	0.433	0.456	0.189	0.192
Obs.	2283	2283	1451	1451	832	832
Firms	459	459	433	433	363	363

Table 6.5 Industry-adjusted investment rate and pecking order preference

This table examines the effect of industry-adjusted investment rate (including *IAIR1_L4*, *IAIRD* and *IAIR2_L4*) on the pecking order preference by looking at the interaction between industry-adjusted investment rate and financing deficit (*DEF*) in the Shyam-Sunder and Myers (1999) financing deficit regression framework. The dependent variable is net debt issues scaled by net assets. Panel A is based on the full sample, while Panel B and C focus on firm-years observations with financing deficit (i.e. *DEF*>0) and financing surplus (i.e. *DEF*<0) respectively. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

	Dependent variable: net debt issues scaled by net assets								
	Panel A. Full sample (model 1-3)			*Panel B. DEF_BS>0 (model 4-6)*			*Panel C. DEF_BS<0 (model 7-9)*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEF	0.559***	0.587***	0.57***	0.573***	0.620***	0.580***	0.234***	0.255***	0.245***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IAIR1_L4	0.090***			0.084*			-0.100		
	(0.008)			(0.055)			(0.103)		
IAIRD		0.075***			0.134***			-0.127**	
		(0.002)			(0.000)			(0.029)	
IAIR2_L4			0.229***			0.334***			-0.083
			(0.004)			(0.005)			(0.579)
*IAIR1_L4*DEF*	-0.071			-0.086			**-0.293***		
	(0.192)			(0.188)			**(0.083)**		
*IAIRD*DEF*		**-0.152****			**-0.219*****			-0.242	
		(0.020)			**(0.005)**			(0.210)	
*IAIR2_L4*DEF*			**-0.282****			**-0.307***			0.194
			(0.041)			**(0.052)**			(0.618)
Δ *MB*	-0.005	-0.005	-0.004	0.000	0.000	0.001	-0.002	-0.003	-0.002
	(0.599)	(0.621)	(0.673)	(0.991)	(0.989)	(0.93)	(0.862)	(0.813)	(0.888)
Δ *Firm size*	0.140***	0.148***	0.134***	0.129**	0.131**	0.119**	0.159***	0.166***	0.178***
	(0.000)	(0.000)	(0.000)	(0.014)	(0.011)	(0.027)	(0.005)	(0.003)	(0.002)
Δ *Tangibility*	-0.082	0.028	0.000	0.279	0.393*	0.235	-0.200	-0.203	-0.226
	(0.513)	(0.828)	(1.000)	(0.165)	(0.056)	(0.282)	(0.225)	(0.226)	(0.210)
Δ *Profitability*	-0.259***	-0.241***	-0.243***	-0.323***	-0.295**	-0.305***	-0.191***	-0.188***	-0.203***
	(0.003)	(0.006)	(0.006)	(0.006)	(0.012)	(0.010)	(0.005)	(0.006)	(0.002)
Constant	-0.004	-0.008	-0.006	0.002	-0.011	-0.004	-0.074***	-0.066***	-0.069***
	(0.434)	(0.160)	(0.229)	(0.848)	(0.325)	(0.709)	(0.000)	(0.000)	(0.000)
Within R^2	0.687	0.692	0.693	0.66	0.678	0.669	0.221	0.218	0.208
Between R^2	0.444	0.456	0.434	0.457	0.474	0.445	0.165	0.144	0.189
Obs.	2283	2283	2283	1451	1451	1451	832	832	832
Firms	459	459	459	433	433	433	363	363	363

6.5.3 Further analysis

Having provided the evidence that managerial overconfidence, as measured by tone and firm investment, leads to a reverse pecking order preference, we conduct further analysis to see whether managerial overconfidence may contribute to the pecking order puzzle (i.e. size anomaly) by comparing the effects of managerial overconfidence on pecking order preference for small and large firms. In addition, we examine whether "risk perception bias (i.e. underestimation of the riskiness of earnings)" is the underlying channel through which managerial overconfidence weakens pecking order preference (as described in *hypothesis 1b*). In particular, we compare the effects of managerial overconfidence on pecking order preference for firms with high and low earning volatility. Furthermore, considering that CEO and CFO may have different duties, we compare CEO and CFO overconfidence, as indicated by their net purchase of their own firms' shares, on pecking order preference.

6.5.3.1 Can managerial overconfidence explain the pecking order puzzle/size anomaly?

We examine whether the effects of managerial overconfidence on pecking order preference are different for small and large firms. This further analysis is motivated by the pecking order puzzle documented by Frank and Goyal (2003) that firm size is positively associated with the degree of pecking order preference, which contradicts the standard (information asymmetry-based) pecking order theory. A potential explanation for this puzzle is that overconfident managers in smaller firms are reluctant to follow standard pecking order although smaller firms are subject to higher information costs. To test this conjecture, we split the whole sample into two subsamples: Panel A in Table 6.6 and 6.7 includes firm-year observations with firm size below median, while Panel B in Table 6.6 and 6.7 includes firm-year observations with firm size above median.

Table 6.6 and 6.7 compares the effects of tone and industry-adjusted investment rate respectively on pecking order preference for small and large firms. Consistent with Frank and Goyal's (2003) observation that small firms exhibit weaker pecking order preference, we also find that the pecking order coefficient (i.e. the coefficient on *DEF*)

is smaller for small firms.[129] More importantly, we find that both optimistic tone (see model 1, 2 and 4 in Panel A of Table 6.6) and industry-adjusted investment rate (see model 4, 5 and 6 in Panel A of Table 6.7) have negative and statistically significant impacts on the pecking order coefficient especially for small firms whose firm size is below sample median. This finding sheds important light on the pecking order puzzle. In particular, our results suggest that managerial overconfidence in small firms makes those small firms less willing to follow standard pecking order preference and therefore contribute to the pecking order puzzle or size anomaly.

6.5.3.2 What is the underlying channel through which managerial overconfidence leads to reverse pecking order preference?

Recall *hypothesis 1b* that overconfident managers with risk perception bias who underestimate the riskiness of firm earnings tend to have a reverse pecking order preference, if risk perception bias is the channel through which managerial overconfidence weakens pecking order preference, we expect the overconfidence-induced revere pecking order preference is more significant especially for firms with higher earnings volatility. Consistent with this conjecture, we find that, for firms with relatively high earnings volatility, both tone and industry-adjusted investment rate have negative impacts on the pecking order preference, which are statistically significant (see model 2 of Table 6.8 and model 2, 4, 5 and 6 of Table 6.9). In contrast, for firms with low earnings volatility, the impacts of tone and industry-adjusted investment rate on the pecking order preference are either positive or negative and statistically insignificant in all the models (see Panel B of Table 6.8 and 6.9). Taken together, we may conclude that managerial overconfidence has negative and statistically significant impacts on the pecking order preference only for those firms with relatively higher earnings volatility. This is consistent with overconfident managers in those highly volatile (in terms of the earnings) firms having a biased perception of the riskiness of earnings which in turn leads to a reverse pecking order preference as we described in *hypothesis 1b*. In brief,

[129] The observed relatively weaker pecking order preference of small firms may not be due to managerial choice/preference. In particular, small firms may find it difficult to raise debt financing and therefore have to use equity. In this case, small firms are not able to follow the standard pecking order, which can potentially explain why small firms have lower pecking order coefficient. However, the purpose of our analysis is to see whether managerial overconfidence contributes to the weakened pecking order of small firms.

the above subsample analysis based on firm earnings volatility further confirms *hypothesis 1b* by suggesting that the overconfidence-induced reverse pecking order preference can be attributed to the underestimation of earnings volatility.

6.5.3.3 Do net purchases (as a proxy for overconfidence) of CEO and CFO have the same impact on pecking order preference?

Table 6.10 presents the effects of overconfidence of both CEO and CFO, as measured by their net purchase ratio (NPR), on the pecking order preference. *VA_CEO* and *VA_CFO* are value-based NPR of CEO and CFO respectively, while *VOL_CEO* and *VOL_CFO* are volume-based NPR of CEO and CFO respectively. Interestingly, the effects of CEO and CFO net purchase have different impacts on pecking order coefficient. In particular, the coefficients on *VA_CEO*DEF* and *VOL_CEO*DEF* are positive and statistically significant in model 5 and 7 respectively, which suggests that the CEO net purchase leads to an enhanced pecking order preference.

In contrast, the coefficients on *VA_CFO*DEF* and *VOL_CFO*DEF* are negative and statistically significant in model 6 and 4 respectively, meaning that the CFO net purchase leads to reverse pecking order preference. The results related to the CFO net purchase is consistent with our findings related to tone that managerial overconfidence weaken firms' pecking order preference. However, the opposite effect of CEO net purchase could potentially be attributed to the fact that CEO has more private information about the firm relative to CFO and therefore CEO's trading is more likely to be driven by information asymmetry rather than CEO overconfidence. In other words, CEO insider trading more reflects private information rather than overconfidence. Therefore, we find that CEO net purchase, which is likely to be contaminated by information asymmetry, is associated with an enhanced pecking order preference.

As a robustness test, Table 6.11 presents the effects of CEO and CFO net purchase dummies on the pecking order preference. *CEO_DUM* and *CFO_DUM* are binary variables that take the value of 1 if the NPR of CEO and CFO take the value of one and 0 otherwise. We find that only the effects of *CFO_DUM* on pecking order coefficient are statistically significant and negative (model 2 and 4). To conclude, CFO overconfidence as measured by their net purchase of their own firms' share leads to a reverse pecking order preference.

Table 6.6 Comparison of the effects of tone on pecking order preference for small and large firms

This table examines whether the effect of optimistic tone index (*TONE*) and orthogonalized tone index (*TONE_RES*) on the pecking order preference depends on firm size. We therefore compare the results from two subsamples divided by firm size. The dependent variable is net debt issues scaled by net assets. Panel A is the subsample including small firms with firm size below its median and Panel B is the subsample including large firms with firm size above its median. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

	Dependent variable: net debt issues scaled by net assets							
	Panel A. Small firms (below median) (model 1-4)				*Panel B. Large firms (above median) (model 5-8)*			
	DEF_BS (model 1-2)		DEF_CF (model 3-4)		DEF_BS (model 5-6)		DEF_CF (model 7-8)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DEF	0.420***	0.431***	0.450***	0.471***	0.727***	0.728***	0.928***	0.933***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
TONE	0.011*		0.024***		0.010***		0.015***	
	(0.053)		(0.003)		(0.000)		(0.010)	
TONE_RES		0.014**		0.025***		0.010***		0.012**
		(0.023)		(0.002)		(0.000)		(0.029)
*TONE*DEF*	**-0.027***		-0.057		-0.009		0.036	
	(0.075)		(0.131)		(0.416)		(0.246)	
*TONE_RES*DEF*		**-0.032****		**-0.057***		-0.012		0.042
		(0.021)		**(0.092)**		(0.330)		(0.194)
Δ *MB*	-0.004	-0.005	-0.021*	-0.021*	-0.014	-0.012	-0.066***	-0.064***
	(0.748)	(0.649)	(0.099)	(0.098)	(0.373)	(0.433)	(0.001)	(0.002)
Δ *Firm size*	0.141***	0.138***	0.222***	0.225***	0.045	0.047	0.463***	0.466***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.153)	(0.137)	(0.002)	(0.002)
Δ *Tangibility*	0.165	0.164	0.042	0.031	-0.041	-0.044	-0.169	-0.181
	(0.308)	(0.305)	(0.869)	(0.900)	(0.765)	(0.754)	(0.523)	(0.495)
Δ *Profitability*	-0.199**	-0.188**	-0.252***	-0.234**	-0.129**	-0.118*	-0.544**	-0.527**
	(0.028)	(0.033)	(0.009)	(0.013)	(0.037)	(0.055)	(0.015)	(0.017)
Constant	-0.006	-0.007	0.017	0.013	0.012**	0.014***	0.058***	0.060***
	(0.486)	(0.345)	(0.129)	(0.209)	(0.023)	(0.007)	(0.000)	(0.000)
Within R^2	0.521	0.524	0.250	0.251	0.880	0.880	0.563	0.562
Between R^2	0.381	0.398	0.186	0.190	0.869	0.871	0.682	0.676
Obs.	1141	1141	1141	1141	1142	1142	1142	1142
Firms	291	291	291	291	212	212	212	212

Table 6.7 Comparison of the effects of industry-adjusted investment rate on pecking order preference for small and large firms

This table examines whether the effect of industry-adjusted investment rate (including *IAIR1_L4*, *IAIRD* and *IAIR2_L4*) on the pecking order preference depends on firm size. We therefore compare the results from two subsamples divided by firm size. The dependent variable is net debt issues scaled by net assets. Panel A is the subsample including small firms with firm size below its median and Panel B is the subsample including large firms with firm size above its median. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

	Dependent variable: net debt issues scaled by net assets											
	Panel A. Small firms (below median) (model 1-6)						*Panel B. Large firms (above median) (model 7-12)*					
	DEF_BS (model 1-3)			DEF_CF (model 4-6)			DEF_BS (model 7-9)			DEF_CF (model 10-12)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DEF	0.414***	0.444***	0.430***	0.237***	0.254***	0.229***	0.718***	0.747***	0.748***	0.585***	0.604***	0.594***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IAIR1_l4	0.039			0.028**			0.109***			0.062***		
	(0.333)			(0.029)			(0.000)			(0.006)		
IAIRD		0.028			0.028***			0.064			0.020	
		(0.334)			(0.008)			(0.133)			(0.249)	
IAIR2_l4			0.111			0.134**			0.229***			0.080*
			(0.238)			(0.015)			(0.001)			(0.091)
*IAIR1_l4*DEF*	0.004			**-0.079*** **			-0.030			0.076		
	(0.949)			**(0.002)**			(0.813)			(0.653)		
*IAIRD*DEF*		-0.073			**-0.127*** **			-0.139			-0.034	
		(0.387)			**(0.000)**			(0.258)			(0.727)	
*IAIR2_l4*DEF*			-0.109			**-0.199*** **			**-0.607*** **			0.051
			(0.453)			**(0.000)**			**(0.001)**			(0.665)
Δ *MB*	0.000	-0.002	-0.001	0.001	0.000	0.002	-0.009	-0.008	-0.002	-0.005	-0.005	-0.006
	(0.988)	(0.851)	(0.935)	(0.853)	(0.965)	(0.489)	(0.548)	(0.534)	(0.857)	(0.463)	(0.376)	(0.291)
Δ *Firm size*	0.14***	0.152***	0.142***	0.021	0.021*	0.011	0.053*	0.054	0.054	0.005	0.006	0.004
	(0.001)	(0.000)	(0.001)	(0.105)	(0.087)	(0.453)	(0.093)	(0.113)	(0.154)	(0.794)	(0.775)	(0.832)
Δ *Tangibility*	0.078	0.225	0.187	0.194*	0.220*	0.153	-0.165	-0.081	-0.135	-0.075	-0.013	-0.017
	(0.659)	(0.223)	(0.282)	(0.096)	(0.052)	(0.152)	(0.280)	(0.577)	(0.325)	(0.271)	(0.837)	(0.795)
Δ *Profitability*	-0.201**	-0.183**	-0.185**	-0.086***	-0.077***	-0.081***	-0.095	-0.090	-0.128**	-0.069	-0.069	-0.066
	(0.021)	(0.040)	(0.040)	(0.000)	(0.001)	(0.001)	(0.117)	(0.160)	(0.028)	(0.121)	(0.132)	(0.125)
Constant	-0.015*	-0.016*	-0.015**	-0.020***	-0.022***	-0.021***	0.012**	0.011***	0.010**	0.002	0.004	0.003
	(0.061)	(0.058)	(0.045)	(0.000)	(0.000)	(0.000)	(0.027)	(0.005)	(0.016)	(0.291)	(0.107)	(0.244)
Within R^2	0.516	0.518	0.517	0.299	0.310	0.306	0.881	0.883	0.896	0.712	0.709	0.710
Between R^2	0.393	0.407	0.389	0.219	0.235	0.204	0.861	0.878	0.913	0.395	0.415	0.396
Obs.	1141	1141	1141	1141	1141	1141	1142	1142	1142	1142	1142	1142
Firms	291	291	291	291	291	291	212	212	212	212	212	212

Table 6.8 Comparison of the effects of tone on pecking order preference for firms with high and low earnings volatility

This table examines whether the effect of optimistic tone index (*TONE*) and orthogonalized tone index (*TONE_RES*) on the pecking order preference depends on earnings volatility. Earnings volatility is defined as the standard deviation of the first difference in EBITD in the past five years (at least three years), scaled by the average book value of assets. We therefore compare the results from two subsamples divided by earnings volatility. The dependent variable is net debt issues scaled by net assets. Panel A is the subsample including firms with earnings volatility above its median and Panel B is the subsample including firms with earnings volatility below its median. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

	Dependent variable: net debt issues scaled by net assets							
	Panel A. Firms with high earnings volatility (above median) (model 1-4)				*Panel B. Firms with low earnings volatility (below median) (model 5-8)*			
	DEF_BS (model 1-2)		DEF_CF (model 3-4)		DEF_BS (model 5-6)		DEF_CF (model 7-8)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DEF	0.471***	0.485***	0.629***	0.658***	0.754***	0.754***	0.800***	0.798***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
TONE	0.004		0.011		0.007**		0.022***	
	(0.455)		(0.143)		(0.023)		(0.003)	
TONE_RES		0.005		0.014*		0.007**		0.020***
		(0.376)		(0.068)		(0.023)		(0.009)
*TONE*DEF*	-0.016		-0.035		-0.004		0.026	
	(0.376)		(0.406)		(0.711)		(0.575)	
*TONE_RES*DEF*		**-0.030***		-0.056		-0.006		0.039
		(0.068)		(0.143)		(0.584)		(0.374)
Δ *MB*	-0.002	-0.003	-0.023	-0.024	-0.017	-0.017	-0.049***	-0.044***
	(0.885)	(0.804)	(0.184)	(0.145)	(0.374)	(0.393)	(0.004)	(0.008)
Δ *Firm size*	0.148***	0.142***	0.214***	0.208***	0.024	0.025	0.706***	0.712***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.689)	(0.678)	(0.000)	(0.000)
Δ *Tangibility*	-0.098	-0.112	-0.176	-0.184	-0.141	-0.140	0.016	0.001
	(0.535)	(0.464)	(0.510)	(0.481)	(0.338)	(0.344)	(0.957)	(0.997)
Δ *Profitability*	-0.163*	-0.150*	-0.240**	-0.227**	-0.059	-0.047	-1.234***	-1.198***
	(0.061)	(0.070)	(0.017)	(0.020)	(0.645)	(0.712)	(0.000)	(0.001)
Constant	-0.001	-0.001	0.012	0.012	0.007	0.008	0.023	0.026
	(0.918)	(0.938)	(0.222)	(0.210)	(0.180)	(0.129)	(0.144)	(0.108)
Within R^2	0.574	0.578	0.363	0.368	0.895	0.895	0.519	0.519
Between R^2	0.517	0.522	0.182	0.187	0.850	0.849	0.436	0.418
Obs.	1095	1095	1095	1095	1095	1095	1095	1095
Firms	340	340	340	340	286	286	286	286

Table 6.9 Comparison of the effects of industry-adjusted investment rate on pecking order preference for firms with high and low earnings volatility

This table examines whether the effect of industry-adjusted investment rate (including *IAIR1_L4*, *IAIRD* and *IAIR2_L4*) on the pecking order preference depends on earnings volatility. Earnings volatility is defined as the standard deviation of the first difference in EBITD in the past five years (at least three years), scaled by the average book value of assets. We therefore compare the results from two subsamples divided by earnings volatility. The dependent variable is net debt issues scaled by net assets. Panel A is the subsample including firms with earnings volatility above its median and Panel B is the subsample including firms with earnings volatility below its median. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

	Dependent variable: net debt issues scaled by net assets											
	Panel A. Firms with high earnings volatility (above median) (model 1-6)						*Panel B. Firms with low earnings volatility (below median) (model 7-12)*					
	DEF_BS (model 1-3)			DEF_CF (model 4-6)			DEF_BS (model 7-9)			DEF_CF (model 10-12)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DEF	0.469***	0.512***	0.472***	0.303***	0.317***	0.290***	0.754***	0.750***	0.755***	0.685***	0.676***	0.677***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IAIR1_l4	0.052			0.030**			0.079***			0.045***		
	(0.243)			(0.038)			(0.001)			(0.006)		
IAIRD		0.028			0.030**			0.050**			0.023*	
		(0.430)			(0.026)			(0.038)			(0.068)	
IAIR2_l4			0.166**			0.099***			0.001			0.110**
			(0.047)			(0.004)			(0.993)			(0.021)
*IAIR1_l4*DEF*	-0.028			**-0.088****			-0.039			-0.141		
	(0.710)			**(0.011)**			(0.763)			(0.304)		
*IAIRD*DEF*		**-0.185***			**-0.134*****			0.000			0.001	
		(0.085)			**(0.005)**			(0.994)			(0.994)	
*IAIR2_l4*DEF*			-0.083			**-0.161****			0.085			-0.075
			(0.666)			**(0.014)**			(0.673)			(0.761)
Δ *MB*	0.000	-0.004	-0.001	-0.001	0.000	0.000	-0.015	-0.015	-0.015	-0.014	-0.015*	-0.015*
	(0.980)	(0.726)	(0.963)	(0.854)	(0.986)	(0.914)	(0.444)	(0.423)	(0.426)	(0.104)	(0.084)	(0.098)
Δ *Firm size*	0.150***	0.166***	0.141***	0.033**	0.032**	0.025*	0.018	0.023	0.016	-0.032	-0.028	-0.034
	(0.000)	(0.000)	(0.001)	(0.029)	(0.027)	(0.098)	(0.778)	(0.720)	(0.765)	(0.328)	(0.399)	(0.248)
Δ *Tangibility*	-0.135	0.038	-0.112	0.015	0.030	-0.014	-0.266	-0.206	-0.167	0.015	0.033	0.023
	(0.415)	(0.838)	(0.523)	(0.880)	(0.772)	(0.893)	(0.104)	(0.186)	(0.273)	(0.857)	(0.653)	(0.762)
Δ *Profitability*	-0.161*	-0.123	-0.157*	-0.098***	-0.093***	-0.104***	-0.003	0.005	0.002	0.029	0.021	0.014
	(0.058)	(0.145)	(0.070)	(0.000)	(0.000)	(0.000)	(0.979)	(0.966)	(0.983)	(0.602)	(0.709)	(0.796)
Constant	-0.004	-0.004	-0.006	-0.019***	-0.020***	-0.019***	0.006	0.006	0.008*	0.005	0.004	0.004
	(0.536)	(0.618)	(0.370)	(0.000)	(0.000)	(0.000)	(0.225)	(0.292)	(0.080)	(0.148)	(0.210)	(0.189)
Within R^2	0.574	0.589	0.574	0.410	0.416	0.403	0.895	0.895	0.894	0.776	0.773	0.774
Between R^2	0.534	0.544	0.520	0.247	0.253	0.235	0.852	0.850	0.853	0.622	0.622	0.627
Obs.	1095	1095	1095	1095	1095	1095	1095	1095	1095	1095	1095	1095
Firms	340	340	340	340	340	340	340	340	340	340	340	340

Table 6.10 Net purchase of CEO and CFO and pecking order preference

This table examines the effect of value-based and volume-based net purchase ratio (NPR) of CEO and CFO on the pecking order preference by looking at the interaction between net purchase ratios of CEO/CFO and financing deficit (*DEF*) in the Shyam-Sunder and Myers (1999) financing deficit regression framework. The dependent variable is net debt issues scaled by net assets. Panel A is based on the full sample, while Panel B and C focus on firm-years observations with financing deficit (i.e. *DEF*>0) and financing surplus (i.e. *DEF*<0) respectively. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

Dependent variable: net debt issues scaled by net assets												
	Panel A. Full sample (model 1-4)				*Panel B. DEF_BS>0 (model 5-8)*				*Panel C. DEF_BS<0 (model 9-12)*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DEF	0.582***	0.685***	0.570***	0.698***	0.609***	0.697***	0.594***	0.689***	0.238***	0.291*	0.234***	0.405**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.082)	(0.002)	(0.043)
VA_CEO	0.001				-0.006				-0.003			
	(0.927)				(0.531)				(0.853)			
VA_CFO		0.006				0.018*				0.003		
		(0.513)				(0.073)				(0.825)		
VOL_CEO			-0.001				-0.009				0.000	
			(0.955)				(0.444)				(0.996)	
VOL_CFO				0.013				0.010				-0.006
				(0.105)				(0.439)				(0.646)
*VA_CEO*DEF*	0.025				**0.052***				0.004			
	(0.446)				**(0.063)**				(0.956)			
*VA_CFO*DEF*		-0.064				**-0.098****				0.120		
		(0.116)				**(0.015)**				(0.475)		
*VOL_CEO*DEF*			0.044				**0.072****				0.012	
			(0.203)				**(0.021)**				(0.869)	
*VOL_CFO*DEF*				**-0.079***				-0.081				-0.016
				(0.072)				(0.106)				(0.932)
Δ *MB*	-0.007	-0.002	-0.007	-0.001	0.009	0.012	0.008	0.009	-0.003	-0.002	-0.003	0.001
	(0.498)	(0.852)	(0.469)	(0.886)	(0.457)	(0.442)	(0.480)	(0.559)	(0.872)	(0.794)	(0.877)	(0.871)
Δ *Firm size*	0.126**	0.135	0.127**	0.134	0.038	0.198	0.040	0.194	0.231***	0.097*	0.231***	0.092*
	(0.017)	(0.105)	(0.016)	(0.107)	(0.454)	(0.105)	(0.423)	(0.111)	(0.000)	(0.065)	(0.000)	(0.072)
Δ *Tangibility*	-0.279**	0.031	-0.278*	0.024	-0.152	0.316	-0.144	0.304	-0.148	-0.187	-0.144	-0.190
	(0.05)	(0.889)	(0.051)	(0.913)	(0.341)	(0.220)	(0.367)	(0.244)	(0.671)	(0.441)	(0.678)	(0.508)
Δ *Profitability*	-0.079	0.007	-0.076	0.006	-0.136	-0.265	-0.131	-0.268	-0.232*	-0.204**	-0.230*	-0.203***
	(0.543)	(0.976)	(0.560)	(0.981)	(0.298)	(0.176)	(0.319)	(0.177)	(0.056)	(0.012)	(0.057)	(0.010)
Constant	0.000	-0.012	0.000	-0.016**	0.002	-0.019	0.004	-0.015	-0.061***	-0.054***	-0.062***	-0.045**
	(0.964)	(0.127)	(0.984)	(0.037)	(0.832)	(0.167)	(0.712)	(0.317)	(0.000)	(0.001)	(0.000)	(0.015)
Within R^2	0.706	0.756	0.708	0.757	0.741	0.774	0.743	0.771	0.218	0.511	0.218	0.495
Between R^2	0.417	0.517	0.42	0.513	0.366	0.495	0.368	0.495	0.063	0.006	0.062	0.007
Obs.	1327	1071	1327	1071	843	680	843	680	484	391	484	391
Firms	377	340	377	340	320	286	320	286	262	230	262	230

Table 6.11 Net purchase dummies and pecking order preference

This table examines the effect of CEO/CFO net purchase dummies (i.e. *CEO_DUM* and *CFO_DUM* that are one if the net purchase ratio (NPR) of CEO and CFO are 1 and zero otherwise) on the pecking order preference by looking at the interaction between CEO/CFO net purchase dummies and financing deficit (*DEF*) in the Shyam-Sunder and Myers (1999) financing deficit regression framework. The dependent variable is net debt issues scaled by net assets. Panel A is based on the full sample, while Panel B and C focus on firm-years observations with financing deficit (i.e. *DEF*>0) and financing surplus (i.e. *DEF*<0) respectively. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

	Dependent variable: net debt issues scaled by net assets					
	Panel A. Full sample (model 1-2)		*Panel B. DEF_BS>0 (model 3-4)*		*Panel C. DEF_BS<0 (model 5-6)*	
	(1)	(2)	(3)	(4)	(5)	(6)
DEF	0.579***	0.705***	0.584***	0.697***	0.257**	0.236
	(0.000)	(0.000)	(0.000)	(0.000)	(0.034)	(0.439)
CEO_DUM	0.003		-0.001		-0.005	
	(0.680)		(0.905)		(0.677)	
CFO_DUM		0.003		0.004		-0.001
		(0.719)		(0.651)		(0.960)
*CEO_DUM*DEF*	0.022		0.076		-0.024	
	(0.691)		(0.131)		(0.863)	
*CFO_DUM*DEF*		**-0.091***		**-0.098***		0.170
		(0.064)		**(0.083)**		(0.579)
Δ *MB*	-0.006	-0.002	0.009	0.009	-0.002	-0.002
	(0.519)	(0.825)	(0.439)	(0.547)	(0.884)	(0.808)
Δ *Firm size*	0.127**	0.128	0.040	0.183	0.230***	0.096*
	(0.016)	(0.126)	(0.427)	(0.136)	(0.000)	(0.065)
Δ *Tangibility*	-0.275*	0.028	-0.146	0.320	-0.151	-0.190
	(0.054)	(0.900)	(0.362)	(0.224)	(0.668)	(0.449)
Δ *Profitability*	-0.081	0.017	-0.142	-0.248	-0.236*	-0.204**
	(0.528)	(0.941)	(0.280)	(0.207)	(0.053)	(0.011)
Constant	-0.001	-0.009	-0.001	-0.006	-0.060***	-0.051***
	(0.804)	(0.216)	(0.963)	(0.669)	(0.000)	(0.002)
Within R^2	0.706	0.757	0.74	0.772	0.219	0.505
Between R^2	0.415	0.52	0.362	0.503	0.067	0.006
Obs.	1327	1071	843	680	484	391
Firms	377	340	320	286	262	230

6.5.4 Further robustness tests

We conduct a battery of robustness checks to show that our main findings are robust to alternative model specifications, alternative measures and scaling of financing deficit (*DEF*) and exclusion of zero-leverage firms.

