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On corruption and decentralized economies

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On Corruption and Institutions in Decentralized Economies

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Abstract. This paper studies opportunistic behaviour in a model of decentralized economic exchange and inadequate institutional framework of formal contract enforcement. It is shown that (i) when the number of cheating traders is sufficiently large, inadequate institutions (e.g. due to insufficient legal provisions and/or ineffective enforcement of existing laws) result in a loss of decentralized trading contracts which suggests yet another explanation of the output fall puzzle of the recent transition experience; (ii) while being necessary for the attainment of a Pareto optimal outcome, an adequate institutional framework may not be sufficient if traders *perceive* it as inadequate; and (iii) in the presence of adequate institutional framework, even if enforcers are corrupt contractual breach is deterred when enforcers enjoy strong bargaining power. The results suggest that institutions of formal contract enforcement have a first order effect on the success of liberalization in the economy with a high level of corruption.

Keywords: Formal contract enforcement, corruption, transition economies.

JEL C70, D82, K42

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'We are being asked to solve complex equations in multiple unknowns without so much as a multiplication table to guide us.'
Veniamin Iakovlev, Chairman of the Higher Commercial Court of the Russian Federation.[1]

1 Introduction

This paper puts forward a simple framework for analysing the impact of institutions on the implementation of reforms in the formerly planned economies of Central and Eastern Europe (CEE). The institution under study is formal contract enforcement which is widely regarded as an important ingredient of well-functioning markets. In the model I construct, an economic exchange is subject to opportunistic behaviour and may be undertaken in one of two sectors, labelled as 'state' and 'market'. The two sectors differ in their trading potential as well as the effectiveness of contract enforcement. Trade in the state sector is less efficient than in the market (when measured in terms of an achievable trade surplus), but the state contract enforcement is more effective in curtailing opportunistic behaviour. In contrast, the market sector is able to deliver a higher trade surplus, but due to the less effective deterrence of opportunistic behaviour, the higher trade surplus may fail to materialize.

The simple model presented here advances our understanding of salient facts about transition.[2] Firstly, the analysis suggests that adequate institutional framework—specifically, effective contract enforcement which ensures a sufficiently high probability of punishment for contractual breach—is conducive to achieving a Pareto optimal outcome. Alternatively, inadequate formal enforcement of contracts is shown to lead to a loss of decentralized trading contracts, thus suggesting yet another explanation of the output fall puzzle observed in the initial years of post-communist transition. Viewed from this perspective, the present work relates to Blanchard and Kremer (1997) and Roland and Verdier (1999) which explain the output fall following decentralization of productive chains with strong technological complementarities as resulting from inefficient bargaining (Blanchard and Kremer 1997) or capital

[1] *Izvestiia*, July 3 1993, *cit op* Gustafson (1999, p. 151).

[2] The initial debate in transition economics focused on the trade-off between the big-bang versus gradualist approach to reforms in the presence of political constraints, uncertainty, reform complementarities, as well as differing initial conditions. See Murphy, Shleifer and Vishny (1992), Dewatripont and Roland (1992), and Blanchard (1997) for a flavour of the debate; and Roland (2000) for a comprehensive summary of theoretical and applied research in transition economics.

depreciation and delays due to search for more efficient partners (Roland and Verdier 1999). In the present paper, the explanation of the output fall derives from inadequate contract enforcement, thereby emphasizing informational and legal factors, as opposed to technological ones.

Secondly, and perhaps surprisingly, good enforcement *per se* may not be sufficient: agents' perceptions of the inadequacy of the legal system may force the reforming economy into an inferior equilibrium even when the level of enforcement is relatively high. The stylised setting in this paper identifies two possible scenarios in which the perception of the inadequacy of the legal system will determine the equilibrium outcome. In the first scenario, the enforcement technology may exhibit a negative enforcement externality: the higher the proportion of non-complying agents the more difficult it is to detect non-compliance. In such a case, the perception of a legal void leads to the highest level of undeterred opportunistic behaviour in the economy which, if combined with a large number of opportunists, forces honest agents to avoid the market altogether. The higher the enforcement externality, the higher the level of enforcement required to achieve a Pareto optimal outcome. For a sufficiently high enforcement externality, the perception of legal inadequacy is most damaging: even the most extensive legal provisions will not suffice to achieve the good equilibrium, because the fixed resources devoted to enforcement are spread too thinly for the number of non-complying agents. The enforcement externality scenario is analysed under the assumption of an exogenously fixed market contract price. An alternative scenario has a 'lemons' problem (Akerlof 1970) and arises when the price is endogenously determined by the demand for market contracts in the presence of a large number of cheating contractual partners. In this alternative scenario, asymmetric information regarding the type of a contractual partner (honest or opportunistic supplier) affects the market contract price. When one party to the contract, the buyer, believes that opportunistic behaviour in the market is rampant, the market contract price at which the buyer is willing to trade may be too low to cover the honest suppliers' cost of honouring the contract. With honest suppliers' being driven out of contracting, the market falls apart because of the buyers' certainty to be dealing with breaching suppliers.