6.5.4.1 Alternative definitions of DEF using cash flow data

We use an alternative measure of *DEF* as a robustness check. The major empirical results are qualitatively similar when using cash flow data to construct financing deficit (*DEF*). In particular, tone dummies have negative and statistically significant impacts on the pecking order coefficient (see Panel A and B of Table 6.12). Industry-adjusted investment rates also have negative and highly significant effects on the pecking order coefficient (see Panel A and B of Table 6.13). These results are largely consistent with our main results in section 6.5.1-6.5.3 where the *DEF* is constructed using balance sheet data.

6.5.4.2 Alternative specification to distinguish between firms with positive and negative DEF

As an alternative way to test and compare the effects of managerial overconfidence on the pecking order coefficient of firms with positive and negative *DEF* respectively, we use the following modified Shyam-Sunder and Myers (1999) regression:

$$\Delta D_{it} = a + \beta_1 PDEF_{it} + \beta_2 NDEF_{it} + \beta_3 MO_{it} + \beta_4 MO_{it} * NDEF_{it} + \beta_5 MO_{it} * PDEF_{it} + B_6 \Delta \boldsymbol{X}_{it} + v_i + e_{it} \quad (6.6)$$

where, ΔD_{it} is net debt issues as a percentage of beginning-of-year net assets. $NDEF_{it}$ equals DEF_{it} if $DEF_{it} < 0$ and zero otherwise; $PDEF_{it}$ equals DEF_{it} if $DEF_{it} > 0$ and zero otherwise. MO_{it} is managerial overconfidence. The definitions of other variables in this equation are the same as in equation 6.5. In this alternative specification, the pecking order coefficients are not only heterogeneous but also asymmetric.

We find that both *TONE* (see Panel A in Table 6.14) and industry-adjusted investment rate (see Panel B in Table 6.14) have negative and significant effects on the coefficient of *PDEF*, which confirms our earlier finding that tone has negative and significant

impacts on the coefficient of *DEF* especially in the subsample with positive *DEF*. On the other hand, both *TONE* and *TONE_RES* (see Panel A in Table 6.14) have positive and significant effects on the coefficient of *NDEF*, suggesting that overconfidence leads to a preference for equity over debt repurchase. Similar to our earlier findings, the effects of net purchase of CEO and CFO (see Panel C in Table 6.14) are also mixed: CEO net purchase has a positive and significant effect on the coefficient of *PDEF*, while CFO net purchase has a negative and significant effect on the coefficient of *NDEF*. In brief, two alternative specifications (i.e. equation 6.5 and 6.6) provide largely consistent results.

6.5.4.3 Scaling of the DEF

Although not required by the pecking order theory, the purpose of scaling is to control for the differences in firm size (Frank and Goyal, 2003). Furthermore, Frank and Goyal (2003) point out that the coefficient estimates can be highly sensitive to scaling if the denominator is correlated with some variables in the regression. We normalize the *DEF* by two alternative denominators including total assets and sales. The results are not sensitive to scaling.

6.5.4.4 Exclusion of zero-leverage firms

As a robustness check, we exclude from our analysis those firm-years with zero leverage[130]. The reason is that standard capital structure theories (e.g. trade-off theory, pecking order theory and market timing theory) are almost silent on the zero-leverage puzzle that some firms do not use any debt financing. Given that the main purpose of this study is to test pecking order preference, we exclude zero-leverage observations from our tests and the empirical results are qualitatively similar.

[130] Over 14 percent of the observations (i.e. 326 out of 2283 observations) have zero leverage in our sample.

Table 6.12 Alternative definition of financing deficit (DEF) using cash flow data: the effects of tone

This table examines the effect of optimistic tone dummies (i.e. *TONE_DUM* and *TONE_RES_DUM* that are one if tone index and orthogonalized tone index are above their median respectively and zero otherwise) on the pecking order preference by looking at the interaction between tone dummies and financing deficit (*DEF*) in the Shyam-Sunder and Myers (1999) financing deficit regression framework. The dependent variable is net debt issues scaled by net assets. Panel A is based on the full sample, while Panel B and C focus on firm-years observations with financing deficit (i.e. *DEF*>0) and financing surplus (i.e. *DEF*<0) respectively. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

	Dependent variable: net debt issues scaled by net assets					
	Panel A. Full sample (model 1-2)		*Panel B. DEF_CF>0 (model 3-4)*		*Panel C. DEF_CF<0 (model 5-6)*	
	(1)	(2)	(3)	(4)	(5)	(6)
DEF	0.813***	0.748***	0.812***	0.709***	0.487**	0.296
	(0.000)	(0.000)	(0.000)	(0.000)	(0.011)	(0.318)
TONE_DUM	0.043***		0.075***		0.021	
	(0.006)		(0.009)		(0.334)	
TONE_RES_DUM		0.042***		0.068**		0.044
		(0.006)		(0.011)		(0.103)
*TONE_DUM*DEF*	**-0.234*** **		**-0.329*** **		-0.267	
	(0.004)		**(0.001)**		(0.332)	
*TONE_RES_DUM*DEF*		**-0.145***		**-0.191***		0.088
		(0.087)		**(0.072)**		(0.770)
Δ *MB*	-0.036***	-0.034***	-0.032**	-0.030*	-0.029	-0.024
	(0.003)	(0.005)	(0.047)	(0.063)	(0.101)	(0.161)
Δ *Firm size*	0.301***	0.311***	0.313***	0.331***	0.450***	0.457***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.003)
Δ *Tangibility*	-0.185	-0.182	-0.222	-0.209	0.049	0.049
	(0.322)	(0.334)	(0.386)	(0.427)	(0.880)	(0.880)
Δ *Profitability*	-0.389***	-0.398***	-0.529***	-0.571***	-0.349***	-0.346***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.005)	(0.005)
Constant	0.008	0.010	-0.009	-0.001	0.002	-0.009
	(0.386)	(0.242)	(0.682)	(0.947)	(0.915)	(0.708)
Within R^2	0.384	0.379	0.370	0.356	0.16	0.157
Between R^2	0.175	0.189	0.240	0.272	0.137	0.134
Obs.	2283	2283	1124	1124	1067	1067
Firms	459	459	392	392	375	375

Table 6.13 Alternative definition of financing deficit (DEF) using cash flow data: the effects of industry-adjusted investment rate

This table examines the effect of industry-adjusted investment rate (including *IAIR1_L4*, *IAIRD* and *IAIR2_L4*) on the pecking order preference by looking at the interaction between industry-adjusted investment rate and financing deficit (*DEF*) in the Shyam-Sunder and Myers (1999) financing deficit regression framework. The dependent variable is net debt issues scaled by net assets. Panel A is based on the full sample, while Panel B and C focus on firm-years observations with financing deficit (i.e. *DEF*>0) and financing surplus (i.e. *DEF*<0) respectively. All models are estimated using fixed effects within estimators. Robust standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, ** and * indicate that coefficient is significant at 1%, 5% and 10% levels, respectively.

	Dependent variable: net debt issues scaled by net assets								
	Panel A. Full sample (model 1-3)			*Panel B. DEF_CF>0 (model 4-6)*			*Panel C. DEF_CF<0 (model 7-9)*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEF	0.383***	0.393***	0.369***	0.271***	0.280***	0.258***	0.557***	0.558***	0.561***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IAIR1_L4	0.058***			0.053***			0.026*		
	(0.000)			(0.001)			(0.052)		
IAIRD		0.048***			0.062***			0.016	
		(0.000)			(0.000)			(0.163)	
IAIR2_L4			0.168***			0.144*			0.060
			(0.000)			(0.053)			(0.170)
*IAIR1_L4*DEF*	**-0.147*** **			**-0.095*** **			-0.027		
	(0.000)			**(0.000)**			(0.917)		
*IAIRD*DEF*		**-0.175*** **			**-0.126*** **			0.016	
		(0.000)			**(0.001)**			(0.927)	
*IAIR2_L4*DEF*			**-0.268*** **			**-0.163*** **			0.937
			(0.000)			**(0.003)**			(0.162)
Δ *MB*	-0.001	-0.001	0.001	0.001	0.002	0.003	-0.003	-0.003	-0.003
	(0.760)	(0.838)	(0.856)	(0.761)	(0.605)	(0.531)	(0.415)	(0.336)	(0.324)
Δ *Firm size*	0.026*	0.026**	0.016	0.040**	0.038**	0.027	-0.025	-0.020	-0.020
	(0.051)	(0.032)	(0.236)	(0.041)	(0.032)	(0.231)	(0.173)	(0.291)	(0.319)
Δ *Tangibility*	0.064	0.077	0.023	0.016	0.020	-0.033	0.048	0.063	0.072
	(0.377)	(0.306)	(0.762)	(0.885)	(0.853)	(0.751)	(0.442)	(0.280)	(0.219)
Δ *Profitability*	-0.151***	-0.144***	-0.151***	-0.147***	-0.138***	-0.143***	-0.011	-0.011	-0.011
	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)	(0.002)	(0.667)	(0.670)	(0.660)
Constant	-0.012***	-0.014***	-0.014***	0.018**	0.016*	0.019**	-0.010*	-0.010*	-0.010*
	(0.000)	(0.000)	(0.000)	(0.041)	(0.078)	(0.029)	(0.072)	(0.068)	(0.073)
Within R^2	0.471	0.466	0.460	0.327	0.328	0.315	0.332	0.330	0.332
Between R^2	0.213	0.216	0.209	0.264	0.257	0.251	0.400	0.396	0.387
Obs.	2283	2283	2283	1124	1124	1124	1067	1067	1067
Firms	459	459	459	392	392	392	375	375	375

Table 6.14 Alternative specification: PDEF vs. NDEF

This table presents fixed effect regressions with net debt issues as dependent variable. We use modified SSM (1999) financing deficit framework where managerial overconfidence and its interactions with positive and negative financing deficit (*PDEF* and *NDEF*) respectively are included to examine asymmetric pecking order behaviour. Financing deficit variables (including *PDEF* and *NDEF*) are measured using both aggregate cash flow (CF) and balance sheet (BS) data. Panel A, B and C present the effects of tone, industry-adjusted investment rate and net purchase of CEO and CFO on pecking order preference respectively. All the variables are defined in Appendix 6.A. Standard errors are adjusted for firm-level clustering. P-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Panel A. Tone and pecking order preference

Dependent variable: net debt issues scaled by net assets (model 1-4)

Variables	(1) CF	(2) BS	(3) CF	(4) BS
PDEF	0.285***	0.588***	0.302***	0.601***
	(0.000)	(0.000)	(0.000)	(0.000)
NDEF	0.843***	0.368***	0.817***	0.362***
	(0.000)	(0.000)	(0.000)	(0.000)
TONE	0.002	0.009**		
	(0.315)	(0.015)		
TONE_RES			0.007***	0.011***
			(0.001)	(0.004)
TONE×PDEF	0.016	-0.011		
	(0.275)	(0.363)		
TONE_RES×PDEF			-0.012	**-0.028****
			(0.418)	**(0.022)**
TONE×NDEF	**-0.059***	-0.020		
	(0.054)	(0.444)		
TONE_RES×NDEF			0.021	-0.041
			(0.561)	(0.176)
Δ *MB*	-0.001	-0.004	-0.001	-0.005
	(0.773)	(0.678)	(0.803)	(0.624)
Δ *Firm size*	0.023*	0.138***	0.022*	0.133***
	(0.054)	(0.000)	(0.076)	(0.000)
Δ *Tangibility*	0.045	0.064	0.038	0.067
	(0.525)	(0.598)	(0.587)	(0.566)
Δ *Profitability*	-0.132***	-0.308***	-0.132***	-0.293***
	(0.000)	(0.000)	(0.000)	(0.001)
Constant	0.012**	-0.019**	0.011**	-0.020**
	(0.015)	(0.025)	(0.032)	(0.018)
Within R^2	0.484	0.691	0.482	0.695
Between R^2	0.240	0.430	0.241	0.437
Obs.	2283	2283	2283	2283
Firms	459	459	459	459

Table 6.14 (Continued)

Panel B. Industry-adjusted investment rate and pecking order preference

Dependent variable: net debt issues scaled by net assets (model 1-6)

Variables	(1) CF	(2) BS	(3) CF	(4) BS	(5) CF	(6) BS
PDEF	0.337***	0.603***	0.323***	0.613***	0.345***	0.640***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
NDEF	0.792***	0.375***	0.809***	0.370***	0.791***	0.358***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
INVEST_1	0.051***	0.090***				
	(0.000)	(0.006)				
INVEST_2			0.153***	0.257***		
			(0.001)	(0.006)		
INVEST_D					0.048***	0.103***
					(0.000)	(0.000)
INVEST_1×PDEF	**-0.124*** **	-0.090				
	(0.000)	(0.132)				
INVEST_2×PDEF			**-0.234*** **	**-0.325** **		
			(0.000)	**(0.031)**		
INVEST_D ×PDEF					**-0.151*** **	**-0.200*** **
					(0.000)	**(0.006)**
INVEST_1×NDEF	-0.001	-0.088				
	(0.997)	(0.660)				
INVEST_2×NDEF			**1.423** **	-0.091		
			(0.014)	(0.789)		
INVEST_D ×NDEF					0.213	0.081
					(0.252)	(0.663)
Δ *MB*	-0.001	-0.003	0.001	-0.001	-0.001	-0.003
	(0.750)	(0.762)	(0.858)	(0.880)	(0.825)	(0.764)
Δ *Firm size*	0.025**	0.138***	0.017	0.131***	0.026**	0.146***
	(0.041)	(0.000)	(0.183)	(0.001)	(0.023)	(0.000)
Δ *Tangibility*	0.059	0.005	0.025	0.065	0.065	0.118
	(0.396)	(0.965)	(0.720)	(0.652)	(0.360)	(0.368)
Δ *Profitability*	-0.120***	-0.282***	-0.117***	-0.269***	-0.115***	-0.262***
	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)	(0.002)
Constant	0.006	-0.025***	0.006	-0.029***	0.004	-0.033***
	(0.224)	(0.004)	(0.218)	(0.000)	(0.398)	(0.000)
Within R^2	0.502	0.694	0.497	0.701	0.499	0.702
Between R^2	0.237	0.435	0.234	0.426	0.246	0.456
Obs.	2283	2283	2283	2283	2283	2283
Firms	459	459	459	459	459	459

Table 6.14 (Continued)

Panel C. Net purchase of CEO and CFO and pecking order preference

Dependent variable: net debt issues scaled by net assets (model 1-8)

Variables	(1) CF	(2) BS	(3) CF	(4) BS	(5) CF	(6) BS	(7) CF	(8) BS
PDEF	0.352***	0.644***	0.337***	0.630***	0.434***	0.720***	0.426***	0.709***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
NDEF	0.877***	0.338***	0.873***	0.333***	0.957***	0.490***	1.002***	0.644***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)
VA_CEO	-0.008	-0.010						
	(0.124)	(0.229)						
VOL_CEO			-0.010*	-0.011				
			(0.075)	(0.273)				
VA_CFO					0.002	-0.002		
					(0.753)	(0.855)		
VOL_CFO							0.000	-0.006
							(0.988)	(0.579)
VA_CEO×PDEF	0.057	0.046						
	(0.371)	(0.154)						
VOL_CEO×PDEF			0.077	**0.063***				
			(0.252)	**(0.073)**				
VA_CFO×PDEF					-0.045	-0.044		
					(0.499)	(0.410)		
VOL_CFO×PDEF							-0.027	-0.028
							(0.778)	(0.654)
VA_CEO×NDEF	0.011	-0.069						
	(0.872)	(0.443)						
VOL_CFO×NDEF			0.019	-0.053				
			(0.808)	(0.568)				
VA_CEO×NDEF					-0.195	-0.105		
					(0.134)	(0.549)		
VOL_CFO×NDEF							**-0.249***	**-0.274****
							(0.091)	**(0.032)**
Δ *MB*	-0.009*	-0.007	-0.010*	-0.007	-0.004	-0.002	-0.004	-0.002
	(0.062)	(0.480)	(0.051)	(0.467)	(0.473)	(0.859)	(0.439)	(0.865)
Δ *Firm size*	0.036**	0.101**	0.037**	0.103**	0.006	0.124	0.006	0.122
	(0.025)	(0.034)	(0.025)	(0.030)	(0.797)	(0.128)	(0.785)	(0.134)
Δ *Tangibility*	-0.130*	-0.146	-0.131*	-0.146	-0.125*	0.081	-0.130*	0.090
	(0.086)	(0.361)	(0.084)	(0.358)	(0.089)	(0.720)	(0.081)	(0.690)
Δ *Profitability*	-0.070*	-0.106	-0.068*	-0.101	-0.027	-0.024	-0.033	-0.026
	(0.063)	(0.370)	(0.073)	(0.395)	(0.641)	(0.906)	(0.584)	(0.898)
Constant	0.009	-0.029***	0.011	-0.027***	0.006	-0.031***	0.007	-0.025**
	(0.182)	(0.003)	(0.114)	(0.007)	(0.337)	(0.004)	(0.350)	(0.018)
Within R^2	0.582	0.728	0.585	0.729	0.550	0.766	0.549	0.768
Between R^2	0.223	0.415	0.227	0.415	0.135	0.511	0.130	0.498
Obs.	1327	1327	1327	1327	1071	1071	1071	1071
Firms	377	377	377	377	340	340	340	340

6.6 Conclusions

This study is motivated by contrasting theoretical predictions made by Heaton (2002) and Hackbarth (2008) that managerial overconfidence can be either positively or negatively related to the degree of pecking order preference. A closely related study by Malmendier, Tate and Yan (2011) provides empirical evidence that CEO overconfidence may lead to an enhanced pecking order preference. Our empirical strategies are not exactly the same as Malmendier, Tate and Yan (2011). In particular, we use modified Shyam-Sunder and Myers (1999) regression that distinguishes between firms with financing deficits and surpluses. In addition, we also extend prior work by developing and using time-varying measures of managerial overconfidence.

Our empirical findings are in contrast to Malmendier, Tate and Yan (2011) but supports Hackbarth's (2008) proposition that managerial overconfidence can lead to reverse pecking order preference. More specifically, we find that managerial overconfidence weakens the preference of firms with positive financing deficit for debt over equity financing. This new evidence is consistent with Hackbarth's (2008) model prediction that overconfident managers with "risk perception bias" (i.e. underestimation of the riskiness of earnings) prefer equity over debt financing because of the convexity of equity. Further support for this proposition (*hypothesis 1b*) is provided by showing that the overconfidence-induced reverse pecking order preference is more pronounced for firms with high earnings volatility. This finding suggests that "risk perception bias" is the underlying channel through which overconfidence weakens the pecking order preference. Interestingly, we further document that managerial overconfidence is more significantly associated with a reverse pecking order preference especially for small firms. This finding partly explains the pecking order puzzle (size anomaly): small firms exhibit weaker pecking order preference partly because overconfident managers in small firms appear to have a reverse pecking order preference.

CHAPTER 7

Empirical Study 3: Managerial Overconfidence and Corporate Debt Maturity Structure

Chapter 7. Empirical Study 3: Managerial Overconfidence and Corporate Debt Maturity Structure

7.1 Introduction

Recent finance literature examines the impact of 'managerial overconfidence' on firms' financing decisions.[131, 132] Various theoretical (e.g., Hackbarth, 2008; Malmendier *et al*. 2011) and empirical (e.g., Ben-David *et al*., 2013; Malmendier *et al*., 2011) studies argue that the degree of managerial overconfidence is positively linked to the amount of debt and to financial leverage. Building upon this literature, we propose and test the hypotheses that link managerial overconfidence to corporate debt maturity structure. Our study is related to recent literature that examines the link between managerial overconfidence and debt maturity in the US (Graham *et al*., 2013; Ben-David *et al*., 2013) and France (Landier and Thesmar, 2009). However, these studies rely on time-invariant survey-based measures of managerial overconfidence. In contrast, this study implements time-varying measures of overconfidence. Time-varying overconfidence measures allow us to make important contributions by testing the impact of changes of overconfidence on debt maturity. Our empirical evidence supports the hypothesis that managerial overconfidence is beneficial for the firm in terms of reducing the agency cost of debt. Our evidence complements the recent finding that managerial overconfidence can enhance firm innovation (Hirshleifer *et al*., 2012), while existing behavioural studies tend to focus on the adverse consequences of overconfidence.

The existing empirical literature on the determinants of corporate debt maturity primarily focuses on firm characteristics (e.g., firm size, market-to-book, leverage,

[131] Managerial overconfidence is also found to be relevant to firm investment (Malmendier and Tate, 2005), merger and acquisition (Malmendier and Tate, 2008), dividend policy (Burg, Scheinert and Streitz, 2012), management forecasts (Hribar and Yang, 2011), firm innovations (Galasso and Simcoe, 2011) and executive compensation (Keiber, 2005) and turnover (Campbell *et al*., 2011).

[132] The managerial overconfidence literature builds upon one of the most robust findings in the psychological studies that people tend to be overconfident (Taylor and Brown, 1988). Overconfident people may overestimate their own abilities, the precision of their knowledge/information and the probabilities of good outcomes. In finance, overconfidence is often modeled as overestimation of mean future cash flow and underestimation of variance (e.g., Hackbarth, 2008). However, it should be noted that Roll (1986) highlighted the significance of managerial overconfidence (i.e. hubris) in mergers and acquisitions decisions over two decades ago.

liquidity, asset maturity, tax, abnormal earnings, earnings volatility) and debt and equity market conditions (e.g., term structure, interest rate volatility, stock price performance) (see, e.g., Barclays and Smith, 1995; Stohs and Mauer, 1994; Johnson, 2003; Barclay *et al*., 2003; Antoniou *et al*., 2006; Fan *et al*., 2012). To date, very little empirical evidence exists on the impact of various managerial traits (e.g., managerial overconfidence) on debt maturity structure. Such empirical evidence is relevant for academics and practitioners in finance, because it is important to know whether a particular managerial trait could affect financial decision making and whether this has a positive or negative effect.

Hypothetically, managerial overconfidence is associated with either a positive effect (e.g. reducing agency cost of debt) or biased beliefs (e.g. biased risk perceptions) and therefore can have a either positive or negative effect on debt maturity. A few indirect[133] empirical studies find mixed results. Ben-David *et al*. (2013) find that survey-based CFO overconfidence has a positive effect on debt maturity. Li (2010a) empirically examines the effect of self-attribution bias (SAB) (Hilary and Hsu, 2011)[134], regarded as a dynamic counterpart of overconfidence (Hirshleifer, 2001) or "endogenous/acquired overconfidence"[135], on firms' financial decisions. He documents that self-attribution bias also has a positive effect on debt maturity. However, no formal hypothesis regarding the positive overconfidence-debt maturity relationship has been developed. Based on Hackbarth's (2009) behavioural agency model of corporate borrowing, we articulate that managerial overconfidence can mitigate agency cost especially associated with long-term debt and therefore has a positive effect on debt maturity.

In contrast, some behavioural financing models and evidence suggest that managerial overconfidence can be negatively related to debt maturity. Landier and Thesmar's (2009)

[133] "Indirect" means that the primary purpose of their studies (e.g. Ben-David *et al*., 2013; Graham *et al*., 2013) is not to examine the determinants of debt maturity structure. Put differently, their studies are not dedicated to the test of debt maturity determinants. Consequently, no formal hypotheses regarding the overconfidence-debt maturity relationship have been developed. Empirically, their control variables (i.e. standard determinants of debt maturity) are limited, which may lead to omitted variable bias.

[134] The effect of the SAB has been empirically examined in the context of CEO turnover (Kim, 2011), managerial earnings forecast (Hilary and Hsu, 2011) and merger and acquisitions (Billett and Qian, 2008).

[135] Hilary and Hsu (2011) use "endogenous overconfidence" to describe the dynamic self-attribution-induced overconfidence.

model shows that short-term debt is optimal for optimistic entrepreneurs. This prediction is supported by their empirical analysis based on surveys of French entrepreneurs. In addition, overconfident managers who are subject to "risk perception bias" (Hackbarth, 2008) may underestimate the liquidity risk associated with short-term debt and consequently use more short-term debt. Graham *et al*. (2013) find that survey-based CEO overconfidence has a negative effect on debt maturity. In sum, existing studies use survey-based measures of managerial overconfidence but find mixed results. To test contrasting theoretical arguments, the effect of managerial overconfidence on debt maturity is an empirical question that needs to be further investigated using appropriate measures of overconfidence.

Apart from proposing the positive effect of overconfidence on debt maturity from an agency perspective, our contributions also arise from using two time-varying words-based measures and one action-based measure of managerial overconfidence. First, we develop two types of words-based overconfidence measures based on computational linguistic analysis of Chairman's Statement in the UK annual reports. In particular, we use first person pronouns, regarded as "linguistic biomarkers of hubris" in a recent study on hubris syndrome (Garrard *et al*., 2014). The first person pronouns have also been used as a proxy for self-attribution bias (Li, 2010a). We also construct optimistic tone measures as another words-based proxy for overconfidence. To ensure the validity of tone measures, we form a tone index using principal component analysis (PCA). Our study is therefore the first empirical test of the impact of optimistic words in Chairman's Statement on debt maturity. Methodologically, our study is also the first attempt to gauge time-varying managerial overconfidence based on managerial words in the Chairman's Statement. Second, we use an action-based overconfidence measure based on how managers trade shares of their own firms.[136] Insider trading data allows us

[136] Malmendier and Tate (2005) propose two overconfidence measures that are based on stock option and press portrayal. First, although the stock option-based proxy has been widely used in many US studies, it might not be suitable for the UK. Kyriacou *et al*. (2010) point out that "UK executives' need to diversify is less pressing" because of the significant differences in the structure of executive remuneration and regulation. Therefore, this proxy may be especially weak for UK studies. Furthermore, Cao's (2009) evidence suggests that CEO option exercise is more related to mispricing and growth opportunity and thus is not a valid measure of CEO overconfidence. Second, the press-based proxy is subject to two major criticisms: (1) the press coverage might be biased,

to compare the influences of overconfidence of different directors (including Chairman, CEO and CFO) on debt maturity.

Our detailed empirical analysis support the positive effect of overconfidence hypothesis. Firstly, first person singular pronouns (*I*), has a positive and significant effect on debt maturity, while the positive effect of first person plural pronouns (*WE*) is significant only when *WE* is below its median. In addition, the net purchase ratios (NPR), as a proxy for overconfidence, of executive directors and especially CEOs are significantly and positively related to debt maturity. Second, using first difference estimator we find that the changes of *I* and optimistic tone also have significant and positive effects on the change of debt maturity. These results are consistent with the US evidence provided by Ben-David *et al*. (2013) and Li (2010a). However, this study is the first to document that time-variations in overconfidence have a positive effect on the change of debt maturity.

The remainder of this study proceeds as follows. Section 7.2 reviews the literature on the standard and behavioural determinants of debt maturity and develops hypotheses. Section 7.3 describes methodology and data. Section 7.4 discusses empirical results and section 7.5 concludes the paper.

7.2 Related Research and Hypotheses

7.2.1 Related research

Most of the previous empirical studies test two major types of standard determinants of debt maturity including firm characteristics and equity and debt market conditions[137]. More recent studies examine the managerial impact (e.g., stock ownership (Datta *et al*., 2005) and effect of executive compensation (Brockman *et al*., 2010)) on debt maturity. For a brief review of studies on the standard determinants of debt maturity, see Appendix 7.B. In behavioural finance, a few recent studies examine the role of managerial overconfidence. There are only one test using French survey data (Landier

---

and (2) certain terms used in the press may not have exactly the same meanings as in psychology (Gider and Hackbarth, 2010).

[137] For a brief review of the previous empirical debt maturity studies, please see Antoniou *et al*. (2006).

and Thesmar, 2009) and two indirect tests based on US survey data (Graham *et al*., 2013; Ben-David *et al*., 2013). However, they report differing signs for the relationship between overconfidence and debt maturity.

Two studies find managerial overconfidence is negatively related to debt maturity. Landier and Thesmar (2009) develop a model of financial contracting with optimists and their survey-based measure of optimism is found to be negatively related to debt maturity[138]. Also using a survey data approach, Graham *et al*. (2013) measure executive attitudes (mainly the U.S. based CEOs) including optimism and then relate them to acquisition and capital structure decisions. More specifically, they gauge optimism using well-established psychometric tests (i.e. Life Orientation Test-Revised (LOT-R) developed by Scheier and Carver (1994)). Consistent with the prediction of Landier and Thesmar's (2009) model, they find that highly optimistic CEOs are more likely to use short-term debt.

However, another US study finds a positive relationship between managerial overconfidence and debt maturity. Ben-David *et al*. (2013) test the impact of CFO overconfidence on corporate financial policies. Their measure of CFO overconfidence is constructed using over 6,500 quarterly stock market forecasts by US CFOs. Following a method widely adopted in laboratory experiments of overconfidence, the CFOs are asked to predict one- and ten-year stock market returns and the 10^{th} and 90^{th} percentiles of the market return distribution. The narrowness of individual probability distributions (i.e. imputed volatility[139]) of market returns is used as a proxy for each CFO's overconfidence. Their empirical results suggest that firms with overconfident CFOs use proportionally more long-term than short-term debt.

In brief, the above two US empirical studies indicate that CEO and CFO overconfidence may have opposite influences on debt maturity. The results for CEO and CFO

[138] Landier and Thesmar's (2009) empirical tests are based on the French data, while according to the French GAAP all leases are treated as operating lease. Therefore, the capitalized lease is not a concern. However, for the US and UK studies, capitalized lease may potentially drive the results. More discussions will be provided regarding this issue later.

[139] This is calculated as the difference between the 90^{th} and 10^{th} percentiles divided by the number of standard deviations within the 80% confidence interval (i.e. 2.65).

overconfidence may partly reflect general differences in their psychological traits, in particular, CEOs tend to be more optimistic than CFOs (Graham *et al*., 2013). Further, although CEOs often dominate capital structure decisions in some firms (Graham *et al*., 2013), the role of directors in debt maturity decisions may vary across companies. This study mitigates this problem by examining the role of different types of directors. In particular, we compare the effects of overconfidence of (1) the Chairman, CEO and CFO and (2) executive and non-executive directors.

Li (2010a) finds that the SAB of managers is positively related to debt maturity, consistent with Ben-David *et al*. (2013). However, this is also an indirect debt maturity study with limited control variables, which may suffer from omitted variable bias. A more important limitation is that the Management Discussion and Analysis (MD&A)[140] is heavily regulated and "subject to auditor's examination" (Li, 2010a) and consequently may not be a perfect source of narratives for the measurement of the SAB. This study uses an unaudited narrative (i.e. Chairman's Statement) to measure the SAB of Chairman.

7.2.2 Hypothesis development

This section reviews several behavioural financing models that shed light on the impact of managerial overconfidence on debt maturity decisions. In particular, we hypothesize that managerial overconfidence may decrease debt maturity from financial contracting, perceived undervaluation and risk perception perspectives but increase debt maturity from an agency cost of debt perspective.

7.2.2.1 Managerial overconfidence decreases debt maturity

a. Financial contracting perspective

Landier and Thesmar (2009) develop a financial contracting model that explains the relationship between entrepreneurial optimism and debt maturity. Their model shows a separating equilibrium in which short-term (long-term) debt is optimal for optimistic (realistic) entrepreneurs. Optimists prefer short-term debt for the following reason. In their model, a short-term debt contract allows the exchange of cash-flow rights in the bad states, in which case investors may impose "adaptation decisions" by choosing a

[140] Li's (2010) measure of SAB is based on the content analysis of the MD&A.

safer investment strategy. However, from the perspective of optimistic entrepreneurs, the bad state that leads to the exchange of cash-flow rights will be very unlikely. Most importantly, the optimistic entrepreneurs believe that the short-term debt contract provides more upsides of the project at the expense of the bond holders. That is why firms with optimistic managers tend to use more short-term debt. Their model is supported by their empirical results. Therefore, according to Landier and Thesmar (2009), managerial overconfidence is expected to be negatively associated with debt maturity.

b. Perceived undervaluation (perceived information asymmetry)

Managerial overconfidence may also be related to debt maturity when there is a perceived undervaluation of debt with longer maturity. Heaton's (2002) model shows more pronounced pecking order behaviour of firms with overconfident managers. Overconfident managers believe that equity and debt issued by the firm are systematically undervalued by outside investors. It is also important to notice that more risky securities are more sensitive to probabilistic beliefs and therefore are more subject to perceived undervaluation. Similarly, Malmendier and Tate (2005a) argue that Heaton's Model provide a re-interpretation of the traditional Myers-Maljuf (1984) model with information asymmetry. In other words, the information cost of long-term debt might be perceived to be higher for overconfident managers. Empirically, Malmendier *et al*. (2011) provide evidence that managerial overconfidence is a potential driver of pecking order behaviour because it contributes to perceived information asymmetry.

Furthermore, Heaton's (2002) model implies that overconfident managers will always prefer to issue the security with the largest component of risk-free debt, in which case the cost of financing is minimized. To be specific, the risky debt is considered as a combination of risk-free debt and equity and thus the financing cost can be represented as a weighted average of cost of risk-free debt and equity. In the spirit of Heaton's (2002) model, considering that long-term debt tends to be perceived by overconfident managers to be undervalued and associated with higher information cost relative to short-term debt, we may expect that firms with overconfident managers prefer short-term debt to the informationally disadvantaged long-term debt. Thus, from this

perspective, managerial overconfidence is expected to be negatively related to debt maturity.

c. Risk perception bias

The risk perception argument posits that overconfident managers may underestimate the liquidity risk associated with short-term debt and therefore tend to use more short-term debt. In Hackbarth's (2008) model, overconfidence managers may be subject to risk perception bias, meaning that they may underestimate the risk associated with future earnings. More specifically, overconfident managers underestimate the likelihood of financial distress because of risk perception bias. Therefore, in the light of trade-off theory, managerial overconfidence is positively related to debt issue. This prediction is supported by Ben-David *et al.*'s (2013) empirical finding that managerial overconfidence is positively related to the leverage ratio.

Regarding debt maturity decisions, Jun and Jen (2003) construct a trade-off model of debt maturity structure. Their model suggests that firms' debt maturity decision is based on the trade-off between the costs and benefits associated with short-term debt. In particular, short-term debt is less expensive but has higher refinancing risk. However, in the presence of the risk perception bias in Hackbarth's (2008) model, we may argue that overconfident managers may overestimate their firms' ability to repay the short-term debt and also underestimate the liquidity or refinancing risk associated with short-term debt. In this case, overconfident managers have more incentive to pursue the cost advantage of short-term debt. Thus, it is expected that managerial overconfidence, especially the risk perception bias, is also negatively associated with debt maturity.

To sum up, consistent with Landier and Thesmar's (2009) financial contracting model which suggests that short-term debt is optimal for overconfident managers, two behavioural capital structure models by Heaton (2002) and Hackbarth (2008) also imply that overconfident managers are more likely to use short-term debt due to their biased perceptions of information costs and liquidity risk, respectively. In brief, from the demand side, the above three perspectives suggest that overconfident managers are more willing to use short-term debt. Therefore, we propose the following overconfidence hypothesis:

H1a: *managerial overconfidence is negatively associated with debt maturity, ceteris paribus.*

7.2.2.2 Managerial overconfidence increases debt maturity

a. Agency cost of debt hypothesis

Managerial overconfidence may also increase debt maturity if it reduces the agency cost of debt. Overconfidence can be particularly favourable from the long-term bond investors' perspective, which makes those firms with overconfident managers more easily raise long-term debt funds. This idea is consistent with Ben-David *et al.*'s (2007) argument that overconfident CFOs are able to convince lenders to provide long-term debt financing more effectively. More specifically, a particularly relevant type of favourable effect of overconfidence, as modelled by Hackbarth (2009), is related to the reduction of agency cost of debt (i.e. underinvestment problem).

In the light of Hackbarth's (2009)[141] behavioural model of corporate borrowing, we articulate that managerial overconfidence can be positively related to debt maturity. Hackbarth's (2009) model studies the agency conflicts between bondholders and shareholders in the presence of managerial overconfidence. His model shows that managerial overconfidence can play a positive role by mitigating the agency cost of debt (i.e. underinvestment problem), which in turn makes (especially long-term) debt less costly. In his model, he proposes the timing effect of overconfidence, meaning that overconfident managers tend to invest earlier and more than their rational counterparts. In a real-options framework, earlier investment can be viewed as an earlier exercise of the option to invest. The intuition is that overconfident managers, who have lower perceived uncertainty of new project, underestimate the value of the option to wait for more information about the project. Thus, the timing effect can reduce underinvestment problem. This prediction is in line with Goel and Thakor's (2008) proposition that a rational risk-averse CEO underinvests under the optimal compensation contract, while moderate CEO overconfidence mitigates this underinvestment problem which in turn

[141] As pointed out in Hackbarth (2009), this is the first behavioural model related to the conflict between bondholders and shareholders, while previous theories (Gervais, Heaton, and Odean, 2011; Heaton, 2002; Hackbarth, 2008) focus on the conflicts between managers and shareholders.

enhances firm value. Similarly, Gervais *et al*. (2011) also show that overconfidence makes managers less conservative and therefore take more risky but value-enhancing projects. As summarized by Gider and Hackbarth (2010), managerial overconfidence and/or optimism[142] "lead to more favourable corporate policies from the bondholders' point of view" (i.e. less suboptimal future investment decisions).

The major implication of Hackbarth's (2009) model is that managerial overconfidence can mitigate the underinvestment problem. This insight sheds light on the relationship between managerial overconfidence and debt maturity, considering that underinvestment problem tends to increase with debt maturity (e.g. Myers, 1977; Johnson, 2003). In particular, we articulate that managerial overconfidence will make long-term debt less costly and thus increase debt maturity. In other words, in the light of Hackbarth's (2009) model, firms with overconfident managers less suffer from underinvestment problem and are therefore able to use more long-term debt at a lower cost than firms with rational managers.[143]

Put differently, managerial overconfidence provides an alternative solution to the underinvestment problem and therefore can increase debt maturity. In the traditional finance literature, Barnea *et al*. (1980) rationalize debt maturity structure as a mechanism to solve agency costs associated with Myers's (1977) underinvestment/debt overhang problem. More specifically, shortening debt maturity is regarded as a standard way to reduce the conflict between bondholders and shareholders over the exercise of growth options (Myers, 1977). This conflict becomes more severe especially for firms

[142] Both managerial optimism and overconfidence lead to more favourable corporate policies from the bondholders' point of view, that is, the timing effect that alleviates the conflicts between bondholders and shareholders.

[143] It is recognized that underinvestment problem is a major concern of long-term debt holders. If long-term debt investors know which firms have overconfident managers and believe that overconfidence can mitigate underinvestment problem, those long-term debt investors will lend money to overconfident managers but not rational ones. This means that all the long-term debt financing in the market will be allocated to firms with overconfident managers. As a result, the debt maturity ratio of firms with rational managers is zero, while that of firms with overconfident managers must be above zero. In this extreme example, overconfidence leads to higher debt maturity.

with greater investment opportunities.[144] By using short-term debt, this conflict may largely disappear if the maturity of debt is so short that it matures before the investment options are to be exercised. However, from a behavioural agency perspective, Hackbarth's (2009) model implies that firms with overconfident managers are subject to lower agency cost of debt (especially long-term debt), meaning that those firms have less need to shorten debt maturity.

On the other hand, overconfidence is associated with higher level of agent's effort (Larwood and Whittaker, 1977; Gervais *et al*., 2011). Higher effort level associated with overconfidence will improve firm performance and reduce default risk on debt and thus makes overconfident managers more attractive to firms relative to their rational counterparts (Gervais *et al*., 2011). This additional favourable effect of overconfidence also makes investors more willing to provide long-term debt financing to firms with overconfident managers because of reduced default risk. Taken together, managerial overconfidence can not only reduce the agency cost of (especially long-term) debt but also reduce the default risk of long-term debt by increasing manager's effort.[145] Therefore, the positive effect of managerial overconfidence hypothesis can be stated as follows:

[144] Consistent with this argument, our subsequent subsample analysis shows that the positive overconfident-debt maturity is more significant for firms with more growth opportunities.

[145] Managerial overconfidence is also associated with other positive effects. In particular, overconfidence can be favourable for the firms on the following three aspects. First, overconfidence may mitigate moral hazard problem (Keiber, 2005). This is possible because, as suggested by Larwood and Whittaker (1977), overconfidence may lead to higher level of agent's effort. Second, Goel and Thakor (2008) show that a certain level of overconfidence counteracts managers' risk aversion and hence make them invest in more risky but value-enhancing projects. Third, overconfidence can also be productive for the whole organization. Gervais and Goldstein (2004) argue that overconfident agents may overestimate their own marginal productivity and therefore work harder, which in turn makes other team members work harder as well. In a similar vein, according to Rosenthal and Pittinsky (2006), narcissistic managers are able to infuse their employees with self-confidence and enthusiasm. Therefore, managerial narcissism may enhance the perceived success of the firm, especially from outside stakeholders' perspective (Bollaert and Petit, 2010). In brief, from the supply side, positive effect of overconfidence suggests that investors may be more willing to provide long-term financing. Therefore, managerial overconfidence can be positively related to debt maturity.

H1b: *from an agency perspective, managerial overconfidence is positively associated with debt maturity, ceteris paribus.*

7.2.2.3 Managerial duty hypothesis: CEO versus CFO

The discussion in this section is motivated by the fact that CEO and CFO have different core duties (Malmendier and Zheng, 2012). Most existing behavioural corporate finance studies focus on unbiased beliefs by CEOs.[146] This is because CEO is often considered as the principal corporate decision maker (Graham *et al*., 2013). On the other hand, Ben-David, Graham, and Harvey (2013) document that CFO's biased beliefs also have significant influence on various corporate policies. However, as argued by Malmendier and Zheng (2012), some firm decisions are under the control of a manager but are not that manager's core duties. Therefore, personal traits of the CEO and CFO are likely to have different impacts on different corporate decisions. However, these studies construct overconfidence measures in a different manner, which makes it difficult to compare CEO and CFO effects across studies.

To facilitate the comparability of CEO and CFO effects, several recent empirical studies examine the influences of both CEO and CFO on corporate polices using same measures of managerial traits. Chava and Purnanandam (2010) compare the influences of the risk-taking incentives of CEO and CFO on corporate polices. They document that CEO risk-preferences are more related to capital structure and cash holdings, while CFO risk-preferences have stronger impacts on debt maturity. Malmendier and Zheng (2012) compare the roles of CEO and CFO overconfidence. They find that only CEO overconfidence has significant impacts on non-financing decisions including investment, mergers and acquisitions and R&D, while CFO overconfidence has a stronger influence on some financing decisions (i.e. debt and equity issuance). However, they do not examine the debt maturity decision. This study fills this gap by developing a hypothesis on the different impacts of CEO and CFO overconfidence on the debt maturity decision, namely managerial duty hypothesis.

[146] Existing evidences show that CEO overconfidence has significance impacts on a wide range of corporate financial decisions including investment (Malmendier and Tate, 2005), mergers and acquisitions (Malmendier and Tate, 2008), capital structure (Malmendier, Tate and Yan, 2011) and debt maturity (Graham, Harvey and Puri, 2013).

Next, we develop this managerial duty hypothesis based on (1) the duties of CEO and CFO as suggested by previous studies on managerial effects and (2) the underlying mechanism of the positive overconfidence-debt relationship (i.e. Hackbarth's (2009) timing effect). The above studies on managerial effects seem to suggest that CEO, as key corporate decision-maker, has a strong effect on financing and especially investment decisions. On the other hand, those studies also suggest that CFO has a strong influence on financing and especially debt maturity decisions. Therefore, it is difficult to argue whether CEO or CFO has a stronger impact on debt maturity decision, because existing evidence seems to suggest that neither of them dominate financing decisions. However, recall our hypothesis 1b (***H1b***), the positive overconfidence-debt maturity relationship is driven by overconfident manager's earlier exercise of investment options. From this behavioural agency perspective, CEO, who often dominant investment decisions, is expected to play a more significant role in increasing debt maturity. Therefore, considering that the CEO dominates investment decisions which is the key channel through with managerial overconfidence can have a positive effect on debt maturity (i.e. Hackbarth's (2009) timing effect), we form the managerial duty hypothesis as follows:

> ***H2:*** *CEO overconfidence has a more significant and positive effect on debt maturity relative to that of the CFO.*

7.3 The Methodology and Data

7.3.1 The empirical model

Following the vast US literature (e.g., Barclay and Smith, 1995; Stohs and Mauer, 1996), we use the following empirical model:

$$DM_{it} = \beta_0 + \sum_{k=1} \beta_k X_{k,it} + \upsilon_i + \varepsilon_{it} \quad (7.1)$$

where, DM_{it} is a measure of the debt maturity of firm i in year t. X is the vector of explanatory variables. υ_i represents time-invariant unobservable firm-specific effects. ε_{it} is the error term.

Our debt maturity measure (DM) is the long-term debt ratio, which is calculated as the ratio of debt matures in more than one year to total debt. Previous studies also use debt matures in over three and five years as a measure of long-term debt.[147] Fortunately, existing empirical results do not seem to be particularly sensitive to the choice of various measures of debt maturity. However, as mentioned in Antoniou *et al*. (2006), different accounting treatments and the potential creative accounting problems make the measurement of debt maturity difficult.[148]

We choose our control variables based on previous debt maturity studies[149]. Major standard theories of debt maturity are related to agency cost, liquidity risk and signalling, maturity matching and tax (see Appendix 7.C). Key variables that represent different theories and their predicted signs are outlined as follows[150]: market-to-book (-) measuring growth opportunity, asset maturity (+) controlling for maturity matching, size (+) measuring liquidity risk, liquidity (+) measuring liquidity risk, earnings volatility (-) measuring liquidity risk, leverage (+) measuring liquidity risk, abnormal earnings (-) measuring firm quality, tax (+) accounting for tax hypothesis, stock price performance (+) accounting for market timing. All these variables are defined in Appendix 7.A.

7.3.2 Measurement of managerial overconfidence

7.3.3.1 Words-based measure of managerial overconfidence

We construct two words-based measures of overconfidence based on a computational linguistic analysis of UK Chairman's Statement. Linguistic analysis of financial

[147] Early UK debt maturity studies (e.g., Ozkan, 2000) use the ratio of debt that matures in over five years to total debt as the dependent variable. Unfortunately, the following data items, including debt due in 2-5years (WC18283), 6-10 years (WC18284) and over 10 years (WC18285), become unavailable in the *Worldscope* database after 2004.

[148] For example, some firms may treat the recurrent component of short-term debt as long-term debt. In terms of creative accounting, Gramlich *et al*. (2001) document that firms classify short-term obligations to long-term debt and subsequently reclassify that debt with the purpose of smoothing the reported measure of liquidity.

[149] For a review of standard debt maturity hypotheses, see Stohs and Mauer (1996) and Antoniou *et al*. (2006).

[150] It is true, however, that some variables can be explained by multiple theoretical perspectives and may even have opposite predicted signs. For a summary of the standard debt maturity determinants and their predicted signs, see Table 1 in Antoniou *et al*. (2006).

narratives is becoming increasingly widely used.[151] Recent accounting and finance studies use several content analysis softwares (e.g., Diction, LIWC and General Inquirer) to analyse various language dimensions of different narratives[152] (e.g., personal pronouns, optimistic vs. pessimistic, forward-looking).

a. First person pronouns

Our first words-based overconfidence measure is related to first person pronouns. Recent study on the hubris syndrome (Garrard *et al*., 2014) considers first person pronouns as "linguistic biomarkers of hubris". In addition, previous accounting (Hyland, 1998; Clatworthy and Jones, 2006) research suggests that the presence (absence) of first person pronouns may indicate the messengers' intention to internalise (distance themselves from) good (bad) performance or news. Li (2010a) proposes a measure of self-attribution bias based on the content analysis of MD&A by LIWC software. In particular, he uses the ratio of first person pronouns to second- and third-person pronouns in the MD&A as a proxy for self-attribution bias.[153] Clatworthy and Jones (2006) point out that the potential for self-attribution bias, as measured by first person pronouns, is enhanced by the unaudited nature of the Chairman's Statement. Therefore, the UK Chairman's Statement is more suitable than the US MD&A for capturing managerial biased beliefs.[154] In brief, first person pronouns can be regarded as proxies for dynamic self-attribution-induced overconfidence. Following Li (2010a), we use

[151] This is partly because of the development of content analysis software and the availability of digital financial narratives.