These predictions are in line with observed economic and institutional performance in CEE over the last decade. Countries where a relatively good legal and other institutional infrastructure is perceived by the economic actors as adequate (e.g. the Czech Republic, Hungary, Poland and Estonia) tend to have a high degree of success with liberalization

and reforms (EBRD 1999, IMF 2000). At the same time, countries with a perception of legal inadequacy tend to have less stable economic environment and an unsatisfactory progress with reforms. Russia provides the most striking example: despite relatively high measures of economic liberalization, the perceived inadequacy of extensive legal provisions—which in 1998 according to the EBRD legal transition index measured 3.7 for extensiveness but only 2 for effectiveness, on the scale of 1 (worst) to 4 (best)—is an important factor behind the negative growth rates and the epidemic of crime in the late 1990s (EBRD 1999, pp. 260–1).[3] The analysis therefore suggests that some of the government's reform effort in transition should be directed towards both improving the adequacy as well as the perception of adequacy of the legal system to support markets. *Political centralization* to aid smooth economic *de*centralization, as suggested in Blanchard and Shleifer (2001), is then a natural channel, in view of the model presented here, for achieving better perception of legal effectiveness, since the central government is a provider of the basic institutional environment.[4]

Finally, observers of the transition experience agree that wide-spread, and in some cases endemic, corruption played a critical role when reform efforts in Eastern Europe were deemed unsatisfactory.[5] I therefore supplement the analysis of contract enforcement in a decentralized setting with a study of corruption.[6] The findings presented here suggest that, other things equal, a Pareto optimal outcome is more difficult to achieve when enforcers are corruptible. In such a case, the strong enforcement of contracts must be complemented with a high enough number of honest enforcers, for the good equilibrium to exist. The analysis also uncovers the following surprising but intuitive result: when all enforcers are corrupt and enjoy a strong bargaining power, but the enforcement institution itself is relatively effective in terms of a sufficiently high probability of breach detection, the Pareto optimal outcome

[3]Ironically, one study found that 'statutory legal protections in Russia, which were much lower than the world average in 1992, were some of the world's highest by 1998' (World Bank 2002, p. 64).

[4]Other channels to improve perceptions of institutional quality, actively promoted in World Bank (2002), include better transparency and accountability of courts, improved dissemination of information about recently enacted laws, training of law enforcers, and anti-corruption measures.

[5]This is the grabbing-hand paradigm of the state involvement in the economy (Frye and Shleifer 1997).

[6]The present paper's modelling of corruption as bribery is standard in the literature: see for instance, Shleifer and Vishny (1993), Bardhan (1997), and Johnson, Kaufmann, McMillan and Woodruff (2000). Acemoglu and Verdier (1998) analyze simultaneous determination of corruption, property rights enforcement, and investment in a model which leaves out considerations of economic decentralization.

exists as a unique equilibrium. In such a case, the opportunistic behaviour of suppliers is deterred because it is cheaper to honour the contract than engage in a bribing game with a corrupt enforcer. The analysis therefore suggests that strong institutions (e.g. adequate legal framework for a smooth functioning of markets) have an even greater importance in the economy with a high corruption level.[7]

The rest of the paper is organised as follows. The next section provides a discussion of the relevant literature. Section 2 introduces the model and discusses its assumptions. The analysis of the model is contained in section 3. The analysis of the benchmark case (with fixed market contract price) in subsection 3.1 is followed by the study of endogenous enforcement technology in subsection 3.2 and corruptibility of enforcers in subsection 3.3. The implications of endogenously determined market contract price are analysed in subsection 3.4. Concluding discussion is supplied in section 4, while Appendix contains all the proofs.