[152] Various texts analysed in the finance and accounting literature include MD&A (Kothari *et al*., 2009; Li, 2010a), CEO interviews (Kim, 2013) and earnings announcement (Rogers *et al*., 2009). For a more comprehensive summary of textual analysis studies, see Appendix A2 in Li (2010b).

[153] Li (2010a) uses the percentage of first person pronouns as an alternative proxy for the SAB and finds similar results.

[154] One may ask why our linguistic analysis only focuses on Chairman's Statement, given that other narratives, e.g., CEO review, financial review, business review, operational review, might also be available in the annual report. It would be desirable to capture the overconfidence of CEO and CFO for the purpose of our study. However, the problem is that those reviews are relatively less standard, meaning that (a) not every firm provides statements made by CEO and CFO separately and (b) the structure and content of their statements vary greatly from firm to firm. Another type of narrative that is available for all the firms is Directors' Report. However, it is regulated under the Companies Act 1985 and 2006 and therefore is not perfectly suitable for our analysis of overconfidence.

LIWC software to measure the proportion of first person pronouns (FPP_LIWC_{it}) in the Chairman's Statement as our first words-based overconfidence measure:

$$FPP\_LIWC_{it} = \frac{Number\ of\ FPP_{it}}{Total\ number\ of\ words_{it}} \times 100 \tag{7.2}$$

where, FPP_{it} represents either first person singular pronouns (I) (e.g., I, me, mine) or first person plural pronouns (WE) (e.g., we, us, our) as defined by LIWC.

The reason why we test the effects of *I* and WE separately is that previous empirical studies use the sum of *I* and *WE* and the ratio of *I* to *WE* as proxies for self-attribution bias (Li, 2010a) and narcissism[155] (Chatterjee and Hambrick, 2007) respectively, both of which contribute to managerial overconfidence. Based on the above two operational definitions, the variable *I* is positively related to both constructs, however, variable *WE* is positively related to self-attribution bias but negatively related to narcissism. In brief, the relationship between *WE* and managerial overconfidence might be ambiguous. Therefore, the results for the variable *WE* are expected to be more mixed given its differing relationship to the components of managerial overconfidence.[156]

b. Optimistic tone

Following chapter 5, we form a composite index of optimistic tone of Chairman's Statement using principal component analysis. We define $Tone\ Index_{it}$ as the first principal components of the correlation matrix of six raw tone measures.[157]

[155] A narcissistic personality is considered as a contributor to hubris (i.e. exaggerated self-confidence) (Hayward and Hambrick, 1997; Chatterjee and Hambrick, 2007). More specifically, narcissism is associated with "relative optimism and confidence about positive outcomes" (Chatterjee and Hambrick, 2007).

[156] We find that neither the first person pronouns (i.e. the sum of *I* and *WE*) nor the ratio of *I* to *WE* is statistically significantly related to debt maturity.

[157] The first component, with an eigenvalue of 2.59, explains 43.2 percent of our sample variance. The eigenvalue of second component is close to one.

$$Tone\ Index_{it} = \sum_{j=1}^{6} Loading_j * Tone\_X_{ijt}$$
$$= 0.489Emotion_{it} + 0.162Certain1_{it} + 0.452Optimism_{it}$$
$$+ 0.002Certain2_{it} + 0.481Tone\_H_{it} + 0.547Tone\_LM_{it} \quad (7.3)$$

where, $Tone\_X_{ijt}$ represents individual tone measure *j* of firm *i* in fiscal year *t*. $Loading_j$ is the loading for individual tone measure *j*. The loading for *Certain1* and *Certain2* is much lower compared with other tone measures. However, our empirical results are qualitatively similar when we exclude those two measures of certainty tone from the composite index.

In addition, similar to chapter 5, to address the concern that the raw tone might be contaminated by firm-specific variables[158], a composite index of the orthogonalized tone measures is constructed as follows. First, we regress each individual tone measure on standard determinants of debt maturity. Next, a composite index ($Tone\ Index_{it}^{\perp}$) is formed based on the first principal component of six residuals (i.e. $Tone\_X_{ijt}^{\perp} = \varepsilon_{ijt}$) from the above regressions.[159] In brief, our empirical analysis is based on raw tone index (*TONE*) and orthogonalized tone index (*TONE_RES*) and several individual tone measures including *Optimism* and *Tone_LM*.

7.3.3.2 Action-based measure of managerial overconfidence

a. Net purchase ratio

We construct the valued-based and volume-based net purchase ratio (NPR) using the value and volume of open market purchases and sales respectively as follows:

[158] In terms of the determinants of tone (e.g., current performance, growth opportunities, operating risks and complexity), Huang, Teoh and Zhang (2011) find that tone, as measured using Loughran and McDonald (2011) wordlist, is positively related to market-to-book and volatility of stock returns and negatively related to firm size, age and number of business segments. Our orthogonalized tone measure (*TONE_RES*) controls for all standard determinants of debt maturity.

[159] The first component explains 41.3 percent of the sample variance. The eigenvalues of first and second components are 2.48 and 1.16 respectively.

$$NPR_{it} = \frac{Buy_{it} - Sell_{it}}{Buy_{it} + Sell_{it}} \quad (7.4)$$

where, NPR_{it} is the value-based (or volume-based) NPR of directors of firm i in fiscal year t. Buy_{it} is the aggregate value (or volume) of insider purchases and $Sell_{it}$ is the aggregate value (or volume) of insider sales. Besides, the value-based and volume-based NPRs for individual directors including Chairman, CEO and CFO are also constructed. The NPR ranges from -1 to 1 and higher NPR indicates higher managerial overconfidence.

7.3.3 Estimation methods

One major limitation of previous corporate finance studies is that they often ignore the bounded nature of the dependent variables (e.g., leverage ratio[160], debt maturity ratio). Most standard estimation methods used in the debt maturity literature may generate biased results due to the fractionality (i.e. bounded between zero and one) of debt maturity ratios. Given that our debt maturity measures are fractional, we use a RE-Tobit estimator which is suitable for censored data (as discussed in section 4.2 of chapter 4). In addition, to facilitate comparison with the prior debt maturity literature, we also use pooled OLS, fixed effects and random effects estimators.

7.3.4 The sample

This study uses data from the following sources. The UK firms' financial data is obtained from *Thomson Worldscope* database. Insider trading data is sourced from *Hemmington Scott* database. Chairman's Statements are manually collected from the company annual reports which are downloaded either through *Northcote* website or directly from company websites. Our sample of unbalanced panel data is constructed as follows. The selection of sample period is guided by data availability. All financial and utility firms and firm observations with missing financial data are excluded. Firms in our sample must have at least three consecutive annual observations to examine the role of time-varying words-based overconfidence.

[160] Limited attention has been paid to the biases associated with the fractional dependent variable in corporate finance. Recent study by Elsas and Florysiak (2012) proposes a "doubly-censored Tobit" model to explicitly account for the censoring issue of leverage ratio.

To construct words-based measures of overconfidence, we require the digital version of the UK company annual reports, so that the Chairman's Statement can be readable by the content analysis software (i.e. LIWC 2007 and Diction 6).[161] In addition, to construct insider trading-based measure of overconfidence, only those firms with insider transactions (i.e. open market purchases and/or sales) for at least three consecutive years are selected. Besides the NPRs of executive and non-executive directors, we also construct the NPR of individual directors including Chairman, CEO and CFO. Those directors with joint positions (e.g., CEO duality) or without job title information are excluded from our sample.[162] All the NPRs are constructed according to firms' fiscal year end.

In terms of initial sample sizes and the impacts of various data filters, for financial and accounting information we obtain a list of UK public firms (3,318 firms) from *Worldscope*. A list of firms (2,024 firms) with insider trading data is from *Hemmington Scott*. We exclude financial and utility firms. We then merge the above two datasets using the SEDOL. The merged dataset includes 1,099 firms. Firms with less than three consecutive years' data are dropped and the sample size is reduced to 290 firms. Firms without machine-readable Chairman's Statements are also excluded. Firm-years with digital annual reports before the year 2000 are limited and are therefore excluded. To eliminate the effect of extreme values, all independent variables are winsorized at the 1st and 99th percentiles. The final sample comprises 192 firms and 865 firm-year observations over the period of 2000-2010.[163, 164, 165]

---

[161] In terms of the procedure of content analysis, we first extract Chairman's Statements from annual reports. Next, we detect transformation errors in the combined text file using the Spelling & Grammar function in Microsoft Word 2010. Finally, various types of errors (examples are available upon request) are corrected before the texts are inputted in the LIWC 2007.

[162] Due to data availability, the tests of the roles of the NPR of individual directors are based on a smaller sample.

[163] The *Hemmington Scott* database provides insider trading data from 1994. However, our sampling procedure ends up with very few observations between 1994 and 1999. That is why our sample period starts in 2000.

[164] In terms of initial sample sizes and the impacts of various data filters, for financial and accounting information we obtain a list of UK public firms (3,318 firms) from *Worldscope*. A list of firms (2,024 firms) with insider trading data is from *Hemmington Scott*. We exclude financial and utility firms. We then merge the above two datasets using the SEDOL codes and the merged dataset includes 1,099 firms. Firms with less

7.3.4.1 Descriptive statistics

Panel A in Table 7.1 shows descriptive statistics of our main dependent and independent variables. The mean of the debt maturity ratio (i.e. LTD/TD) is 0.664, which is somewhat higher than previous UK samples (e.g., 0.460 in Antoniou *et al*., 2006; 0.538 in Dang, 2011). In terms of behavioural variables, the means of first person singular (*I*) and plural (*WE*) pronouns are 0.432 (percent of total words) and 2.743 (percent of total words) respectively. The total percentage of first person pronouns is therefore 3.175. This figure is much higher than the percentage of first person pronouns in the MD&A (i.e. 1.27) in Li (2010a). This could be attributed to the fact that the MD&A is more heavily regulated and subject to auditor's examination (Li, 2010a) while the Chairman's Statement is unaudited. From this perspective, the Chairman's Statement seems to be a more suitable type of financial narrative from which to measure overconfidence. The mean of Henry's (2008) tone measure, *Tone_H (mean=0.705)*, is higher than that of Loughran and McDonald's (2011) tone measure, *Tone_LM (mean=0.545)*. This is because Loughran and McDonald's (2003) wordlist includes a more comprehensive list of negative words than that of Henry (2008). For the insider trading-based measure of overconfidence, on average, the NPRs of Chairman are the highest, while CEOs' NPRs are much lower compared with those of Chairman and CFO.[166]

---

than three consecutive years' data are dropped and the sample size is reduced to 290 firms. Firms without machine-readable Chairman's Statements are also excluded. Firm-years with digital annual reports before the year 2000 are limited and are therefore excluded. Our final sample has 192 firms.

[165] This sample is smaller compared with the sample used in the previous two empirical chapters for the following two main reasons: (1) this study has more independent variables (e.g. *Abnormal Earnings*, to construct which we need next year's earnings per share data) and (2) all the firms have at least three consecutive years' data.

[166] In unreported results, both the means of value-based and volume-based NPRs of non-executives are much higher than those of executives This might be attributed to the fact that executive directors have more stock options as part of their personal portfolios. Suppose both executive and non-executive directors in the same firm are overconfident and therefore believe their firms' stocks are undervalued. To do market timing (probably, mistiming), executive directors can delay the option exercise, while for non-executive directors open market purchases become the major (if not only) way to trade on the basis of their perceived mispricing.

7.3.4.2 Correlation analysis

Table 7.1 Panel B shows positive and statistically significant relationships between the debt maturity ratio and several independent variables including firm size, asset maturity, leverage and price performance, which is consistent with the theoretical predictions. The first person pronouns, i.e. *I* and *WE*, are positively correlated. Both *I* and *WE* are positively related to price performance.[167] Both *I* and *WE* are positively correlated with most tone measures. Most of the tone measures (except *Certain2*) are positively correlated with each other. For example, *Optimism* is positively correlated with all other tone measures. Regarding the correlations between various NPRs, we find that (1) value-based and volume-based NPRs of the same individual are highly correlated, (2) the correlation between the NPRs of CEO and CFO is also high and (3) the correlation between the NPRs of Chairman and those of CEO is relatively low, while the correlation between Chairman and CFO is even lower. These correlation coefficients suggest that Chairman's trading activities are far from fully aligned with CEO and especially CFO. Finally, correlations between explanatory variables are not high and therefore multicollinearity is not a major concern.

[167] Stock price is found to be interrelated with the presence of the self-attribution. Staw *et al*. (1983) document that good prior stock performance may lead to more enhancing attributions, followed by subsequent stock price increases.

Table 7.1 Summary statistics and correlation matrix

Panel A: Descriptive statistics

Variable	Obs.	Mean	Median	Std. Dev.	Min.	Max.
I	865	0.432	0.310	0.453	0.000	3.430
WE	865	2.743	2.730	1.738	0.000	8.400
Net emotion	865	0.731	0.749	0.166	0.069	1.000
Certain1	865	0.991	0.920	0.418	0.000	3.270
Optimism	865	53.334	53.140	2.141	41.080	72.420
Certain2	865	45.606	46.000	3.284	22.550	54.530
Tone_H	865	0.705	0.754	0.241	-1.000	1.000
Tone_LM	865	0.545	0.575	0.296	-1.000	1.000
TONE	865	-0.000	0.192	1.611	-6.560	5.947
VA_CH	448	0.592	1.000	0.778	-1.000	1.000
VA_CEO	445	0.456	1.000	0.836	-1.000	1.000
VA_CFO	407	0.547	1.000	0.795	-1.000	1.000
VOL_CH	448	0.642	1.000	0.709	-1.000	1.000
VOL_CEO	445	0.498	1.000	0.791	-1.000	1.000
VOL_CFO	407	0.603	1.000	0.733	-1.000	1.000
LTD/TD	865	0.664	0.758	0.300	0.000	1.000
Tax	865	0.211	0.266	0.391	-1.717	2.046
Abnormal earnings	865	0.048	0.011	0.323	-0.858	1.917
Firm size	865	12.148	12.125	1.821	8.446	17.132
Liquidity	865	1.484	1.285	0.931	0.376	6.063
M/B asset	865	1.525	1.323	0.738	0.553	4.691
Asset maturity	865	9.388	6.659	11.041	1.318	95.028
Earnings volatility	865	0.114	0.060	0.212	0.003	3.183
Leverage	865	0.208	0.196	0.144	0.002	0.620
Price performance	865	-0.034	0.059	0.563	-1.911	1.213

Table 7.1
Continued.

Panel B: Pairwise correlation matrix

Variable	1	2	3	4	5	6	7	8	9
1. I	1								
2. WE	0.104	1							
3. Net emotion	0.128	0.101	1						
4. Certain1	0.177	0.088	0.145	1					
5. Optimism	0.183	0.112	0.445	0.246	1				
6. Certain2	0.044	0.019	-0.044	0.127	0.063	1			
7. Tone_H	-0.021	0.057	0.458	0.047	0.372	-0.025	1		
8. Tone_LM	0.071	0.072	0.612	0.097	0.520	-0.022	0.670	1	
9. TONE	0.126	0.112	0.788	0.261	0.728	0.004	0.774	0.881	1
10. VA_CH	0.053	-0.053	-0.110	0.050	-0.093	-0.014	-0.064	-0.077	-0.100
11. VA_CEO	0.032	-0.052	-0.068	-0.071	-0.116	0.005	-0.133	-0.139	-0.147
12. VA_CFO	0.051	-0.056	-0.081	-0.001	-0.020	-0.083	-0.083	-0.127	-0.098
13. VOL_CH	0.089	-0.042	-0.097	0.063	-0.065	0.004	-0.065	-0.071	-0.085
14. VOL_CEO	0.029	-0.041	-0.041	-0.071	-0.119	-0.030	-0.124	-0.129	-0.134
15. VOL_CFO	0.054	-0.075	-0.069	0.008	-0.027	-0.089	-0.096	-0.126	-0.099
16. LTD/TD	-0.000	0.044	0.092	0.086	0.116	0.002	0.046	0.076	0.109
17. Tax	-0.043	0.005	0.070	-0.001	0.014	-0.048	-0.011	0.038	0.035
18. Abnormal earnings	0.031	-0.071	-0.096	-0.007	-0.052	0.023	-0.093	-0.113	-0.111
19. Firm size	0.039	0.141	0.107	0.222	0.117	0.038	-0.021	0.049	0.098
20. Liquidity	-0.039	-0.025	-0.098	-0.097	-0.056	0.035	0.020	-0.008	-0.052
21. M/B asset	0.006	0.032	0.172	0.057	0.182	0.025	0.283	0.235	0.273
22. Asset maturity	-0.008	0.000	0.033	0.096	0.019	-0.008	-0.070	-0.000	0.004
23. Earnings volatility	-0.071	-0.052	-0.096	-0.070	-0.032	-0.035	0.053	-0.023	-0.037
24. Leverage	0.007	0.040	-0.094	0.099	0.011	-0.004	-0.107	-0.086	-0.077
25. Price performance	0.037	0.059	0.232	0.019	0.168	-0.005	0.337	0.308	0.324

Variable	10	11	12	13	14	15	16	17
10. VA_CH	1							
11. VA_CEO	0.477	1						
12. VA_CFO	0.401	0.763	1					
13. VOL_CH	0.951	0.505	0.405	1				
14. VOL_CEO	0.498	0.958	0.758	0.527	1			
15. VOL_CFO	0.432	0.756	0.959	0.446	0.788	1		
16. LTD/TD	-0.035	-0.032	-0.043	-0.009	-0.009	-0.033	1	
17. Tax	-0.024	-0.077	-0.056	-0.027	-0.074	-0.049	-0.007	1
18. Abnormal earnings	0.025	0.114	0.0705	0.021	0.113	0.066	-0.051	-0.065
19. Firm size	-0.099	-0.214	-0.232	-0.076	-0.190	-0.212	0.291	0.149
20. Liquidity	-0.015	-0.024	0.025	-0.038	-0.044	0.004	0.113	-0.038
21. M/B asset	-0.229	-0.295	-0.226	-0.220	-0.311	-0.237	0.053	-0.010
22. Asset maturity	-0.092	-0.192	-0.222	-0.113	-0.105	-0.182	0.179	0.052
23. Earnings volatility	0.086	-0.006	0.112	0.084	-0.021	0.112	-0.015	-0.114
24. Leverage	0.004	0.016	-0.056	0.051	0.063	-0.038	0.199	0.003
25. Price performance	-0.140	-0.166	-0.154	-0.134	-0.157	-0.165	0.089	0.080

Variable	18	19	20	21	22	23	24	25
18. Abnormal earnings	1							
19. Firm size	-0.048	1						
20. Liquidity	-0.043	-0.161	1					
21. M/B asset	-0.065	0.055	0.277	1				
22. Asset maturity	-0.058	0.301	-0.061	0.004	1			
23. Earnings volatility	0.024	-0.187	0.040	0.047	-0.062	1		
24. Leverage	0.074	0.300	-0.307	-0.107	0.286	-0.056	1	
25. Price performance	-0.209	0.066	0.023	0.336	0.056	-0.038	-0.094	1

Notes:
Panel A presents the descriptive statistics of the main dependent and independent variables. Panel B shows Pearson correlation coefficients between all pairs of our main variables.

7.4 Empirical Results

We estimate fixed effects, random effects and RE-Tobit models. Several diagnostic tests are conducted to decide which estimator is more suitable for our data. First, we use Breusch-Pagan Lagrange Multiplier (LM) test to decide between random effects and pooled OLS. The null hypothesis of the LM test (i.e. no significant difference across firms) is rejected at 1% significance level in all specifications. This suggests that pooled OLS estimator is not valid for our data. Next, Hausman test is conducted to decide between random effects and fixed effects. The null hypothesis of Hausman test is that random effects model is more valid. In most of the specifications, Hausman test suggests that we should use fixed effects.

Furthermore, the likelihood ratio (LR) tests reject the null in all the specifications, suggesting that the RE-Tobit is more valid than the pooled Tobit. The RE-Tobit is estimated using Gauss-Hermite quadrature and the quadrature approximation may depend on the number of integration points. We find that our results are robust to quadrature sensitivity[168]. In brief, fixed effects and RE-Tobit seem to be the appropriate estimators in most of the specifications. Next, we discuss the statistical and economic significance of our explanatory variables.

7.4.1 The role of words-based managerial overconfidence: first person pronouns

Table 7.2 examines the impact of first person pronouns (*I* and *WE*), as proxies for managerial overconfidence, on debt maturity. The coefficient estimates on the first person singular pronouns (*I*) are positive and statistically significant (*p-value*=0.027) in fixed effects regressions. The economic significance of the variable *I* is also large. In particular, model 1 shows that a 1 percent increase in *I* will increase the debt maturity by 0.046 percent. In brief, the above evidence is consistent with the hypothesis that overconfidence has a positive effect on debt maturity (H1b). Results for the first person plural pronouns (*WE*) are more mixed. We find the coefficient estimate on *WE* is positive but statistically insignificant. The economic significance of the *WE* coefficient is also modest. The stronger results for *I* compared to *WE* likely reflects that *I* is

[168] We use the "quadchk" command in *STATA 12* to check whether the coefficients change substantially when using different numbers of integration points. We use 100 integration points (the default is 12) to make sure the relative difference is less than 0.01.

positively associated with narcissism but *WE* is negatively associated with narcissism (Chatterjee and Hambrick, 2007), which contributes to overconfidence[169].

Table 7.2 Words-based measures of overconfidence and debt maturity: the roles of first person pronouns

This table presents regressions of debt maturity measure on first person pronouns and control variables, as defined in Appendix 7.A. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using fixed effects (FE). p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Variable	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
I	0.046**					
	(0.027)					
WE		0.003				
		(0.686)				
Ln(I+1)			0.071*			
			(0.066)			
Ln(WE+1)				0.021		
				(0.386)		
I_NON-ZERO					0.051***	
					(0.004)	
WE_NON-ZERO						-0.002
						(0.786)
Tax	-0.007	-0.008	-0.008	-0.008	-0.010	-0.010
	(0.631)	(0.598)	(0.624)	(0.596)	(0.563)	(0.530)
Abnormal earning	-0.008	-0.005	-0.008	-0.005	0.012	0.001
	(0.745)	(0.846)	(0.771)	(0.853)	(0.732)	(0.971)
Firm size	0.058**	0.058**	0.059**	0.058**	0.057	0.058*
	(0.040)	(0.037)	(0.038)	(0.039)	(0.106)	(0.064)
Liquidity	0.144***	0.144***	0.144***	0.145***	0.139***	0.154***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
M/B asset	0.006	0.005	0.006	0.006	0.023	0.011
	(0.748)	(0.782)	(0.762)	(0.762)	(0.401)	(0.625)
Asset maturity	-0.000	-0.000	-0.001	-0.001	-0.001	-0.001
	(0.823)	(0.827)	(0.806)	(0.801)	(0.797)	(0.823)
Earnings volatility	0.094	0.092	0.094	0.092	0.074	0.087
	(0.170)	(0.176)	(0.169)	(0.178)	(0.252)	(0.222)
Leverage	0.353**	0.352**	0.349**	0.355**	0.394**	0.404**
	(0.018)	(0.020)	(0.020)	(0.018)	(0.017)	(0.013)
Price performance	0.030*	0.031*	0.031*	0.031*	0.009	0.027
	(0.068)	(0.058)	(0.066)	(0.059)	(0.612)	(0.114)
Constant	-0.358	-0.348	-0.369	-0.362	-0.380	-0.350
	(0.307)	(0.312)	(0.296)	(0.302)	(0.384)	(0.359)
Obs.	865	865	865	865	685	795
Firms	192	192	192	192	180	184
R^2 *(within)*	0.143	0.137	0.142	0.138	0.139	0.151

Next, by taking a closer look at the distribution of *I* and *WE*, we find that some firms do not use first person (especially singular) pronouns in their Chairman's Statement. Over 20% of *I* in our sample are zero. More importantly, those zero values of *I* tend to be

[169] We also find that neither the first person pronouns (i.e. the sum of *I* and *WE*) nor the ratio of *I* to *WE* is statistically significantly related to debt maturity.

consecutive, in which case there is no within-firm variation in the number of *I* used. Therefore, excluding firm-years with zero *I* from the sample will make the fixed effects estimator perform better. As expected, the positive coefficient on *I_NON-ZERO* is highly significant at 1% level (*p-value*=0.004) after excluding firm-years with zero *I*. In addition, around 8% of *WE* in our sample are zero. We also exclude those firm-years with zero *WE*. However, the relationship between *WE_NON-ZERO* and debt maturity is still insignificant. To conclude, the highly significant positive effect of *I_NON-ZERO* on debt maturity provides strong support for the hypothesis of positive overconfidence-debt maturity relationship (H1b).

To sum up, the positive and significant effects of *I* (model 1), Ln (*I+1)* (model 3) and *I_NON-ZERO* (model 5) on debt maturity support the prediction of the positive effect of overconfidence hypothesis (H1b). These findings are consistent with overconfidence being beneficial from long-term debt holders' perspective because overconfidence can ameliorate the agency cost of debt (Hackbarth, 2009). Thus, consistent with our hypothesis 1b overconfident managers have a longer debt maturity than realist managers.

7.4.2 The role of words-based managerial overconfidence: optimistic tone

Table 7.3 examines the impacts of various measures of the optimistic tone of the Chairman's Statement on debt maturity. Considering that the tone-debt maturity relationship might be potentially driven by unobserved time-invariant firm fixed effects, we present results from fixed effects estimators. Panel B shows that the coefficient estimates on all individual and composite tone measures are positive but statistically insignificant. However, in pooled OLS regressions (see Appendix 7.D), *OPTIMISM* and *TONE_LM* have positive and statistically highly significant impacts on debt maturity (*p-value*=0.004 and 0.028 respectively). In addition, the coefficients on two composite tone indices, *TONE* and *TONE_RES*, are also positive and statistically highly significant at the 1% level (*p-value*=0.002 and 0.001 respectively) without controlling for unobserved heterogeneity.

Table 7.3 Words-based measures of overconfidence and debt maturity: the roles of optimistic tone

This table presents regressions of debt maturity measure on various tone measures of Chairman's Statement and control variables, as defined in Appendix 7.A. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using fixed effects (FE). p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Variable	(1) FE	(2) FE	(3) FE	(4) FE
Optimism	0.003			
	(0.393)			
Tone_LM		0.021		
		(0.548)		
TONE			0.002	
			(0.708)	
TONE_RES				0.002
				(0.714)
Tax	-0.009	-0.009	-0.009	-0.009
	(0.605)	(0.588)	(0.599)	(0.597)
Abnormal earning	0.012	0.012	0.012	0.012
	(0.688)	(0.670)	(0.681)	(0.683)
Firm size	0.059**	0.059**	0.059**	0.059**
	(0.031)	(0.030)	(0.033)	(0.032)
Liquidity	0.146***	0.145***	0.145***	0.145***
	(0.000)	(0.000)	(0.000)	(0.000)
M/B asset	0.012	0.011	0.012	0.013
	(0.552)	(0.576)	(0.566)	(0.522)
Asset maturity	-0.001	-0.001	-0.001	-0.001
	(0.723)	(0.696)	(0.716)	(0.716)
Earnings volatility	0.071	0.072	0.072	0.072
	(0.229)	(0.218)	(0.223)	(0.223)
Leverage	0.358**	0.352**	0.352**	0.349**
	(0.028)	(0.030)	(0.031)	(0.031)
Price performance	0.020	0.020	0.020	0.022
	(0.211)	(0.236)	(0.223)	(0.181)
Constant	-0.560	-0.357	-0.342	-0.344
	(0.197)	(0.291)	(0.320)	(0.315)
Obs.	865	865	865	865
Firms	192	192	192	192
R^2 *(within)*	0.157	0.156	0.156	0.156

To summarise, the positive tone-debt maturity relationship is statistically highly significant in the OLS regressions but appears to be insignificant after controlling for firm fixed effects in the fixed effects regressions. This interesting observation indicates the existence of managerial fixed effects that may drive firm financial policies as documented in Bertrand and Schoar (2003). Furthermore, Davis *et al*. (2012) find that the tone of earnings conference calls is also influenced by managerial "style" (i.e. manager-specific factors such as gender and early career experiences). Taken together, the positive tone-debt maturity relationship seems to be driven by firm/managerial fixed effects. The implication of this observation is that it is important to control for firm fixed effects when examining the effect of tone on firm policies. (In our subsequent

analysis (see section 7.4.5), we examine the effects of changes of optimistic tone using first difference estimator which also controls for firm fixed effects.)

7.4.3 The role of NPRs of CEO, CFO and Chairman

This section is motivated by the fact that directors have different core duties (Malmendier and Zheng, 2012). Most existing studies focus on biased beliefs of CEOs.[170] This is because the CEO is often considered as the principle corporate decision maker (Graham *et al*., 2013). On the other hand, Ben-David, Graham, and Harvey (2013) document that CFO's biased beliefs also have significant influence on various corporate policies. Malmendier and Zheng's (2012) empirical analysis suggests that CEOs have the most influence upon investment decisions, while the CFO has a greater effect on equity issuance. If the positive overconfidence-debt maturity relationship is driven by reducing the agency cost of debt (i.e. underinvestment problem) then the overconfidence of the director who has greatest influence over investment decisions, the CEO, should play a more significant role in increasing debt maturity.

Table 7.4 reports the empirical results regarding the impact of NPRs of Chairman, CEO and CFO on debt maturity. The coefficients on both value-based and volume-based NPRs of CEO are positive and statistically significant (*p-value*=0.062 and 0.076 respectively). However, the NPRs of the CFO are insignificant. We also find that the NPRs of Chairman are insignificant; this is perhaps not surprising considering the fact that most UK Chairmen are non-executive directors. These results suggest that the Chairman's Statement in the annual reports does not only reflect Chairman's overconfident belief but also that of the senior management team, especially the CEO[171]; this interpretation is consistent with prior research (Clatworthy and Jones, 2003, 2006; Schleicher and Walker, 2010). The positive significant relationship found for the CEO (only) is consistent with the agency cost of debt hypothesis given that of all

[170] Existing evidences show that CEO overconfidence has significance impacts on a wide range of corporate financial decisions including investment (Malmendier and Tate, 2005), mergers and acquisitions (Malmendier and Tate, 2008), capital structure (Malmendier, Tate and Yan, 2011) and debt maturity (Graham, Harvey and Puri, 2013).

[171] In particular, results for CEO are positive (consistent with all words-based measures) and significant (consistent with some words-based measures); in contrast the results for CFO and Chairman do not even have the same sign as those for the words-based measures.

the directors, the CEO has the greatest influence upon investment policy (Malmendier and Zheng, 2012). In brief, the evidence based on CEO NPRs supports the hypothesis that overconfidence can have a positive effect on debt maturity (H1b).[172, 173]

However, one may argue that the insider trading activities may reflect directors' private information, meaning that insiders with positive private information tend to purchase more their own firm's shares and are reluctant to sell, which in turn makes the NPR close to one. This alternative interpretation is not consistent with our empirical results. Based on the signalling model, managers will signal the quality of their firms by issuing short-term debt (Flannery, 1986). In this case, managers with positive private information, as indicated by high NPR, should use more short-term debt. This prediction, from the signalling model, is contradicted by the observed positive and significant relation between the NPR and debt maturity for the CEO and the insignificant results for the CFO and Chairman. Therefore, we tentatively suggest our results based on NPRs are not driven by private information.

Another potential driver of the insider trading activities is hyperbolic discounting. According to Laibson (1997), hyperbolic discounting is characterised by "a relatively high discount rate over short horizons and a relatively low discount rate over long

[172] In unreported results we examined the NPRs of all the Executive directors. These results confirm a positive relationship between executive directors' overconfidence and debt maturity supporting hypothesis 1b. This suggests the executive directors have an important influence on the firm's financial decision making.

[173] Uncontrolled heterogeneity in the debt contract designs may also explain our observed positive relation between overconfidence and debt maturity. Debt contracts are highly complex with various features and provisions. However, this significant heterogeneity has often been ignored in the empirical capital structure literature. Much of the existing studies take the existence of debt security as given (Roberts and Sufi, 2009). A recent study by Burg, Scheinert and Streitz (2012) examines the impact of managerial overconfidence on the use of performance-sensitive debt (PSD). Under PSD contract, the interest payment depends on the future performance of the firm. This performance-pricing provision refers to a contracting feature that interest rates fluctuate with the measures of firm performance (e.g., accounting measures or debt ratings) (Armstrong, Guay and Weber, 2010). In particular, lower (higher) interest payments are associated with good (poor) performance. Overconfident managers overestimate the probability of good performance and hence prefer to use PSD to reduce financing costs. As expected, they find that overconfidence managers are more likely to use PSD over straight debt. It is likely that our measure of long-term debt also includes some debt with similar contract design as PSD. Therefore, this finding may provide a potential explanation for our empirical result.

horizons". The hyperbolic discounting might be particularly relevant to the debt maturity decisions. This is because our insider-trading based measure of managerial overconfidence, namely net purchase ratio (NPR), is likely to be driven by hyperbolic discounting rather than managerial overconfidence. The intuition is that hyperbolic managers discount future less and therefore believe that their own firms' shares are undervalued by the market, which in turn increases insider purchase of the shares. In addition, a hyperbolic manager tends to use a relatively high discount rate to estimate the present value of short-term bond but use a relatively low discount rate to estimate the present value of long-term bond. As a result of the different discount rates used to value bonds with different maturities, the hyperbolic manager tend to underestimate the value of short-term debt but overestimate the value of long-term debt. Therefore, the hyperbolic manager, as indicated by high NPR, is expected to prefer short-term debt to long-term debt, because they believe that short-term debt is overvalued by the market while long-term debt is undervalued by the market. In other words, if NPR is considered as a proxy for hyperbolic discounting, the NPR is expected to be negatively related to debt maturity. Nevertheless, the prediction is not consistent with our observation that NPR is positively related to debt maturity. Thus, the observed positive relation between managerial overconfidence and debt maturity seems unlikely to be driven by hyperbolic discounting.

Table 7.4 Action-based measures of overconfidence and debt maturity

This table presents regressions of debt maturity measures on the NPRs of Chairman, CEO and CFO and control variables, as defined in Appendix 7.A. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using fixed effects (FE). p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Variable	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
VA_CH	-0.016					
	(0.274)					
VA_CEO		0.032*				
		(0.062)				
VA_CFO			-0.015			
			(0.456)			
VOL_CH				-0.012		
				(0.505)		
VOL_CEO					0.037*	
					(0.076)	
VOL_CFO						-0.014
						(0.533)
Tax	-0.035	-0.014	-0.009	-0.035	-0.013	-0.009
	(0.199)	(0.556)	(0.666)	(0.202)	(0.563)	(0.657)
Abnormal earning	-0.030	-0.067	-0.067	-0.030	-0.068	-0.067
	(0.384)	(0.127)	(0.140)	(0.386)	(0.123)	(0.140)
Firm size	0.132***	0.065*	0.035	0.131***	0.063*	0.037
	(0.001)	(0.080)	(0.435)	(0.001)	(0.088)	(0.412)
Liquidity	0.157***	0.192***	0.185***	0.156***	0.193***	0.185***
	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)	(0.004)
M/B asset	0.029	-0.021	0.010	0.031	-0.020	0.011
	(0.332)	(0.593)	(0.756)	(0.303)	(0.606)	(0.737)
Asset maturity	0.003	0.005	0.000	0.003	0.005	0.000
	(0.445)	(0.414)	(0.900)	(0.448)	(0.393)	(0.901)
Earnings volatility	0.040	0.050	0.219	0.040	0.050	0.221
	(0.355)	(0.332)	(0.299)	(0.365)	(0.321)	(0.301)
Leverage	0.118	0.595***	0.527**	0.119	0.592***	0.524**
	(0.490)	(0.007)	(0.017)	(0.491)	(0.008)	(0.017)
Price performance	0.018	0.052**	0.037	0.017	0.052**	0.037
	(0.501)	(0.040)	(0.141)	(0.504)	(0.044)	(0.142)
Constant	-1.257***	-0.540	-0.151	-1.245***	-0.517	-0.176
	(0.007)	(0.255)	(0.792)	(0.007)	(0.274)	(0.760)
Obs.	448	445	407	448	445	407
Firms	162	156	141	162	156	141
R^2 *(within)*	0.179	0.233	0.144	0.178	0.234	0.143

7.4.4 The role of NPRs of executive vs. non-executive directors

In unreported results[174], we examine the impact of the aggregate NPRs of all a firm's directors on debt maturity. The reason why we examine the aggregate NPRs is that debt maturity decisions may be influenced by a group of executive or non-executive directors. The empirical results are somewhat mixed. Specifically, the volume-based NPRs of executive directors have significantly positive impacts on the debt maturity in all the regressions. However, the NPRs of non-executive directors are statistically

[174] This is for the purpose of brevity and the tables are available upon request.

insignificant. Our results indicate that the overconfident beliefs of executive directors play a more important role than those of non-executives in increasing their firm's debt maturity. This finding is intuitively acceptable since it is mainly the executive directors' duty to make firm financial policies which should in principle be monitored and approved by the non-executive directors. In this case, the executive directors, especially the CEO and CFO, much more heavily engaged in the financial decision makings than the non-executive directors. To conclude, the significant and positive impact of the NPRs of executive directors supports the proposition that managerial overconfidence is positively related to debt maturity (H1b).

7.4.5 Change of managerial overconfidence and change of debt maturity

Prior behavioural corporate finance literature focuses primarily on static overconfidence measures. Recall that overconfidence can vary over time because of self-attribution bias, thus time-variations in managerial overconfidence is potentially extremely important. However, perhaps surprisingly, static overconfidence measures predominate in the behavioural corporate finance literature. Malmendier and Tate's (2005, 2008) option-based and press-based overconfidence measures are widely used, both of which are static measures. Graham *et al*. (2013) examine the relationship between static survey-based overconfidence measure and debt maturity. Landier and Thesmar (2009) find that their survey-based optimism measure (i.e. expectation errors) tends to persist over the two time periods (i.e. year 1994 and 1998) they examine and do not provide evidence on the effect of changes of optimism on debt maturity. Thus, the effect of time-variation in overconfidence is largely under-researched.

Here we provide, to our knowledge, the first extensive test of the effect of changes of overconfidence on the change of debt maturity.[175] This is an important and novel extension of the existing literature on behavioural corporate financing. We need time-varying measures of overconfidence, such as the words-based measures examined in

[175] Words-based overconfidence measures (including first person pronouns and especially tone measures) are quite volatile. Specifically, for example, the within, between and overall standard deviation of *Tone_LM* are 0.216, 0.195 and 0.290 respectively and the mean and standard deviation of the yearly average of *Tone_LM* are 0.533 and 0.084 respectively.

this study to conduct this analysis. We can therefore shed initial light on the question: how sensitive are changes in debt maturity to changes in overconfidence?

In Table 7.5, we examine the changes of words-based overconfidence measures on the change of debt maturity using a first difference estimator. In particular, we run OLS regressions with first differenced data, which also controls for firm fixed effects. Consistent with our main result in Table 7.2 that *I* has a significantly positive effect on debt maturity, Δ *I* also has a positive and highly significant effect (*p-value*=0.011) on the change of debt maturity. In addition, we find that the changes of several tone measures including Δ *TONE_LM* and Δ *TONE_RES* have positive and statistically significant impacts on the change of debt maturity (*p-value*=0.078 and 0.100 respectively).[176] In brief, the above evidence shows that the increase in the level of words-based managerial overconfidence is significantly associated with increases in debt maturity. This observation supports the agency cost hypothesis of a positive relationship between overconfidence and debt maturity **(**H1b**)**. More broadly, we provide new and novel evidence that *time-variation* in managerial overconfidence can have an important impact on corporate financing; thus the impact of *time-variation* in managerial overconfidence in other corporate finance contexts would be a fertile line for future research.

7.4.6 Control variables

Next, we briefly discuss empirical evidence related to the impacts of the following control variables on the standard debt maturity measure.

Market-to-book ratio: The coefficient for the market-to-book ratio is either positive or negative and insignificant, providing no support for the agency cost hypothesis. This result is consistent with prior studies controlling leverage (see, e.g., Stohs and Mauer, 1996; Antoniou *et al.*, 2006). This finding may suggest that the underinvestment problem is not a major concern of the UK firms.

[176] The NPRs display relatively little time variation and hence we do not report the impact of a change in NPR here. For example, over 60% of the NPRs take the value of one.

Asset maturity: The coefficient estimates on asset maturity are either positive or negative, depending on model specifications. They are statistically and economically insignificant. Antoniou *et al*. (2006) also find the similar result and further point out that the joint insignificance of both market-to-book ratio and asset maturity is consistent with the life cycle theory.

Table 7.5 Changes of words-based measures of overconfidence and change of debt maturity

This table presents regressions of change of debt maturity measure on the changes of various tone measures of Chairman's Statement and control variables, as defined in Appendix 7.A. The dependent variable is the change of ratio of long-term debt to total debt (i.e. Δ LTD/TD). All the models are estimated using first difference (FD) estimator (i.e. first-differenced data with OLS regression). p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Variable	(1) FD	(2) FD	(3) FD	(4) FD	(5) FD	(6) FD
Δ *I*	0.049**					
	(0.011)					
Δ *WE*		0.001				
		(0.841)				
Δ *Optimism*			0.004			
			(0.288)			
Δ *Tone_LM*				0.059*		
				(0.078)		
Δ *TONE*					0.010	
					(0.108)	
Δ *TONE_RES*						0.009*
						(0.100)
Δ *Tax*	0.011	0.010	0.009	0.009	0.008	0.008
	(0.424)	(0.489)	(0.484)	(0.491)	(0.521)	(0.533)
Δ *Abnormal earnings*	-0.010	-0.006	-0.005	-0.002	-0.002	-0.003
	(0.756)	(0.837)	(0.871)	(0.941)	(0.923)	(0.920)
Δ *Firm size*	-0.014	-0.011	-0.007	-0.012	-0.011	-0.010
	(0.835)	(0.864)	(0.907)	(0.847)	(0.857)	(0.864)
Δ *Liquidity*	0.161***	0.159***	0.160***	0.160***	0.160***	0.158***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ *M/B asset*	0.025	0.024	0.022	0.019	0.019	0.023
	(0.339)	(0.351)	(0.387)	(0.450)	(0.460)	(0.372)
Δ *Asset maturity*	0.001	0.001	0.000	0.000	0.000	0.000
	(0.787)	(0.854)	(0.868)	(0.916)	(0.888)	(0.886)
Δ *Earnings volatility*	0.075*	0.073*	0.071*	0.066*	0.066	0.065
	(0.077)	(0.087)	(0.089)	(0.096)	(0.102)	(0.104)
Δ *Leverage*	0.160	0.162	0.171	0.172	0.184	0.172
	(0.294)	(0.291)	(0.269)	(0.262)	(0.242)	(0.266)
Δ *Price performance*	-0.010	-0.009	-0.009	-0.013	-0.012	-0.004
	(0.569)	(0.618)	(0.600)	(0.461)	(0.504)	(0.781)
Δ *Constant*	0.007	0.007	0.006	0.007	0.007	0.007
	(0.516)	(0.556)	(0.560)	(0.478)	(0.482)	(0.481)
Obs.	663	663	663	663	663	663
R^2	0.150	0.142	0.144	0.148	0.146	0.147

Firm size: The coefficient estimates on firm size are positive and significant in almost all the regressions. This could be explained by the fact that the larger firms are associated with lower transaction costs, lower information asymmetry and less agency problems.

Liquidity: The relationship between liquidity and debt maturity is positive and highly significant in all the regressions. This is probably because the long-term debt investors prefer those firms that have more highly liquid assets and hence find it easier to meet debt payment from their cash flows.

Earnings volatility: The effect of earnings volatility on debt maturity is positive and significant in only a few regressions. This finding indicates that firms with highly volatile earnings want to avoid long-term commitment and therefore may not use long-term debt to reduce liquidity risk.

Leverage: Leverage has positive and significant impacts on debt maturity. This finding is consistent with previous US and UK studies (see, e.g., Stohs and Mauer, 1996; Datta *et al*., 2005; Antoniou *et al*., 2006). This observed positive relation is in line with the argument that highly leveraged firms use more long-term debt to control liquidity risk and financial distress cost.

Abnormal earnings: The coefficient estimates on abnormal earnings are negative and statistically significant in some random effects and RE-Tobit models. This finding provides weak evidence that some UK firms may use short-term debt as a signal of their high quality.

Effective tax rate: The coefficient estimates on the effective tax rate are either negative or positive, depending on model specification and estimation methods, and statistically insignificant. This finding is consistent with previous UK studies (Ozkan, 2000; Antoniou *et al*., 2006).

Share price performance: The coefficient estimates on the share price performance are positive and statistically significant in many regressions. This finding is consistent with the proposition of the issuance of informationally disadvantaged securities (e.g., long-

term debt) following a past share price runup (Lucas and McDonald, 1990). It is also consistent with the positive effect of managerial overconfidence argument that good past firm performance, as indicated by the increase of share price, enhances managerial overconfidence, which then leads to longer debt maturity.

7.4.7 Further analysis

7.4.7.1 Subsample analysis

We perform subsample analysis to examine the sensitivity of overconfidence-debt maturity relationship to several firm characteristics. The goal here is to examine if there is further support for the agency cost of debt mechanism that we hypothesise to have been driving the observed positive relationship between overconfidence and debt maturity. Table 7.5 presents subsample analysis where the full sample is split into two subsamples based on measures of investment opportunities (market-to-book value of asset and market-to-book value of equity) and a measure of long-term debt capacity (leverage). This subsample analysis can shed light on the underlying mechanisms of the overconfidence-debt maturity relationship by looking at the sensitivity of overconfidence-debt maturity relationship to the above firm characteristics. Our subsample analysis focuses on three overconfidence measures: first person singular pronouns (*I*) and the NPRs of CEO (*CEO_VA* and *CEO_VOL*) which have positive and significant impacts on debt maturity in our main tests in Table 7.2 and 7.4 respectively.[177]

a. Market-to-book value

Firms with more investment opportunities, as indicated by higher market-to-book value of asset or equity, have more severe agency problems of underinvestment (i.e. debt overhang). Put differently, the fewer investment opportunities, the less severe the potential conflict over the exercise of those investment options. If overconfidence influences debt maturity through the agency channel, we expect that the overconfidence-debt maturity relationship will be stronger for high growth firms which are associated with more underinvestment problem. Our empirical findings are consistent with this conjecture. As we can see in Table 7.6 that the coefficients on both *I* and NPRs of the CEO are more significant for firms with higher market-to-book value

[177] Other overconfidence-related measures (e.g., *WE* and NPRs of Chairman and CFO) remain to be insignificant in the subsample analysis.

of asset. These results are generally robust to an alternative measure of investment opportunities that is market-to-book value of equity.[178]

Table 7.6 Subsample analysis: sensitivity of overconfidence-debt maturity relationship to firm characteristics

This table presents regressions of debt maturity measures on first person pronouns and NPRs of CEO and control variables, as defined in Appendix 7.A. Subsamples split based on the medians of market-to-book value of asset (Panel A), market-to-book value of equity (Panel B) and leverage (Panel C) are estimated to examine the impacts of the above firm characteristics on the overconfidence-debt maturity relationship. To make the results comparable, medians of the full sample (865 obs.) are also used to divide the smaller sample (445 obs.) used to analyse the effects of the NPRs of CEO, which is why the sample sizes in columns 5-8 are slightly different. All firm level control variables are included in all models but not reported to save space. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using fixed effects (FE) or first difference (FD) estimator. p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	(1) FE	(2) FE	(3) FD	(4) FD	(5) FE	(6) FE	(7) FE	(8) FE
Panel A: M/B asset	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*
I	0.055*	0.014						
	(0.095)	(0.634)						
Δ *I*			0.049**	0.069*				
			(0.030)	(0.052)				
CEO_VA					0.049**	0.018		
					(0.046)	(0.412)		
CEO_VOL							0.056*	0.018
							(0.069)	(0.445)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2 *(within)*	0.162	0.163	0.166	0.125	0.250	0.269	0.252	0.268
Obs.	433	432	321	342	209	236	209	236
Panel B: M/B equity	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*
I	0.065*	0.057						
	(0.058)	(0.111)						
Δ *I*			0.060**	0.054*				
			(0.014)	(0.093)				
CEO_VA					0.048*	0.042**		
					(0.067)	(0.046)		
CEO_VOL							0.054*	0.042*
							(0.088)	(0.088)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2 *(within)*	0.179	0.146	0.159	0.133	0.321	0.238	0.322	0.237
Obs.	432	433	324	339	219	226	219	226
Panel C. Leverage	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*
I	0.043	0.060**						
	(0.186)	(0.049)						
Δ *I*			0.045*	0.067**				
			(0.061)	(0.032)				
CEO_VA					0.008	0.066*		
					(0.619)	(0.070)		
CEO_VOL							0.011	0.067*
							(0.614)	(0.095)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2 *(within)*	0.389	0.088	0.322	0.073	0.404	0.205	0.405	0.203
Obs.	433	432	333	330	222	223	222	223

[178] Note that market-to-book value of equity will be affected by the firm's leverage and thus may not be as good an indicator of growth opportunities as market-to-book value of assets.

b. Leverage

If a firm's leverage is high, according to trade-off theory of capital structure, the firm will be reluctant to use more debt. In other words, only firms with relatively low leverage will use debt and thus have to make a debt maturity decision. Consistent with this reasoning, the positive overconfidence-debt maturity relationship is found to be stronger for firms with lower leverage (see Table 7.6). Thus, we find that the overconfidence-debt maturity relationship is intensified for firms that do not face long-term debt capacity constraints.

To summarise, our major finding is that the effect of managerial overconfidence is stronger when the firm has high growth opportunities. This supports our main agency cost hypothesis (that builds on the timing effect from Hackbarth's (2009) model), which posits that managerial overconfidence can reduce the underinvestment problem, in a novel scenario where the underinvestment problem is exacerbated, i.e. for firms with more growth opportunities. In addition, high leverage makes firms less likely to use debt, which in turns weakens the positive overconfident-debt maturity relationship.

7.4.8 Robustness tests

7.4.8.1 Dummies of first person pronouns and NPRs

In Table 7.7 we regress debt maturity on binary variables based on first person singular pronoun (*I*) and net purchase ratios (NPRs) of Chairman, CEO and CFO. *I_DUMMY* is coded as 1 if *I* is in the top decile and 0 otherwise. *CH_NPD*, *CEO_NPD* and *CFO_NPD* are net purchase dummies which take the value of 1 if the NPRs of Chairman, CEO and CFO respectively are above zero and 0 otherwise. Consistent with our main findings, *I_DUMMY* has a positive and significant effect (*p-value*=0.053) on debt maturity in fixed effects regressions. In addition, the coefficients on *CEO_NPD* are positive and statistically significant at 5% level. Therefore, the positive relationship between overconfidence and debt maturity is robust to alternative measures of *I* and NPRs of CEO. Finally, the *WE_DUMMY* and the *CFO_NPD* and *CH_NPD* are insignificant as consistent with our earlier results and could be attributed to the negative association of *WE* with narcissism (Chatterjee and Hambrick, 2007) that diminishes overconfidence.

Table 7.7 Dummies of first person pronouns and NPRs and debt maturity

This table presents regressions of debt maturity measure on first person pronouns dummy (*I_DUMMY* is coded as 1, if I is in the top decile and 0 otherwise) and net purchase dummies of Chairman, CEO and CFO (*CH_NPD*, *CEO_NPD* and *CFO_NPD* are coded as 1 if the net purchase ratios are above zero and 1 otherwise) and control variables, as defined in Appendix 7.A. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using fixed effects (FE). p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Variable	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE
I_DUMMY	0.047*				
	(0.053)				
WE_DUMMY		-0.013			
		(0.745)			
CH_NPD			-0.028		
			(0.377)		
CEO_NPD				0.068**	
				(0.011)	
CFO_NPD					-0.009
					(0.813)
Tax	-0.007	-0.008	-0.036	-0.018	-0.010
	(0.655)	(0.614)	(0.195)	(0.460)	(0.672)
Abnormal earning	-0.009	-0.005	-0.031	-0.067	-0.069
	(0.733)	(0.845)	(0.380)	(0.131)	(0.136)
Firm size	0.057**	0.060**	0.132***	0.068*	0.041
	(0.041)	(0.034)	(0.001)	(0.066)	(0.373)
Liquidity	0.145***	0.144***	0.157***	0.191***	0.184***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)
M/B asset	0.005	0.005	0.031	-0.020	0.013
	(0.803)	(0.803)	(0.310)	(0.599)	(0.705)
Asset maturity	-0.001	-0.001	0.004	0.005	0.001
	(0.865)	(0.816)	(0.448)	(0.410)	(0.908)
Earnings volatility	0.094	0.094	0.040	0.054	0.222
	(0.176)	(0.171)	(0.361)	(0.303)	(0.303)
Leverage	0.356**	0.346**	0.116	0.594***	0.519**
	(0.017)	(0.022)	(0.500)	(0.007)	(0.019)
Price performance	0.031*	0.032*	0.018	0.054**	0.038
	(0.059)	(0.056)	(0.512)	(0.036)	(0.135)
Constant	-0.331	-0.357	-1.240***	-0.608	-0.214
	(0.337)	(0.305)	(0.008)	(0.199)	(0.710)
Obs.	865	865	448	445	407
Firms	192	192	162	156	141
R^2 *(within)*	0.140	0.140	0.149	0.236	0.142

7.4.8.2 Alternative estimator: Random Effects Tobit (RE-Tobit)

As a further robustness test, in Table 7.8 we use random effects Tobit (RE-Tobit) estimator that controls for the fractional nature of our dependent variable (i.e. the debt maturity ratio is bounded between zero and one). The likelihood ratio (LR) tests reject the null, suggesting that the RE-Tobit is more valid than the pooled Tobit.[179] Consistent

[179] The RE-Tobit is estimated using Gauss-Hermite quadrature and the quadrature approximation may depend on the number of integration points. We find that our results are robust to quadrature sensitivity. In particular, we use the "quadchk" command in

with our main findings, the coefficients on *I* and both value-based and volume-based NPRs of CEO are positive and statistically significant (*p-value*=0.090, 0.052 and 0.047 respectively).

Table 7.8 Alternative estimator: random-effects Tobit model

This table presents regressions of debt maturity measure on first person pronouns and NPR of Chairman, CEO and CFO and control variables, as defined in Appendix 7.A. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using random-effects Tobit (RE-Tobit). p-values are given in parentheses. Log-likelihood values are reported as measures of goodness-of-fit. The p-values of likelihood ratio (LR) test are reported, comparing pooled Tobit against RE-Tobit. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	(1) RE-Tobit	(2) RE-Tobit	(3) RE-Tobit	(4) RE-Tobit	(5) RE-Tobit	(6) RE-Tobit	(7) RE-Tobit	(8) RE-Tobit
I	0.034*							
	(0.090)							
WE		0.000						
		(0.913)						
VA_CH			-0.007					
			(0.642)					
VOL_CH				-0.002				
				(0.887)				
VA_CEO					0.031*			
					(0.052)			
VOL_CEO						0.034**		
						(0.047)		
VA_CFO							0.003	
							(0.862)	
VOL_CFO								0.008
								(0.655)
Tax	0.001	0.001	0.005	0.005	-0.009	-0.009	-0.009	0.004
	(0.885)	(0.900)	(0.589)	(0.588)	(0.678)	(0.683)	(0.678)	(0.719)
Abnormal	-0.009**	-0.009**	-0.011***	-0.011***	-0.009**	-0.009**	-0.009**	-0.026
earning	(0.012)	(0.012)	(0.003)	(0.003)	(0.014)	(0.014)	(0.014)	(0.233)
Firm size	0.047***	0.047***	0.050***	0.050***	0.049***	0.049***	0.049***	0.043***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Liquidity	0.090***	0.089***	0.081***	0.081***	0.087***	0.087***	0.087***	0.129***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
M/B asset	-0.000	-0.001	0.014	0.015	-0.038*	-0.038	-0.038*	-0.015
	(0.959)	(0.908)	(0.517)	(0.473)	(0.096)	(0.103)	(0.096)	(0.563)
Asset maturity	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.000
	(0.372)	(0.371)	(0.366)	(0.361)	(0.296)	(0.319)	(0.296)	(0.773)
Earnings	0.081	0.079	0.030	0.029	0.028	0.030	0.028	0.080
volatility	(0.110)	(0.123)	(0.577)	(0.588)	(0.647)	(0.634)	(0.647)	(0.523)
Leverage	0.302***	0.301***	0.228*	0.227*	0.445***	0.441***	0.445***	0.575***
	(0.001)	(0.001)	(0.065)	(0.067)	(0.000)	(0.000)	(0.000)	(0.000)
Price	0.026*	0.027*	0.019	0.019	0.058***	0.057***	0.058***	0.055**
performance	(0.068)	(0.058)	(0.312)	(0.311)	(0.003)	(0.003)	(0.003)	(0.021)
Constant	-0.133	-0.117	-0.146	-0.152	-0.103	-0.107	-0.103	-0.143
	(0.253)	(0.309)	(0.321)	(0.303)	(0.477)	(0.461)	(0.477)	(0.385)
Obs.	865	865	448	448	445	445	407	407
Left-censored	0	0	0	0	0	0	0	0
Right-censored	31	31	11	11	23	23	15	15
Firms	192	192	162	162	156	156	141	141
Log-likelihood	-36.418	-37.850	-13.136	-13.234	-33.736	-33.640	-31.439	-31.354
LR test	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

STATA 12 to check whether the coefficients change substantially when using different numbers of integration points. We use 100 integration points (the default is 12) to make sure the relative difference is less than 0.01.

7.4.9 Summary and further discussions

We conduct an extensive analysis of the relationship between *time-varying* measures of managerial overconfidence and debt maturity. To sum up, there is evidence that both words-based managerial overconfidence (i.e. first person singular pronouns) and action-based CEO overconfidence have positive impacts on debt maturity in the UK. Interestingly, we provide new evidence that the changes of words-based overconfidence (including both first person singular pronouns and optimistic tone) also have positive effects on the change of debt maturity. Thus we document an important new dynamic effect in the relationship between managerial overconfidence and debt maturity that has not been investigated in prior literature.

Our initial findings are generally consistent with a previous US study on managerial self-attribution bias (Li, 2010a), however we extend this paper in important directions. In contrast to existing studies on the overconfidence-debt maturity relationship, our study contributes to this line of literature by (1) proposing a specific mechanism through which overconfidence leads to longer debt maturity, namely in terms of reducing agency cost of debt (Hackbarth, 2009), (2) empirically verifying the proposed positive overconfidence-debt maturity relationship using multiple managerial words-based and action-based overconfidence measures, while earlier studies rely on survey-based measures of overconfidence, (3) empirically verifying that the overconfidence-debt maturity relationship intensifies when the agency cost of debt is exacerbated, i.e. when firms have high growth opportunities, (4) documenting that overconfidence of the CEO has a stronger influence on debt maturity than that of CFO consistent with the CEO being most influential for investment decisions and thus most important for reducing the agency cost of debt (i.e. underinvestment problem) and (5) showing that time-variations in the level of overconfidence also has a significant and positive effect on the change of debt maturity.

7.5 Conclusions

This study examines the influence of managerial overconfidence on corporate debt maturity structure. We are the first to explain that since managerial overconfidence can mitigate the agency cost of (especially long-term) debt (Hackbarth, 2009) this can have

important implications for debt maturity. In particular, it can lead to a lengthening of debt maturity, i.e. managerial overconfidence can be positively related to debt maturity. The intuition is that managerial overconfidence can help more closely align managers' and debtholders' preferences over the firm's investments (thus it mitigates the agency cost of (long-term) debt), leading to lenders being more willing to lend to overconfident managers and providing overconfident managers with less need and less incentive to shorten debt maturity in order to control for this agency problem. Thus, we hypothesise that from this agency cost perspective managerial overconfidence is positively associated with debt maturity.

This study has three major findings, supporting the agency cost of debt hypothesis of a positive overconfidence-debt maturity relationship. First, we confirm that there is in general a positive covariance between overconfidence and debt maturity using a wide range of time-varying overconfidence measures and especially for changes in overconfidence. For example, first person singular pronouns (*I*) has a significant and positive impact on debt maturity. We also find positive relationships between optimistic tone measures and debt maturity are highly significant in OLS but become insignificant after controlling for firm fixed effects using within transformation. In addition and novelly, using first difference estimator we find the changes of *I* and several tone measures (*Tone_LM* and *TONE_RES*) have positive and significant effects on the change of debt maturity. The above evidence is consistent with the agency cost of debt proposition that firms with overconfident managers tend to use more long-term debt **(**H1b**)**.

Second, we examine a scenario where the agency cost of debt is exacerbated. For firms with high investment opportunities the underinvestment impact from the agency issue is greater. Consistent with the agency cost hypothesis, we find the positive relationship between overconfidence and debt maturity is intensified for firms with high investment opportunities. This is because managerial overconfidence can be a substitute to a standard way of reducing agency cost of debt (i.e. "shortening debt maturity").

Third, we examine the role of different directors' overconfidence. If the agency cost hypothesis holds, we anticipate the overconfidence of the director who has most impact on investment decisions, i.e. CEO, to be crucial. Consistent with this conjecture, we find

the net purchase ratios (NPRs) of CEOs have significantly positive effects on debt maturity, while the coefficients on the NPRs of CFOs and non-executive directors (e.g., Chairman) are insignificant.

In summary, we develop an agency cost hypothesis which builds on and extends Hackbarth's (2009) insight that managerial overconfidence can mitigate the underinvestment problem which is the major concern of long-term debt investors. We explain that this can make firms with overconfident managers more easily raise long-term debt financing at a lower cost (because of the reduced agency cost of debt). Overall, we provide substantial empirical evidence that is consistent with this hypothesis.

Our study has important implications for future studies. We highlight the importance of recognizing and empirically capturing the time-variations in managerial overconfidence. Time-varying overconfidence measures have two benefits. One is that it allows us to examine the effect of the change of overconfidence. The other is that it makes it easier to control for unobserved heterogeneity by using fixed effects estimators. However, the observed effect of static overconfidence measures (e.g. option-based and press-based measures) in prior studies could be driven by unobserved heterogeneity. To avoid this potential spurious relationship, future studies can utilise time-varying overconfidence measures in other contexts.

CHAPTER 8

Conclusion

Chapter 8. Conclusion

This chapter concludes this thesis by first highlighting the major contributions to the relevant finance and accounting literature in Section 8.1. In particular, new insights provided by each empirical study will be summarized. Section 8.2 outlines potential limitations and Section 8.3 provides key implications and directions for future research.

8.1 Major Contributions

This thesis contributes to the growing behavioural corporate finance literature by examining the effects of time-varying managerial overconfidence on various corporate financing decisions (see section 2.4 of chapter 2 for a review of behavioural capital structure theories). Theoretically, we propose a more comprehensive version of market timing theory (namely "Market Timing Matrix" (MTM)) by incorporating managerial overconfidence into market timing framework. Empirically, we develop a time-varying measure of overconfidence based on computational tone analysis of accounting narratives (i.e. Chairman's Statement). To the best of our knowledge, this is the first study that establishes the link between tone and corporate financing decisions. More detailed new insights offered by three empirical studies on capital structure, pecking order preference and debt maturity will be summarized in the following subsections.

8.1.1 Theoretical contributions

A more complete market timing theory: This thesis proposes a more complete market timing theory, namely "Market Timing Matrix (MTM)". This market timing framework is more complete in the sense that it is an important complement to Baker and Wurgler's (2002) market timing theory. More specifically, we relax Baker and Wurgler's (2002) assumption that managers are rational and are able to take the benefit of market mispricing. Instead, our market timing theory assumes that managers are irrational in general and overconfident in particular. In the market timing framework, managerial overconfidence is associated with perceived (not real) mispricing of firm stocks. This perceived mispricing will lead to market mistiming, meaning that overconfident managers "buy high". This thesis also provides a review on behavioural capital structure theories.

8.1.2 Methodological contributions

Time-varying words-based measure of overconfidence: One of the major challenges of behavioural corporate finance is the measurement of behavioural biases. This thesis articulates the importance of using a time-varying measure of managerial overconfidence, while most of the existing studies use static measures of overconfidence. We develop a time-varying words-based overconfidence measure by capturing the optimistic tone of corporate disclosure (i.e. UK Chairman's Statement) using computational linguistic analysis software. To ensure the validity of the tone measure, we form a composite tone index based on six individual tone measures. This time-varying measure allows us to examine the impact of the change of managerial overconfidence on financing decisions (i.e. the change of leverage and debt maturity). In addition, our overconfidence measures also make it possible to compare the effects of overconfidence of CEO and CFO.

8.1.3 Empirical contributions (new economic insights)

This thesis contributes to the behavioural corporate finance literature by showing that time-varying managerial overconfidence is an important driver of firm financing decisions. Our studies do not simply replicate existing (mostly US) studies using UK data, but more importantly offer new empirical insights. In particular, our work leads to a better understanding of capital structure puzzle, low leverage puzzle, pecking order puzzle (i.e. size anomaly) and debt maturity decisions. This section summarizes major new economic insights provided by each empirical study.

Managerial overconfidence and low leverage: Empirical study 1 (chapter 5) suggests that managerial overconfidence is an important determinant of capital structure, which sheds light on the well-known capital structure puzzle (i.e. how firms make capital structure decisions). More importantly, different from the US evidence that managerial overconfidence leads to higher leverage (Malmendier, Tate and Yan, 2011), we document that managerial overconfidence is associated with lower leverage. Our study provides the first evidence that supports Malmendier, Tate and Yan's (2011) proposition that managerial overconfidence may lead to debt conservatism. In other words, our finding suggests that managerial overconfidence might be a potential explanation of why some firms have low leverage (i.e. low leverage puzzle).

Managerial overconfidence and reverse pecking order preference: Empirical study 2 (chapter 6) shows that managerial overconfidence is an alternative driver of pecking order preference (while information asymmetry is probably the most commonly cited driver of pecking order behaviour). However, different from the US evidence that managerial overconfidence enhances pecking order preference (Malmendier, Tate and Yan, 2011), we document that managerial overconfidence leads to reverse pecking order preference. Importantly, our empirical analysis distinguishes between firms with financing deficit and surplus. Our study provides initial and robust evidence for an overconfidence-induced reverse pecking order preference, which is particularly pronounced for small firms and firms with high earnings volatility. Our evidence partly explains the pecking order puzzle: overconfident managers with reverse pecking order preference make small firms exhibit weaker pecking order preference relative to large firms.

Managerial overconfidence and higher debt maturity: Empirical study 3 (chapter 7) first hypothesizes that managerial overconfidence can reduce the agency cost of debt (underinvestment problem) (Hackbarth, 2009) and therefore may lead to higher debt maturity. Our proposition is confirmed by our empirical result that managerial overconfidence increases debt maturity. This study implies that managerial overconfidence does not always cause suboptimal decisions but is favourable especially from long-term debt investors' perspective.

Overall, this thesis shows that managerial overconfidence plays an important role in firms' financing decisions. In particular, managerial overconfidence may cause biased financing decision but is also likely to have a favourable effect in terms of reducing agency cost of debt. Importantly, our initial empirical findings shed light on two important puzzles in the traditional corporate financing literature, namely low leverage puzzle and pecking order puzzle (or "size anomaly").

On the other hand, the thesis is not only of interest to academics but also practitioners. In particular, practitioners (e.g. corporate managers and investors) may learn from this thesis that managerial overconfidence is value-relevant. More specifically, managerial overconfidence leads to lower debt level and a weakened preference for debt over

equity. Consequently, overconfident managers are likely to forgo tax benefits, which reduces firm value. Furthermore, managerial overconfidence is likely to increase debt maturity by reducing the underinvestment problem associated with long-term debt. In this case, managerial overconfidence is favourable in the sense that it mitigates the agency cost of debt which in turn may reduce firms' cost of debt and make investors more willing to provide long-term debt financing. In addition, the words-based measures of overconfidence receive considerable attention in press. For example, in a recent *Financial Times* article, Tett (2013) suggests that "savvy investors should screen executives' statements for signs of arrogance … investors would dearly love to see: real-time analysis of whether the language of chief executives at banks (or anywhere else) is starting to display linguistic biomarkers of hubris". Therefore, the time-varying words-based measure of managerial overconfidence proposed in this thesis can be used by investors to detect potential overconfidence bias of senior managers of companies. To conclude, our key findings related to the effects of managerial overconfidence on financing policies and our measures of time-varying overconfidence would be useful for both corporate managers and investors.

8.2 Potential Limitations

Next, we outline several potential limitations of this thesis.

(1) data availability: This thesis uses accounting data (e.g. leverage ratio, net debt issuance, debt maturity ratio) as proxies for corporate financial policies. However, one may use corporate event data (e.g. equity offering, share repurchase) to test the effect of managerial overconfidence on financing decisions. In addition, more detailed information on the maturity of each individual corporate debt might be useful to construct more accurate measures of debt maturity. Furthermore, our study does not control for heterogeneity in the debt contract designs, although debt contracts are highly complex with various features and provisions.

(2) measurement of overconfidence: Overconfidence has many facets and is often used interchangeably with several closely related constructs, e.g. optimism and miscalibration. It is particularly important, although highly challenging, to try to

empirically distinguish between overconfidence and optimism which have differing impacts on some aspects of financing decisions (e.g. pecking order preference). Future studies should develop better ways to gauge different facets of overconfidence especially when they have different theoretical implications.

(3) alternative explanations of our overconfidence measures: Our tone-based and insider trading-based measures of managerial overconfidence are both subject to alternative interpretations, especially information asymmetry. It is important to justify that our empirical findings are not driven by information asymmetry. Our empirical tests can be improved by using better proxies to control for information asymmetry. For example, one may develop market microstructure-based measure of information asymmetry.

(4) the use of Chairman's Statement: Our key measure of managerial overconfidence is based on content analysis of UK Chairman's Statement. However, it is ideal to have narratives provided by CEO and/or CFO who are key financial decision makers, e.g. CEO speech.

(5) comparability: To make our empirical results more comparable to previous literature (e.g. Malmendier, Tate and Yan, 2011), we can use two commonly used proxies for overconfidence (i.e. stock option-based and press-based measures) as a robustness check, although as we discussed in Chapter 3 that those two measures might not be suitable for our study.

(6) formal theoretical modelling: Although this thesis focuses on empirical testing of the role of managerial overconfidence, we provide new economic insights that shed light on development of behavioural theories. For example, more formal behavioural models can be developed regarding the positive relationship between managerial overconfidence and debt maturity from the agency perspective.

8.3 Implications and Directions for Future Research

Finally, we summarize the major implications of this thesis and suggest several promising areas for future research.

(1) corporate governance and debiasing: Have documented the effects of managerial overconfidence on corporate financing decisions, future studies may explore the role of corporate governance mechanisms in debiasing *(*i.e. mitigating the negative effects of managerial overconfidence). For example, the proportion of female directors and independent directors may have influences on the impact of managerial overconfidence. In addition, proper design of executive compensation may also have an effect on the level of managerial overconfidence.

(2) comparing different executives/directors: Using insider trading-based measure of overconfidence, we document that CEO and CFO overconfidence do not always have same impact on various aspects of financing decisions. Future studies may develop better proxies that capture CEO and CFO overconfidence. More interestingly, one may compare the impacts of behavioural biases of different firm directors on financial decisions. For example, overconfidence of firms' R&D directors might be more relevant to firm innovation activities relative to CEO or CFO.

(3) interaction between managerial and investor irrationalities: Our empirical analysis is based on the assumption that managers are irrational and investors are rational. However, future studies may take both managerial and investor irrationalities into consideration. For example, one may formally model and empirical test the interaction between managerial overconfidence and investor sentiment, which represent two separate strands of current literature.

(4) joint effects of multiple managerial biases: This thesis focuses on a single behavioural bias of managers, namely overconfidence. However, psychological studies suggest that people are subject to multiple biases (e.g. anchoring, regret aversion, etc.). Therefore, future studies may have to consider the joint effects of multiple managerial biases and the potential interactions among them.

(5) time-varying managerial overconfidence and other corporate financial decisions: The time-varying managerial words-based measure of managerial overconfidence (i.e. the tone index) developed in this thesis can be used in many future studies on the effects of time-varying managerial overconfidence. For example, future study can i) empirically examine the impacts of managerial overconfidence on the speed of capital structure adjustment, ii) empirically examine the effects of managerial overconfidence on cash holding and more specifically test the conjecture that managerial overconfidence increase retained earnings which can be used to finance future investment, which in turn leads to lower debt level and iii) empirically test the impact of managerial overconfidence on dividend policy, among many other corporate activities.

(6) non-linear effect of overconfidence: Although we do not find evidence for the non-linear effect of managerial overconfidence on corporate financing decisions, future studies on overconfidence should try to empirically distinguish between the effects of mild overconfidence and extreme overconfidence (the latter is often detrimental to firm performance). In this case, a continuous measure of overconfidence is necessary and therefore our time-varying measures of overconfidence can be used.

(7) interaction between financing and investment: This thesis only investigates financing decisions using single-equation method. However, there might be interactions between financing and investment activities. Future studies may examine the effects of managerial overconfidence in a framework where leverage, investment and debt maturity decisions are modelled simultaneously.

Appendices

Appendix 3.A description of content analysis software: Diction 6 vs. LIWC 2007

This table describes two content analysis software used in this thesis.

	Diction 6	**LIWC 2007**
Basic description	Diction 6 provides a scientific way to measure the tone of verbal language that mainly includes five semantic features.	LIWC 2007 counts number of times certain list of words (i.e. internal default dictionary) appear in the target text files. The default dictionary is composed of around 4,500 words and word stems.
Default dictionary	Diction 6's default dictionary has five main master variables: Activity, Optimism, Certainty, Realism and Commonality.	LIWC 2007 provides approximately 80 output variables: 4 general descriptor categories, 22 standard linguistic dimensions, 32 word categories tapping psychological constructs, 7 personal concern categories, 3 paralinguistic dimensions, and 12 punctuation categories.
Support for the use of user-defined dictionary	Yes	Yes
Norm	Yes (compare results to 40 normative categories)	No
Relevant language dimensions for this study	Optimism Certainty	Positive emotion Negative emotion Certain
Previous studies using the software	E.g. press release (Davis, Piger and Sedor, 2005); earnings announcement (Rogers, Buskirk and Zechman, 2009)	E.g. 10 K report (Li, 2008); conference calls (Matsumoto, Pronk and Roelofsen, 2008)

Notes: for more detailed description of Diction 6 and LIWC 2007, see the user manuals by Hart and Carroll (2012) and Pennebaker *et al*. (2007) respectively.

Appendix 5.A Variable definitions

Variable	Definition
Panel A: Standard dependent and independent variables	
DEF_CF	Financing deficit measured using aggregate cash flow data (i.e. $\Delta D+\Delta E$)
Net debt issues (ΔD)	Long term borrowings minus reduction in long term debt
Net equity issues (ΔE)	Net proceeds from sale/issue of common and preferred stocks minus common/preferred redeemed, retired, converted
PDEF	PDEF equals DEF if the deficit is positive and zero otherwise
NDEF	NDEF equals DEF if the deficit is negative and zero otherwise
Firm size	Natural logarithm of sales
M/B	The ratio of book value of total assets minus book value of equity plus market value of equity to book value of total assets
Profitability	Earnings before interest, taxes and depreciation divided by total assets
Tangibility	Net property, plant and equipment divided by total assets
Price performance	The difference of natural logarithm of fiscal year-end share prices
Book leverage	Total debt divided by total assets
Market leverage	Total debt divided by (total assets minus common equity plus market capitalization)
Net assets	Total assets minus current liabilities
Firm age	The natural logarithm of the number of months since the incorporation date
Panel B: Measures of managerial beliefs	
a) Optimistic tone measures (based on computational content analysis of Chairman's Statement)	
Net emotion	Positive emotion minus negative emotion including (anxiety, anger and sadness) as defined by *LIWC*
Certain1	Measure of certainty (e.g. always, never) as one aspect of cognitive processes as defined by *LIWC*
Net optimism	[praise+satisfaction+inspiration]-[blame+hardship+denial] as defined by *Diction*
Certain2	[tenacity+leveling+collectives+insistence]-[numerical terms+ambivalence+self reference+variety] as defined by *Diction*
Tone_H	(positive-negative)/(positive+negative), using Henry's (2008) word list
Tone_LM	(positive-negative)/(positive+negative), using Loughran and McDonald's (2011) word list
TONE	Composite tone index (see section 5.3.2.1 for more descriptions)
TONE_RES	Orthogonalized tone index (see section 5.3.2.1 for more descriptions)
b) Insider trading-based measures (i.e. net purchase ratio=(buy - sell)/(buy + sell))	
VA_CEO	The value-based net purchase ratio of CEO
VA_CFO	The value-based net purchase ratio of CFO
VOL_CEO	The volume-based net purchase ratio of CEO
VOL_CFO	The volume-based net purchase ratio of CFO

Appendix 6.A Variable definitions

Variable	Definition
Panel A: Measures of self-attribution bias and managerial overconfidence	
a) Content analysis-based measures (using Chairman's Statement)	
Net emotion	Positive emotion minus negative emotion including (anxiety, anger and sadness) as defined by *LIWC*
Certain1	Measure of certainty (e.g. always, never) as one aspect of cognitive processes as defined by *LIWC*
Optimism	[praise+satisfaction+inspiration]-[blame+hardship+denial] as defined by *Diction*
Certain2	[tenacity+leveling+collectives+insistence]-[numerical terms+ambivalence+self reference+variety] as defined by *Diction*
Tone_H	(positive-negative)/(positive+negative), using Henry's (2008) word list
Tone_LM	(positive-negative)/(positive+negative), using Loughran and McDonald's (2011) word list
TONE	Composite tone index (see section 5.3.2.1 for more descriptions)
TONE_RES	Orthogonalized tone index (see section 5.3.2.1 for more descriptions)
b) Insider trading-based measures (i.e. net purchase ratio=(buy - sell)/(buy + sell))	
VA_CEO	The value-based net purchase ratio of CEO
VA_CFO	The value-based net purchase ratio of CFO
VOL_CEO	The volume-based net purchase ratio of CEO
VOL_CFO	The volume-based net purchase ratio of CFO
c) Investment-based measures	
IAIR1	Industry-adjusted investment rate defined as the ratio of capital expenditure to the beginning of year property, plant and equipment
IAIR2	Industry-adjusted investment rate the ratio of capital expenditure to the beginning of year sales
IAIRD	A dummy variable that takes the value of one if the IAIR1 is in the top quintile in a particular fiscal year and zero otherwise
Panel B:Dependent variable and measures of financing deficit (DEF)	
DEF_CF	Financing deficit measured using aggregate cash flow data (i.e. $\Delta D+\Delta E$)
Net debt issues (ΔD_CF)	Long term borrowings minus reduction in long term debt
Net equity issues (ΔE_CF)	Net proceeds from sale/issue of common and preferred stocks minus common/preferred redeemed, retired, converted
DEF_BS	Financing deficit measured using balance sheet data (i.e. $\Delta D+\Delta E=\Delta A-\Delta RE$)
Net debt issues (ΔD_BS)	Change in total assets minus change in book equity
Net equity issues (ΔE_BS)	Change in book equity minus change in retained earnings
PDEF	PDEF equals DEF if the deficit is positive and zero otherwise
NDEF	NDEF equals DEF if the deficit is negative and zero otherwise
Panel C: Firm characteristics	
Firm size	Natural logarithm of sales
MB	The ratio of book value of total assets minus book value of equity plus market value of equity to book value of total assets
Profitability	Earnings before interest, taxes and depreciation divided by total assets
Tangibility	Net property, plant and equipment divided by total assets
Net assets (NA)	Total assets minus current liabilities
Earnings volatility	The standard deviation of the first difference in EBITD in the past five years (at least three years), scaled by the average book value of assets

Appendix 7.A Variable definitions

Variables	Definition
Panel A: words-based measure of overconfidence: first person pronouns	
I	The percentage of first person singular pronouns in the Chairman's Statement
WE	The percentage of first person plural pronouns in the Chairman's Statement
Panel B: words-based measure of overconfidence: optimistic tone	
Net emotion	Positive emotion minus negative emotion including (anxiety, anger and sadness) as defined by *LIWC*
Certain1	Measure of certainty (e.g. always, never) as one aspect of cognitive processes as defined by *LIWC*
Optimism	[praise+satisfaction+inspiration]-[blame+hardship+denial] as defined by *Diction*
Certain2	[tenacity+leveling+collectives+insistence]-[numerical terms+ambivalence+self reference+variety] as defined by *Diction*
Tone_H	(positive-negative)/(positive+negative), using Henry's (2008) word list
Tone_LM	(positive-negative)/(positive+negative), using Loughran and McDonald's (2011) word list
TONE	Composite tone index (see section 7.3.3.1 for more descriptions)
TONE_RES	Orthogonalized tone index (see section 7.3.3.1 for more descriptions)
Panel C: action-based measure of overconfidence: net purchase ratio (NPR), defined as the difference between insider purchases and sales divided by the sum of insider purchases and sales of own firm's shares	
VA_CH	The value-based net purchase ratio of Chairman
VA_CEO	The value-based net purchase ratio of CEO
VA_CFO	The value-based net purchase ratio of CFO
VOL_CH	The volume-based net purchase ratio of Chairman
VOL_CEO	The volume-based net purchase ratio of CEO
VOL_CFO	The volume-based net purchase ratio of CFO
Panel D: firm characteristics	
LTD/TD	The ratio of long-term debt that matures in more than one year to total debt
Tax	The ratio of income taxes to pre-tax income
Abnormal earnings	The difference between next year's and this year's earnings per share, scaled by this year's stock price
Firm size	The natural logarithm of total assets
Liquidity	The ratio of current assets to current liability
M/B asset	The ratio of book value of total assets minus book value of equity plus market value of equity to book value of total assets
M/B equity	The ratio of market value of equity to book value of equity
Asset maturity	The ratio of net property, plant and equipment to depreciation expense
Earnings volatility	The standard deviation of the first difference in EBITD in the past five years (at least three years), scaled by the average book value of assets
Leverage	The ratio of book value of total debt to book value of total assets
Price performance	The difference of natural logarithm of fiscal year-end share prices

Appendix 7.B Empirical studies on standard determinants of debt maturity

Empirical studies on the determinants of debt maturity are relatively limited compared with the vast capital structure literature. Early evidences on debt maturity are from a few indirect studies. Titman and Wessels (1988) report that short-term debt ratios are negatively related to firm size. They attribute that inverse relation to the high transaction costs associated with long-term debt especially for small firms. Therefore, smaller firms tend to use shorter-term debt. Mitchell's (1993) empirical results strongly support the monitoring hypothesis that firms uses debt maturity to make the monitoring of outsiders easier. Kim *et al*. (1995) report that corporate debt maturity is positively associated with interest rate volatility and the slope of the term structure.

More comprehensive test is conducted by Barclays and Smith (1995) on the contracting-cost hypotheses, signalling hypotheses and tax hypotheses of debt maturity. They find that debt maturity is positively related to firm size, regulation dummy which equals one if the firm belongs to a regulated industry and is negatively related to growth options as measured by market-to-book ratio. However, the term structure of interest rates has no significant effect on debt maturity.

However, Stohs and Mauer (1996) argue that the Barclays and Smith (1995) regressions are misspecified because they do not include leverage as a control variable. Stohs and Mauer (1996) test the determinants of debt maturity using a more comprehensive measure of debt maturity that covers all debt, debtlike obligations and current liabilities. Their results show that firms with larger size, longer asset maturity and high leverage use more long-term debt. In contrast, firms with higher earnings volatility, higher effective tax rate and higher quality (i.e. abnormal earnings) tend to use shorter-term debt. In addition, they find a nonmonotonic relation between bond rating and debt maturity (i.e. firms with high or very low ratings shorten their debt maturity), which is consistent with the model of Diamond (1991). However, the prediction of Myers's (1977) underinvestment model, that is the inverse relationship between growth opportunities (i.e. market-to-book ratio) and debt maturity, receives mixed support.

Different from the balance sheet measure of debt maturity used by Barclays and Smith (1995) and Stohs and Mauer (1996), Guedes and Oplers (1996) adopt incremental approach which measures the maturity of incremental debt issues rather than all

liabilities on the balance sheet. Agency theories of debt maturity are also supported. In particular, firms with more growth options use more short-term debt. However, the signalling and tax-based theories receive little support. Consistent with Diamond's (1991) liquidity risk hypothesis, their major finding is that larger and less risky (i.e. good bond ratings) firms tend to borrow at the two ends of the maturity spectrum. However, risky firms borrow in the middle of that spectrum because those firms are screened out of the long-term debt market and are also reluctant to use short-term debt due to liquidation risk.

The above studies mainly focus on the effects of firm characteristics. More recent studies examine the managerial impact on debt maturity. In particular, managerial stock ownership and compensation are also found to be relevant to debt maturity. Datta, Iskandar-Datta and Raman (2005) test the impact of managerial stock ownership on debt maturity. They document an inverse relationship between managerial stock ownership and debt maturity. Brockman, Martin and Unlu (2010) investigate the influence of executive compensation on debt maturity. They find that executives' portfolio sensitivities to changes in stock prices and stock return volatility are positively and negatively related to debt maturity respectively.

Regarding non-US debt maturity studies, Ozkan (2000) tests the debt maturity determinants of UK firms. He finds that growth opportunity and firm size are negatively associated with debt maturity, while asset maturity has a positive effect. However, tax is found to be insignificant. Leverage is not controlled in Ozkan's (2000) study. Antoniou *et al*. (2006) empirically compare the determinants of debt maturity of French, German and British firms. They find that most of the theories, including those related to tax, information asymmetry and agency problems, are applicable for the UK firms but not for French and German firms.

Besides, Antoniou *et al*. (2006) also examine the impact of equity market conditions, in particular share price performance and equity risk premium, on debt maturity. They document that the relationship between changes in stock prices and debt maturity is positive, especially for German and the UK firms. In terms of the effect of equity risk premium, they find that firms in the market-oriented economy, especially the UK, use more long-term debt when the equity risk premium is higher. However, the equity

market conditions have no significant effect on the debt maturity decisions of French firms. They conclude that the debt maturity decisions not only depend on firm-specific factors but also stock market conditions as well as country-specific financial and institutional environment.

A recent study by Fan, Titman and Twite (2012) examines the effect of institutional environment on capital structure and debt maturity decisions of firms in 39 countries. They find that debt maturity is positively related to asset tangibility, firm size and profitability, which is consistent with prior studies. However, market-to-book ratio is insignificant for the developed countries. In addition, institutional factors (e.g. legal system, tax, corruption) play a significant role in explaining cross-country differences. One limitation of their debt maturity test is that leverage is not controlled.

Appendix 7.C Standard theories of debt maturity

Three standard theories of debt maturity are related to agency cost, information asymmetry and tax, which have been the main focus of the existing debt maturity literature. Key variables that represent different theories will be outlined.

1. Agency cost hypothesis

Growth opportunities

Myers (1977) argues that the underinvestment problem of firms with high growth opportunities can be mitigated by shortening debt maturity. The conflict between equity holders and bondholders over the exercise of growth options becomes greater as the increase of those options. However, this conflict does not exist if the maturity of debt is so short that it matures before the investment options are to be exercised. Thus, firms with more growth opportunities should use more short-term debt.

Barnea *et al*. (1980) also rationalize debt maturity structure as a mechanism to solve agency costs associated with Myers's underinvestment problem. Furthermore, their model suggests that shortening debt maturity and issuing long-term debt with a call provision can resolve agency problems related to not only suboptimal future investment decisions but also information asymmetry and managerial risk incentives.

However, a recent model developed by Diamond and He (2014) shows that maturing risky short-term debt may be associated with a stronger overhang effect. That is, short-term debt is no longer a free solution to debt overhang. Moreover, their model predicts that firms with high growth opportunities will use more long-term debt because the potential early default is more costly for those growth firms. Therefore, their model suggests that the relation between debt maturity and growth opportunities can be positive, which is opposite to the prediction of Myers (1977). In sum, theoretical relationship between growth opportunity and debt maturity can be either negative or positive.

Matching Hypothesis

From agency perspective, Myers (1977) argues that matching the maturities of debt and assets, as an attempt to make the debt repayments correspond to the decline in the value of assets in place, can reduce the agency costs of debt. Hart and Moore's (1994) model

shows that there should be a match between the assets and liabilities. Specifically, the liabilities (i.e. debt repayments) should be matched either with project return stream or with the asset depreciation rate. Therefore, the matching hypothesis predicts that debt maturity is positively associated with asset maturity.

2. Information asymmetry: signalling and liquidity risk

Liquidity risk hypothesis

Diamond's (1991) model shows an optimal debt maturity structure based on a trade-off between the liquidity risks associated with short-term debt and its expected lower borrowing costs. The liquidity risk of short-term debt arises when the lenders are not willing to refinance and consequently the firm is forced to be liquidated. However, short-term debt may allow the firms to reduce financing costs when receiving good news. Considering that the firm insiders are better informed about firm quality than bond investors, firms with favourable private information about future prospects may choose short-term debt that can be refinanced when good news arrive.

Signalling hypothesis

Given the information asymmetry between the firm and bond market investors, the signalling model of debt maturity suggests that debt maturity can serve as a signal about the firm quality. In particular, in Flannery's (1986) model, high-quality firms believe that their long-term debt is undervalued. In addition, they are less concerned about refinancing risk and hence want to signal their quality by issuing short-term debt. In contrast, low quality firms avoid rolling over short-term debt because of positive transaction costs. In brief, high (low)-quality firms are more likely to issue short (long)-term debt. Therefore, we expect that firm quality is negatively related to debt maturity.

3. Tax Hypothesis

Kane, Marcus and McDonald (1985) provide a continuous-time model of debt maturity which incorporates taxes, bankruptcy costs and debt issue flotation costs. The optimal debt maturity is determined by comparing the tax benefits of debt and the bankruptcy and flotation costs. They predict that optimal debt maturity is positively related to the flotation costs and negatively correlated with tax benefits of debt and the volatility of firm value.

Brick and Ravid's (1985) model focuses on the tax implications of debt maturity allowing for default. Their model predicts that an increasing (decreasing) term structure of interest rates makes long (short) term-debt optimal in the sense that the expected tax liability is reduced, which increases the firm value. Therefore, the tax hypothesis implies that firms issue more long-term debt when there is an increasing term structure. However, Brick and Ravid's model is based on the assumption that firm's decision on leverage is made before the debt maturity decisions. As Lewis (1990) points out, taxes may be irrelevant to debt maturity structure especially if firm's leverage and debt maturity structures are determined simultaneously.

4. Equity market conditions

Equity market conditions are also relevant to debt maturity decisions (Antoniou *et al*., 2006). The valuation of long-term debt is more sensitive to new information and it is also more likely to be undervalued. Market timing theory suggests that firms should issue securities with high information costs, especially equity and long-term debt, following stock price run-up. In addition, signalling theory also predicts that firms will use short-term debt as a signal to the market if firms stocks are believed to be undervalued. Therefore, we expect that share price performance is positively related to debt maturity.

5. Leverage as a control variable

Some earlier studies do not include leverage as a control variable. However, leverage should be included for the following two reasons. First, some explanatory variables may have endogeneity problem related to leverage. Early studies (e.g., Barclay and Smith, 1995; Guedes and Opler, 1996) do not control for leverage and find a negative relation between growth opportunity and debt maturity. This finding may be subject to endogeneity problem, considering that leverage is positively related to debt maturity and growth opportunity is negatively related to leverage. In contrast, after controlling for leverage, Stohs and Mauer (1996) find opposite result. In terms of our key variable, managerial overconfidence may also be endogenous. Similarly, if leverage is omitted, positive relation between managerial overconfidence and debt maturity could be due to that 1.) managerial overconfidence is positively associated with leverage and 2.) leverage is positively associated with debt maturity. Therefore, this study will also control for leverage.

Second, theoretically, leverage is expected to have either positive or negative impact on debt maturity. On one hand, Diamond (1991) shows that highly leveraged firms should use more long-term debt to minimize liquidation risk. Therefore, there is a positive relation between leverage and debt maturity. On the other hand, agency theory suggests that underinvestment problem can be mitigated by lowering either leverage or debt maturity (Dennis, Nandy and Sharpe, 2000). In this case, reducing leverage and shortening debt maturity are substitutes, meaning that leverage and debt maturity is negatively related. Thus, leverage is also relevant to debt maturity decisions, while the sign of the coefficient on leverage is an empirical question.

Appendix 7.D Tone and debt maturity: OLS

This table presents regressions of debt maturity measure on various tone measures of Chairman's Statement and control variables, as defined in Appendix 7.A. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using ordinary least square (OLS) with robust standard error. p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Optimism	0.012***			
	(0.004)			
Tone_LM		0.074**		
		(0.028)		
TONE			0.020***	
			(0.002)	
TONE_RES				0.019***
				(0.001)
Tax	-0.039	-0.040	-0.039	-0.040
	(0.104)	(0.106)	(0.106)	(0.102)
Abnormal earning	-0.005	-0.003	-0.002	-0.003
	(0.861)	(0.913)	(0.939)	(0.925)
Firm size	0.036***	0.037***	0.036***	0.037***
	(0.000)	(0.000)	(0.000)	(0.000)
Liquidity	0.073***	0.072***	0.075***	0.070***
	(0.000)	(0.000)	(0.000)	(0.000)
M/B asset	-0.015	-0.014	-0.018	-0.010
	(0.331)	(0.370)	(0.243)	(0.524)
Asset maturity	0.001**	0.001**	0.001**	0.001**
	(0.035)	(0.042)	(0.036)	(0.033)
Earnings volatility	0.037	0.037	0.037	0.036
	(0.228)	(0.240)	(0.224)	(0.234)
Leverage	0.434***	0.443***	0.452***	0.430***
	(0.000)	(0.000)	(0.000)	(0.000)
Price performance	0.036*	0.032	0.028	0.042**
	(0.063)	(0.108)	(0.162)	(0.032)
Constant	-0.632***	-0.002	0.050	0.032
	(0.010)	(0.971)	(0.475)	(0.651)
Obs.	865	865	865	865
Firms	192	192	192	192
R^2	0.164	0.161	0.167	0.167

References

Abrahamson, E. and Park, C. (1994). Concealment of negative organizational outcomes: an agency theory perspective, *Academy of Management Journal*, 37(5), 1302-1334.

Ackert, L.F. and Deaves, R. (2010). *Chapter 6 Overconfidence*, in Behavioral Finance: Psychology, Decision-Making, and Markets, South-Western, Cengage Learning.

Adelberg, A. H. (1979). Narrative disclosures contained in financial reports: means of communication or manipulation, *Accounting and Business Research*, 9(35), 179-189.

Amernic, J. H. and Craig, R. J. (2007). Guidelines for CEO-speak: editing the language of corporate leadership, *Strategy & Leadership*, 35(3), 25-31.

Anderson, T.W. and Hsiao, C. (1981). Estimation of dynamic models with error components, *Journal of the American Statistical Association*, 76, 598-606.

Anderson, T.W. and Hsiao, C. (1982). Formulation and estimation of dynamic models using panel data, *Journal of Econometrics*, 18, 67-82.

Antoniou, A., Guney, Y. and Paudyal, K. (2006). The determinants of debt maturity structure: evidence from France, Germany and the UK, *European Financial Management*, 12, 161-194.

Antoniou, A., Guney, Y. and Paudyal, K. (2008). The determinants of capital structure: capital market-oriented versus bank-oriented institutions, *Journal of Financial and Quantitative Analysis*, 43(1), 59-92.

Arellano, M. and Bond, S. (1991). Some tests of specification for panel data: montecarlo evidence and an application to employment equations, *Review of Economic Studies*, 58, 277-97.

Asteriou, D. and Hall, S.G. (2007). *Applied Econometrics: A Modern Approach*. Revised edition. Published by Palgrave Macmillan.

Baginski, S. P., Hassell, J. M. and Hillison, W. A. (2000). Voluntary Causal Disclosures: Tendencies and Capital Market Reaction, *Review of Quantitative Finance and Accounting*, 15(4), 371-89.

Baker, M. (2009). Capital market-driven corporate finance, *Annu. Rev. Financ. Econ.*, 1(1), 181-205.

Baker, M. and Wurgler, J. (2002). Market timing and capital structure, *Journal of Finance*, 57(1), 1-32.

Baker, M. and Wurgler, J. (2004). Appearing and disappearing dividends: The link to catering incentives, *Journal of Financial Economics*, 73(2), 271-288.

Baker, M. and Wurgler, J. (2006). Investor sentiment and the cross-section of stock returns, *Journal of Finance*, 61(4), 1645-1680.

Baker, M. and Wurgler, J. (2012). "*Behavioral Corporate Finance: A Current Survey*." In Handbook of the Economics of Finance. 2, edited by George M. Constantinides, Milton Harris, and Rene M. Stulz. Handbooks in Economics. New York, NY: Elsevier.

Baker, M. and Wurgler, J. (2013). *Behavioral Corporate Finance: An Updated Survey*, Handbook of the Economics of Finance: Volume 2.

Baker, M., Ruback, R. and Wurgler, J. (2007). *Behavioral Corporate Finance: A survey*. In The Handbook of Corporate Finance: Empirical Corporate Finance, edited by Espen Eckbo. New York: Elsevier/North Holland.

Balli, H. O. and Sørensen, B. E. (2012). Interaction effects in econometrics, *Empirical Economics*, 1-21.

Barclay, M.J. and Smith, C.W. (1995).The maturity structure of corporate debt, *Journal of Finance*, 35, 1223-1234.

Barclay, M.J., Marx, L.M. and Smith, Jr. C.W. (2003). The joint determination of leverage and maturity, *Journal of Corporate Finance*, 9, 149-167.

Barker, V. L. and Mueller, G. C. (2002). CEO characteristics and firm R&D spending, *Management Science*, 48(6), 782-801.

Barnea, A.N., Haugen, R.A. and Senbet, L.W. (1980). A rational for debt maturity structure and call provisions in the agency theoretic framework, *Journal of Finance*, 35, 1223-1234.

Bartlett, S. A. and Chandler, R. A. (1997). The corporate report and the private shareholder: Lee and Tweedie twenty years on, *British Accounting Review*, 29(3), 245–261.

Bazerman, M.H. (2002). *Judgement in Managerial Decision Making*, 5th edition, John Wiley & Sons, Inc.

Bebchuk, L. A., Cremers, K. J. and Peyer, U. C. (2011). The CEO pay slice, *Journal of Financial Economics*, 102(1), 199-221.

Bell, R. M. and McCaffrey, D. F. (2002). Bias reduction in standard errors for linear regression with multi-stage samples, *Survey Methodology*, 28(2), 169-182.

Ben-David, I., Graham, J. R. and Harvey, C. R. (2013). Managerial Miscalibration, *Quarterly Journal of Economics*, 128(4), 1547-1584.

Bennedsen, M., Pérez-González, F. and Wolfenzon, D. (2011). Estimating the value of the boss: Evidence from CEO hospitalization events, Working Paper, INSEAD, Stanford, and Columbia University.

Bertrand, M. and Schoar, A. (2003). Managing with style: The effect of managers on firm policies, *Quarterly Journal of Economics*, 118(4), 1169-1208.

Bessler, W., Drobetz, W. and Grüninger, M.C. (2011). Information asymmetry and financing decisions, *International Review of Finance*, 11(1), 123-154.

Bharath, S. T., Pasquariello, P. and Wu, G. (2009). Does asymmetric information drive capital structure decisions?, *Review of Financial Studies*, 22, 3211-3243.

Billett, M.T. and Qian, Y. (2008). Are overconfident CEOs born or made? Evidence of self-attribution bias from frequent acquirers, *Management Science*, 54, 1037-1051.

Biorn, E. (2000). Panel data with measurement errors: Instrumental variables and GMM procedures combining levels and differences, *Econometric Reviews*, 19, 391–424.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics*, 87(1), 115-143.

Bodnaruk, A., Loughran, T. and McDonald, B. (2013). Using 10-K text to gauge financial constraints. *Social Science Research Network*.

Bollaert, H. and Petit, V. (2010). Beyond the dark side of executive psychology: current research and new directions, *European Management Journal*, 28, 362-376.

Bond, S., Hoeffler, A. and Temple, J. (2001). GMM estimation of empirical growth models, Working Paper, University of Oxford and University of Bristol.

Brennan, N. M. and Conroy, J. P. (2013). Executive hubris: the case of a bank CEO, *Accounting, Auditing & Accountability Journal*, 26(2), 172-195.

Brick, I.E. and Ravid, S.A. (1985).On the relevance of debt maturity structure, *Journal of Finance*, 40(5), 1423-1437.

Brockman, P., Li, X. and Price, S.M. (2012). Do managers put their money where their mouths are? Evidence from insider trading after conference calls, Working Paper, Lehigh University and University of Hong Kong.

Brockman, P., Martin, X. and Unlu, E. (2010). Executive compensation and the maturity structure of corporate debt, *Journal of Finance*, 65, 1123–1161.

Brown, R. and Sarma, N. (2007). CEO overconfidence, CEO dominance and corporate acquisitions, *Journal of Economics and Business*, 59(5), 358-379.

Burg, V., Scheinert, T. and Streitz, D. (2012). Corporate payout policy and managerial overconfidence, Working Paper, Humboldt-Universität zu Berlin.

Byoun, S. (2008). How and when do firms adjust their capital structures toward targets?, *Journal of Finance*, 63(6), 3069-3096.

Cadenillas, A., Cvitanić, J. and Zapatero, F. (2004). Leverage decision and manager compensation with choice of effort and volatility, *Journal of Financial Economics*, 73(1), 71-92.

Cameron, A.C. and Trivedi, P.K. (2009). *Microeconometrics Using Stata*. STATA Press.

Cameron, C. and Trivedi, P.K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press.

Campbell, T.C., Gallmeyer, M., Johnson, S.A., Rutherford, J. and Stanley, B.W. (2011). CEO optimism and forced turnover, *Journal of Financial Economics*, 101(3), 695-712.

Cao, J. (2009). CEO overconfidence or stock mispricing and growth? reexamining the effect of CEO option exercise behavior on corporate investment, Working Paper, Chinese University of Hong Kong.

Chang, X. and Dasgupta, S. (2009). Target behavior and financing: how conclusive is the evidence? *Journal of Finance*, 64(4), 1767-1796.

Chatterjee, A. and Hambrick, D.C. (2007). It's all about me: narcissism CEOs and their effects on company strategy and performance, *Administrative Science Quarterly*, 52, 351-386.

Clatworthy, M. A. and Jones, M. J. (2006). Differential patterns of textual characteristics and company performance in the chairman's statement, *Accounting, Auditing & Accountability Journal*, 19(4), 493-511.

Clatworthy, M. and Jones, M. J. (2003). Financial reporting of good news and bad news: evidence from accounting narratives, *Accounting and Business Research*, 33(3), 171-185.

Conyon, M. and Murphy, K. (2000). The prince and the pauper? CEO pay in the United States and United Kingdom, *Economic Journal*, 110, 640-71.

Conyon, M. J., Core, J. E. and Guay, W. R. (2011). Are US CEOs paid more than UK CEOs? Inferences from risk-adjusted pay, *Review of Financial Studies*, 24(2), 402-438.

Craig, R. J. and Amernic, J. H. (2011). Detecting linguistic traces of destructive narcissism at-a-distance in a CEO's letter to shareholders, *Journal of Business Ethics*, 101(4), 563-575.

Dang, V.A. (2010). Leverage, debt maturity and firm investment: An empirical analysis, *Journal of Business Finance and Accounting*, 38, 225-258.

Daniel, K., Hirshleifer, D. and Subrahmanyam, A. (1998). Investor psychology and security market under-and overreactions, *Journal of Finance*, 53, 1839-1885.

Datta, S., Iskandar-Datta, M. and Raman, K. (2001). Executive compensation and corporate acquisition decisions, *Journal of Finance*, 56(6), 2299-2336.

Datta, S., Iskandar-Datta, M. and Raman, K. (2005). Managerial stock ownership and the maturity structure of corporate debt, *Journal of Finance*, 60, 2333-2350.

Davis, A. K. and Tama-Sweet, I. S. H. O. (2012). Managers' use of language across alternative disclosure outlets: earnings press releases versus MD&A, *Contemporary Accounting Research*, 29(3), 804-837.

Davis, A.K., Ge, W., Matsumoto, D. and Zhang, L. (2012). The effect of managerial "style" on the tone of earnings conference calls, Working Paper, University of Oregon, University of Washington and University of British Columbia.

Davis, A.K., Piger, J.M. and Sedor, L.M. (2012). Beyond the numbers: measuring the information content of earnings press release language, *Contemporary Accounting Research*, 29(3), 845-868.

De Jong, A., Verbeek, M. and Verwijmeren, P. (2010). The impact of financing surpluses and large financing deficits on tests of the pecking order theory, *Financial Management*, 39(2), 733-756.

Demers, E. and Vega, C. (2011). Soft information in earnings announcements: News or noise?, Working Paper, INSEAD.

Dennis, S., Nandy, D. and Sharpe, I.G. (2000). The determinants of contract terms in bank revolving credit agreements, *Journal of Financial and Quantitative Analysis*, 35, 87-110.

Deshmukh, S., Goel, A. M. and Howe, K. M. (2013). CEO overconfidence and dividend policy, *Journal of Financial Intermediation*, 22(3), 440-463.

Devos, E., Dhillon, U., Jagannathan, M. and Krishnamurthy, S. (2012). Why are firms unlevered?, *Journal of Corporate Finance*.

Diamond, D. and Verrecchia, R. (1991). Disclosure, liquidity, and the cost of capital, *Journal of Finance*, 46(4), 1325-1355.

Diamond, D. W. and He, Z. (2014). A theory of debt maturity: the long and short of debt overhang, *Journal of Finance*, 69(2), 719-762.

Diamond, D.W. (1991). Debt maturity structure and liquidity risk, *Quarterly Journal of Economics*, 106(3), 709-737.

Donaldson, G. (1961). Corporate Debt Capacity: A Study of Corporate Debt Policy and the Determination of Corporate Debt Capacity, Boston, Division of Research, Harvard Graduate School of Business Administration.

Dong, M., Hirshleifer, D. and Teoh, S.H. (2012). Overvalued equity and financing decisions, *Review of Financial Studies*, 25(12), 3645-3683.

Doukas, J.A. and Petmezas, D. (2007). Acquisitions, overconfident managers and self-attribution bias, *European Financial Management*, 13, 531-577.

Easley, D. and O'Hara, M. (2004). Information and the cost of capital, *Journal of Finance*, 59(4), 1553-1583.

Elliot, W.B., Koeter-Kant, J. and Warr, R.S. (2007). A valuation-based test of market timing, *Journal of Corporate Finance*, 13, 112-128.

Elsas, R. and Florysiak, D. (2011). Dynamic capital structure adjustment and the impact of fractional dependent variables, Working Paper, University of Munich.

Elsas, R. and Florysiak, D. (2012). Dynamic capital structure adjustment and the impact of fractional dependent variables, Working Paper, Ludwig-Maximilians-Universität Munich.

Eshraghi, A. and Taffler, R. (2012). Fund manager overconfidence and investment performance: evidence from mutual funds, Working Paper, University of Edinburgh and Warwick Business School.

Fama, E, and K. French (2002). Testing Tradeoff and Pecking Order Predictions about Dividends and Debt, *Review of Financial Studies*, 15, 1-33.

Fama, E. F. and French, K. R. (2005). Financing decisions: who issues stock?, *Journal of Financial Economics*, 76(3), 549-582.

Fan, J.P.H., Titman, S. and Twite, G. (2012). An international comparison of capital structure and debt maturity choices, *Journal of Financial and Quantitative Analysis*, 47, 23-56.

Faulkender, M., Flannery, M.J., Hankins, K.W. and Smith, J.M. (2012). Cash flows and leverage adjustments, *Journal of Financial Economics*, 103, 632-646.

Fischhoff, B., Slovic, P. and Lichtenstein, S. (1977). Knowing with certainty: The appropriateness of extreme confidence, *Journal of Experimental Psychology: Human Perception and Performance*, 3(4), 552-564.

Flannery, M. J. and Hankins, K. W. (2013). Estimating dynamic panel models in corporate finance, *Journal of Corporate Finance*, 19(C), 1-19.

Flannery, M.J. (1986). Asymmetric information and risky debt maturity choice, *Journal of Finance*, 41(1), 19-37.

Frank, M. and Goyal, V. (2007). Corporate leverage: How much do managers really matter?, Working Paper, University of Minnesota and Hong Kong University of Science and Technology.

Frank, M. Z. and Goyal, V. K. (2009). Capital structure decisions: which factors are reliably important?, *Financial Management*, 38(1), 1-37.

Frank, M. Z. and Goyal, V. K. (2011). *Trade-off and pecking order theories of debt*, Handbook of Empirical Corporate Finance: Empirical Corporate Finance, 2, 135.

Frank, M., and Goyal, V. (2008). *Trade-off and pecking order theories of debt*, in Espen Eckbo (editor) The Handbook of Empirical Corporate Finance, Elsevier Science, Chapter 12, 135-197.

Frank, M.Z. and Goyal, V.K. (2003). Testing the pecking order theory of capital structure, *Journal of Financial Economics*, 67, 217-248.

Galasso, A. and Simcoe, T.S. (2011). CEO overconfidence and innovation, *Management Science*, 57, 1469-1484.

Garrard, P., Rentoumi, V., Lambert, C. and Owen, D. (2014). Linguistic biomarkers of hubris syndrome, *Cortex*, 55, 167-181.

Gervais, S. (2010). *Capital budgeting and other investment decisions*. Behavioral Finance: Investors, Corporations, and Markets, 413-434.

Gervais, S. and Goldstein, I. (2004). Overconfidence and team coordination, Working Paper, University of Pennsylvania.

Gervais, S. and Odean, T. (2001). Learning to be overconfident, *Review of Financial Studies*, 14(1), 1-27.

Gervais, S., Heaton, J. B. and Odean, T. (2011). Overconfidence, compensation contracts, and capital budgeting, *Journal of Finance*, 66(5), 1735-1777.

Gider, J. and Hackbarth, D. (2010). *Financing decisions*, Behavioral Finance: Investors, Corporations, and Markets, 393-412.

Glaser, M. and Weber, M. (2010). *Overconfidence*. Behavioral Finance: Investors, Corporations, and Markets, 241-258.

Glaser, M., Schafers, P. and Weber, M. (2008). Managerial optimism and corporate investment: Is the CEO alone responsible for the relation? Working Paper American Finance Association Meetings (AFA) 2008 Meetings.

Goel, A. M. and Thakor, A. V. (2008). Overconfidence, CEO selection, and corporate governance, *Journal of Finance*, 63(6), 2737-2784.

Gormley, T. A. and Matsa, D. A. (2014). Common errors: How to (and not to) control for unobserved heterogeneity, *Review of Financial Studies*, 27, 617-661.

Graham, J. R. and Harvey, C. R. (2001). The theory and practice of corporate finance: evidence from the field, *Journal of Financial Economics*, 60(2), 187-243.

Graham, J.R., Harvey, C.R. and Puri, M. (2013). Managerial attitudes and corporate actions, *Journal of Financial Economics*, 109(1), 103-121.

Gramlich, J.D., McAnally, M.L. and Thomas, J. (2001). Balance sheet management: the case of short-term obligations reclassified as long-term debt, *Journal of Accounting Research*, 39, 283-295.

Guedes, J. and Opler, T. (1996).The determinants of the maturity of corporate debt issues, *Journal of Finance*, 51, 1809-1833.

Gujarati, D.N. and Porter, D.C. (2009). *Basic Econometrics*. Fifth edition, Published by McGraw-Hill/Irwin, New York.

Hackbarth, D. (2008). Managerial traits and capital structure decisions, *Journal of Financial and Quantitative Analysis*, 43(04), 843-881.

Hackbarth, D. (2009). Determinants of corporate borrowing: A behavioral perspective, *Journal of Corporate Finance*, 15(4), 389-411.

Hall, B. and Murphy, K. (2002). Stock options for undiversified executives, *Journal of Accounting and Economics*, 33, 3-42.

Harris, M. and Raviv, A. (1991). The theory of capital structure, *Journal of Finance*, 46(1), 297-355.

Hart, O. and Moore, J. (1994). A theory of debt based on the inalienability of human capital, *Quarterly Journal of Economics*, 109, 841-79.

Hart, R.P. and Carroll, C.E. (2012). *Diction 6 (The Text Analysis Program) Help Manual*, Digitext, inc.

Hausman, J. A., and Taylor. W. E. (1981). Panel data and unobservable individual effects, *Econometrica*, 49, 1377–98.

Hayakawa, K. (2007). Small sample bias properties of the system GMM estimator in dynamic panel data models, *Economics Letters*, 95, 32-38.

Hayward, M. L. and Hambrick, D. C. (1997). Explaining the premiums paid for large acquisitions: Evidence of CEO hubris, *Administrative Science Quarterly*, 103-127.

Heaton, J. B. (2002). Managerial optimism and corporate finance, *Financial Management*, 31(2), 33-45.

Hendry, D. F. and Richard, J. F. (1983). The econometric analysis of economic time series, *International Statistical Review*, 51, 111-163.

Hennessy, C.A. and Whited, T.M. (2005). Debt dynamics, *Journal of Finance*, 60, 1129-1165.

Henry, E. (2008). Are investors influenced by how earnings press releases are written? *Journal of Business Communication*, 45(4), 363-407.

Hillary, G. and Hsu, C. (2011). Endogenous overconfidence in managerial forecasts, *Journal of Accounting and Economics*, 51(3), 300-313.

Hillier, D. J., Ross, S. A., Westerfield, R. W., Jaffe, J. and Jordan, B. D. (2010). *Corporate finance: 1st European edition* (No. 1st Edition). McGraw-Hill.

Hirshleifer, D. (2001). Investor psychology and asset pricing, *Journal of Finance*, 56, 1533-1597.

Hribar, P. and Yang, H. (2011). CEO overconfidence and management forecasting, Working Paper, University of Iowa and University of Pennsylvania.

Hsiao, C. (1986). *Analysis of Panel Data*. Cambridge: Cambridge University Press.

Hsiao, C. (2003). *Analysis of Panel Data* (Vol. 34). Cambridge University Press.

Huang, R. and Ritter, J. R. (2009). Testing theories of capital structure and estimating the speed of adjustment, *Journal of Financial and Quantitative Analysis*, 44(2), 237-271.

Huang, X., Teoh, S.H. and Zhang, Y. (2011). Tone management, Working Paper, California State University-Long Beach, University of California-Irvine and The Chinese University of Hong Kong.

Huang-Meier, W., Lambertides, N. and Steeley, J.M. (2013). Cash Hoarding and Managerial Optimism, Working Paper, Aston Business School and Cyprus University of Technology.

Hull, J. (2010). *Options, Futures, and Other Derivatives*, 7/e (With CD). Pearson Education India.

Hyland, K. (1998). Exploring corporate rhetoric: metadiscourse in the CEO's letter, *Journal of Business Communication*, 35, 224-244.

Imbens, G. W. and Kolesar, M. (2012). Robust standard errors in small samples: some practical advice, NBER Working Paper 18478.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers, *American Economic Review*, 323-329.

Jensen, M. C. and Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of Financial Economics*, 3(4), 305-360.

Jenter, D. (2005). Market timing and managerial portfolio decisions, *Journal of Finance*, 60(4), 1903-1949.

Jin, L. and Kothari, S.P. (2008). Effect of personal taxes on managers' decisions to sell their stock, *Journal of Accounting and Economics*, 46(1), 23-46.

Jiraporn, P., Chintrakarn, P. and Liu, Y. (2012). Capital structure, CEO dominance, and corporate performance, *Journal of Financial Services Research*, 42(3), 139-158.

John, K. and Lang, L. H. P. (1991). Insider trading around dividend announcements, *Journal of Finance*, 46, 1361-1389.

John, K., Kim, T. N. and Palia, D. (2012). Heterogeneous speeds of adjustment in target capital structure. Available at SSRN 2024357.

Johnson, S.A. (2003). Debt maturity and the effects of growth opportunities and liquidity risk on leverage, *Review of Financial Studies*, 16, 209-236.

Jolliffe, I. (2005). *Principal Component Analysis*. John Wiley & Sons, Ltd.

Jun, S. and Jen, F.C. (2003). Trade-off model of debt maturity structure, *Review of Quantitative Finance and Accounting*, 20, 5-34.

Kane, A., Marcus, A.J. and McDonald, R.L. (1985). Debt policy and the rate of return premium to leverage, *Journal of Financial and Quantitative Analysis*, 20, 479-499.

Karpoff, J. and Lee, D. (1991). Insider trading before new issue announcements, *Financial Management*, 20(1), 18-26.

Kayhan, A. and Titman, S. (2007). Firms' histories and their capital structures, *Journal of Financial Economics*, 83(1), 1-32.

Keiber, K.L. (2005). Managerial compensation contracts and overconfidence, Working Paper, WHU Otto Beisheim Graduate School of Management.

Kennedy, P. (2002). 'Sinning in the basement: What are the rules? The Ten Commandments of applied econometrics', *Journal of Economic Surveys*, 16(4), 569-589.

Kim, C.S., Mauer, D.C. and Stohs, M.H. (1995). Corporate debt maturity policy and investor tax-timing options: theory and evidence, *Financial Management*, 24, 33-45.

Kim, Y.H. (2011). Self-serving attribution bias and CEO turnover: evidence from CEO interviews on CNBC, Working Paper, Nanyang Business School, Singapore.

Kole, S. (1997). The complexity of compensation contracts, *Journal of Financial Economics*, 43, 79-104.

Korajczyk, R. A., Lucas, D. J. and McDonald, R. L. (1992). Equity issues with time-varying asymmetric information, *Journal of Financial and Quantitative Analysis*, 27(3), 397-417.

Kothari, S. P., Li, X., and Short, J. E. (2009). The effect of disclosures by management, analysts, and business press on cost of capital, return volatility, and analyst forecasts: A study using content analysis, *Accounting Review*, 84, 1639-1670.

Kraus, A. and Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage, *Journal of Finance*, 28(4), 911-922.

Kyriacou, K., Luintel, K.B. and Mase, B. (2010). Private information in executive stock option trades: evidence of insider trading in the UK, *Economica*, 77, 751-774.

Landier, A. and Thesmar, D. (2009). Financial contracting with optimistic entrepreneurs, *Review of Financial Studies*, 22(1), 117-150.

Lang, M.H. and Lundholm, R.J. (2000). Voluntary disclosure and equity offerings: reducing information asymmetry or hyping the stock?, *Contemporary Accounting Research*, 17(4), 623-662.

Langer, E. J. (1975). The illusion of control, *Journal of Personality and Social Psychology*, 32(2), 311-328.

Larwood, L. and Whittaker, W. (1977). Managerial myopia: Self-serving biases in organizational planning, *Journal of Applied Psychology*, 62, 194-198.

Laibson, D. (1997). Golden eggs and hyperbolic discounting, *Quarterly Journal of Economics*, 443-477.

Leary, M.T. and Roberts, M.R. (2010). The pecking order, debt capacity, and information asymmetry, *Journal of Financial Economics*, 95, 332-355.

Lee, D. S., Mikkelson, W. H. and Partch, M. M. (1992). Managers' trading around stock repurchases, *Journal of Finance*, 47(5), 1947-1962.

Lemmon, M.L. and Zender, J.F. (2010). Debt capacity and tests of capital structure theories, *Journal of Financial and Quantitative Analysis*, 45(5), 1161-1187.

Lewis, C.W. (1990). A multiperiod theory of corporate financial policy under taxation, *Journal of Financial and Quantitative Analysis*, 25, 25-44.

Li, F. (2010). Textual analysis of corporate disclosures: a survey of the literature, *Journal of Accounting Literature*, 29, 143-165.

Li, F. (2010a). Managers' self-serving attribution bias and corporate financial policies, Working Paper, University of Michigan.

Li, F. (2010a). Textual analysis of corporate disclosures: a survey of the literature, *Journal of Accounting Literature*, 29, 143-165.

Li, F. (2010b). The information content of forward-looking statements in corporate filings-a naïve bayesian machine learning approach, *Journal of Accounting Research*, 48(5), 1049-1102.

Li, F., Minnis, M., Nagar, V. and Rajan, M. (2009). Formal and real authority in organizations: an empirical assessment. Unpublished working paper.

Lin, Y. H., Hu, S. Y. and Chen, M. S. (2005). Managerial optimism and corporate investment: Some empirical evidence from Taiwan, *Pacific-Basin Finance Journal*, 13(5), 523-546.

Lin, Y. H., Hu, S. Y. and Chen, M. S. (2008). Testing pecking order prediction from the viewpoint of managerial optimism: Some empirical evidence from Taiwan, *Pacific-Basin Finance Journal*, 16(1), 160-181.

Liu, Y., Taffler, R. and John, K. (2009). CEO Value Destruction in M&A Deals and Beyond, Working Paper, University of Edinburgh and New York University.

Loughran, T. and McDonald, B. (2011). When Is a Liability Not a Liability? Textual Analysis, Dictionaries, and 10-Ks, *Journal of Finance*, 66(1), 35-65.

Lowe, W. (2002). *Software for content analysis–A review*. Cambridge: Weatherhead Center for International Affairs and the Harvard Identity Project.

Lucas, D. and McDonald, R. (1990). Equity issues and stock price dynamics, *Journal of Finance*, 45, 1020-43.

Malmendier, U. and Tate, G. (2005). CEO overconfidence and corporate investment, *Journal of Finance*, 60(6), 2661-2700.

Malmendier, U. and Tate, G. (2005a). Does overconfidence affect corporate investment? CEO overconfidence measures revisited, *European Financial Management*, 11, 649-659.

Malmendier, U. and Tate, G. (2005b). CEO overconfidence and corporate investment, *Journal of Finance*, 60, 2661-2700.

Malmendier, U. and Tate, G. (2008). Who makes acquisitions? CEO overconfidence and the market's reaction, *Journal of Financial Economics*, 89, 20-43.

Malmendier, U. and Zheng, H. (2012). Managerial duties and managerial biases, Working Paper, University of California, Berkeley.

Malmendier, U., Tate, G. and Yan, J. (2011). Overconfidence and early-life experiences: the effect of managerial traits on corporate financial policies, *Journal of Finance*, 66(5), 1687-1733.

Marciukaityte, D. and Szewczyk, S.H. (2011). Financing decisions and discretionary accruals: managerial manipulation or managerial overoptimism, *Review of Behavioral Finance*, 3(2), 91-114.

McKinnish, T. (2008). Panel data models and transitory fluctuations in the explanatory variable In Modeling and evaluating treatment effects in econometrics, eds. Daniel L. Millimet, Jeffrey A. Smith, and Edward J. Vytlacil, 335–58. Amsterdam: Elsevier.

Merkl-Davies, D. M. and Brennan, N. M. (2007). Discretionary disclosure strategies in corporate narratives: incremental information or impression management?, *Journal of Accounting Literature*, 26, 116-196.

Merkl-Davies, D.M., and Brennan, N.M. (2011). A conceptual framework of impression management: new insights from psychology, sociology and critical perspectives, *Accounting and Business Research*, 41(5), 415-437.

Miller, D. T. and Ross, M. (1975). Self-serving biases in the attribution of causality: Fact or fiction?, *Psychological Bulletin*, 82(2), 213-225.

Mitchell, K. (1993). The debt maturity choice: an empirical investigation, *Journal of Financial Research*, 16, 309-320.

Modigliani, F. and Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment, *American Economic Review*, 48(3), 261-297.

Modigliani, F. and Miller, M. H. (1963). Corporate income taxes and the cost of capital: A correction, *American Economic Review*, 53, 433-443.

Moore, D. A. and Healy, P. J. (2008). The trouble with overconfidence, *Psychological Review*, 115(2), 502-517.

Myers, S. (2003). *Financing of corporations*. In: Constantinides, G., Harris, M. (Eds.), Handbook of the Economics of Finance. Elsevier, Am- sterdam, 215–254.

Myers, S. C. (1977). *Determinants of corporate borrowing, Journal of Financial Economics*, 5(2), 147-175.

Myers, S. C. and Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics*, 13(2), 187-221.

Myers, S.C. (1984). The capital structure puzzle, *Journal of Finance*, 39(3), 575-592.

Myers, S.C. (2001). Capital structure, *Journal of Economic Perspectives*, 15(2), 81-102.

Nickell, S. (1981). Biases in dynamic models with fixed effects, *Econometrica*, 49(6), 1417-1426.

Osma, B. G. and Guillamón-Saorín, E. (2011). Corporate governance and impression management in annual results press releases, *Accounting, Organizations and Society*, 36(4), 187-208.

Ozkan, A. (2000). An empirical analysis of corporate debt maturity structure, *European Financial Management*, 6(2), 197-212.

Paredes, T. (2004). Too much pay, too much deference: is CEO overconfidence the product of corporate governance, Working Paper, Washington University School of Law.

Pennebaker, J. W., Chung, C. K., Ireland, M., Gonzales, A. and Booth, R. J. (2007). *The development and psychometric properties of LIWC2007*, LIWC. net.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches, *Review of Financial Studies*, 22, 435-480.

Plous, S. (1993). *The Psychology of Judgment and Decision Making*. Mcgraw-Hill Book Company.

Price, S. M., Doran, J. S., Peterson, D. R. and Bliss, B. A. (2012). Earnings conference calls and stock returns: The incremental informativeness of textual tone, *Journal of Banking and Finance*, 36(4), 992-1011.

Reed, W. R. (2013). On the practice of lagging variables to avoid simultaneity, Working Paper, University of Canterbury.

Roberts, M. and Whited, T. (2012). Endogeneity in empirical corporate finance, Working Paper, University of Pennsylvania and University of Rochester.

Rogers, J. L., Skinner, D. J. and Van Buskirk, A. (2009). Earnings guidance and market uncertainty, *Journal of Accounting and Economics*, 48(1), 90-109.

Rogers, J. L., Van Buskirk, A. and Zechman, S. L. (2011). Disclosure tone and shareholder litigation, *Accounting Review*, 86(6), 2155-2183.

Roll, R. (1986). The hubris hypothesis of corporate takeovers, *Journal of Business*, 197-216.

Roodman, D. (2009). A note on the theme of too many instruments, *Oxford Bulletin of Economics and Statistics*, 71(1), 135-158.

Rosenthal, S.A. and Pittinsky, T.L. (2006). Narcissistic personality, *The Leadership Quarterly*, 17, 617-633.

Scheier, M. F., Carver, C. S. and Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test, *Journal of Personality and Social Psychology*, 67, 1063.

Schleicher, T. and Walker, M. (2010). Bias in the tone of forward-looking narratives, *Accounting and Business Research*, 40(4), 371-390.

Schrand, C.M. and Zechman, S.L.C. (2011). Executive overconfidence and the slippery slope to financial misreporting, *Journal of Accounting and Economics*, forthcoming.

Seifert B. and Gonenc, H. (2010). Pecking order behavior in emerging markets, *Journal of International Financial Management and Accounting*, 21(1), 1-31.

Shefrin, H. (2007). *Behavioral Corporate Finance – Decisions that Create Value*, McGraw-Hill/Irwin Series in Finance, Insurance, and Real Est.

Shefrin, H. (2010). *Behavioralizing finance*, Foundations and Trends® in Finance, 4(1-2), 1-184.

Shyam-Sunder, L. and C Myers, S. (1999). Testing static tradeoff against pecking order models of capital structure, *Journal of Financial Economics*, 51(2), 219-244.

Simon, H.A. (1955). A behavioral model of rational choice, *Quarterly Journal of Economics*, 69(1), 99-118.

Simon, H.A. (1957). *Models of man: social and rational; mathematical essays on rational human behavior in society setting*. Wiley.

Smith, M. and Taffler, R. J. (2000). The chairman's statement-A content analysis of discretionary narrative disclosures, *Accounting, Auditing & Accountability Journal*, 13(5), 624-647.

Stata (2009). *Stata Longitudinal Data/Panel Data Reference Manual*, Stata Press, College Station, TX: StataCorp LP.

Staw, B.M., McKechnie, P.I. and Puffer, S.M. (1983). The justification of organizational performance, *Administrative Science Quarterly*, 28(4), 582-600.

Stiglitz, J. (1973). Taxation, corporate financial policy and the cost of capital, *Journal of Public Economics*, 2, 1-34.

Stock, J. H. and Watson, M. W. (2003). *Introduction to Econometrics* (Vol. 104), Boston: Addison Wesley.

Stohs, M.H. and Mauer, D.C. (1996). The determinants of corporate debt maturity structure, *Journal of Business*, 69, 279-312.

Strebulaev, I.A. and Yang, B. (2013). The mystery of zero-leverage firms, *Journal of Financial Economics*

Svenson, O. (1981). Are we all less risky and more skillful than our fellow drivers?, *Acta Psychologica*, 47(2), 143-148.

Taylor, S. E. and Brown, J. D. (1988). Illusion and well-being: a social psychological perspective on mental health, *Psychological Bulletin*, 103(2), 193-210.

Tett, G. (2013, September 23). Science can help to spot symptoms of executive hubris, *Financial Times*, Retrieved from http://www.ft.com

Titman, S. (1984). The effect of capital structure on a firm's liquidation decision, *Journal of Financial Economics*, 13, 137-151.

Titman, S. and Wessels, R. (1988). The determinants of capital structure choice, *Journal of Finance*, 43, 1-19.

Tobin, J. (1958). Estimation of relationships for limited dependent variables, *Econometrica*, 26 (1), 24-36.

Tversky, A. and Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases, *Science*, 185(4157), 1124-1131.

Warr, R. S., Elliott, W. B., Koëter-Kant, J. and Öztekin, Ö. (2012). Equity mispricing and leverage adjustment costs, *Journal of Financial and Quantitative Analysis*, 47(3), 589-616.

Weinstein, N. D. (1980). Unrealistic optimism about future life events, *Journal of Personality and Social Psychology*, 39(5), 806-820.

Welch, I. (2006). Common flaws in empirical capital structure research, Mimeo, Brown University.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators, *Journal of Econometrics*, 126, 25-51.

Wintoki, M. B., Linck, J. S. and Netter, J. M. (2012). Endogeneity and the dynamics of internal corporate governance, *Journal of Financial Economics*, 105(3), 581-606.

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*, The MIT press.

Wooldridge, J. M. (2009). *Introductory Econometrics: A Modern Approach*. Cengage Learning. Inc. USA.

Wooldridge, J.M. (2001). Applications of generalized method of moments estimation, *Journal of Economic Perspectives*, 15, 87-100.