2 Model

There are two equally sized large populations of risk-neutral players: buyers and sellers. In a one shot game, a buyer and a seller negotiate a contract $(z, p(z))$ whereby the seller agrees to deliver one unit of a product embodying a specified value of a quality parameter, $z \geq 0$, and the buyer agrees to pay the price $p(z) \geq 0$ up front.[8] The net value that the buyer obtains from the product is given by $U = z - p(z)$. Provision of quality costs $c(z) \geq 0$ to the seller who gains $V = p(z) - c(z)$ if the contract is agreed. Three levels of quality are considered: high ($z = \bar{z}$), mediocre ($z = \underline{z}$), and low ($z = 0$), with $\bar{z} > \underline{z} > 0$. The corresponding costs and prices are: $c(\bar{z}) = \bar{c}$, $c(\underline{z}) = \underline{c}$, $c(0) = 0$, with $\bar{c} > \underline{c} > 0$; and $p(\bar{z}) = \bar{p}$, $p(\underline{z}) = \underline{p}$, $p(0) = 0$. Also, $\bar{z} > \bar{c}$ and $\underline{z} > \underline{c}$, so that signing a contract for quality $z > 0$ is worthwhile ex ante. Each player can only sign one contract. The outside options of buyers and sellers are normalised to zero.

All buyers are homogeneous. The population of sellers contains two types: opportunistic

[7] This analysis is also of relevance to the debate about public versus private ownership. The 'economy' in the model could be interpreted as a sector of the economy (e.g. health or education), with a part of the sector operating in the 'planned' (or directed) regime and the other part operating in a free market regime. The model proposed here could therefore be useful for understanding the role of law enforcement or regulation in combatting fraud and opportunism in the provision of health care, education, and pensions.

[8] A contractual breach by the buyer (i.e. non-payment upon delivery) is thus excluded from the analysis.

in proportion $\gamma \in (0,1)$ and honest in proportion $1-\gamma$. The seller's type is his private information. An honest seller never fails to honour the contract (say, due to a large 'psychic' cost of breaking promises), while an opportunist chooses whether to abide by the contract depending on the extent of contract enforcement.[9] A contract is breached if the seller fails to deliver the contracted quality.

The economy is divided into two (productive) sectors: the market (or decentralized) sector of size $\mu \in (0,1)$, and the state (or centralized) sector of size $1-\mu$. The assignment of a seller to a sector is random, while buyers can choose the sector in which to trade. The two sectors (subscripted m and s) are distinguished by the following two factors. Firstly, the levels of quality contractible in each sector are $z_m = \{\bar{z}, 0\}$ and $z_s = \{\underline{z}, 0\}$. The assumption captures the idea that the sellers operating in the state sector cannot beat the market sellers in the level of contractible product quality (for $z > 0$) due to, say additional costs of bureaucratic procedures on writing contracts in the state sector (or other deficiencies imposed by centralized information processing). Furthermore, $\bar{z}-\bar{c} > \underline{z}-\underline{c}$, so that (ignoring the problem of enforcement) a total trading surplus from a market contract is higher than that from a state contract.

The second factor which distinguishes the two sectors is the effectiveness of contract enforcement. Enforcement in the state sector is certain and facilitated by *specific performance*: the breaching party is forced to do exactly as the contract specifies. In contrast, enforcement in the market sector is uncertain and enacted by means of *reliance damages*: with probability $\lambda \in (0,1)$ the buyer receives from the breaching seller a monetary payment, $d > 0$, which makes the buyer as well off as if there had been no contract. These assumptions are motivated as follows. The sector with a high degree of centralization relies on commands in enforcement of contracts, as well as in undertaking of economic activity (Kroll 1987, Pistor 1996). Certainty of enforcement in the state sector, as opposed to its uncertainty in the market sector, reflects the observation that in a formerly planned economy the state sector legal provisions are highly developed and well understood, while those necessary for emerging markets are patchy, inadequate, and confusing (Gray 1993, Pistor 1996, Rubin

[9]The distinction between 'honest' and 'opportunistic' suppliers captures dynamic reputational considerations which are not explicitly modelled in this static framework. A non-myopic ('honest') seller's concern for the future forces it to honour all its contracts in expectation of continued custom by its existing buyers, while a myopic ('opportunistic') seller has no concern for the future.

1997, EBRD 1999).[10] Additionally, it is assumed that (i) enforcement is invoked immediately after the contractual breach, (ii) litigation costs are zero, and (iii) dispute resolution is instantaneous.[11]

The timing of the game is as follows.

(1) Nature determines the type of every seller and assigns every seller to a sector.

(2) Each buyer chooses the sector in which to purchase the product.[12]

(3) A buyer and a seller negotiate a contract. If they fail to agree, then each gets his outside option of 0. If the contract $(\tilde{z}, p(\tilde{z}))$ is agreed, the buyer pays $p(\tilde{z})$.

(4) The seller delivers the product of quality z.

(5) If a contract breach has occurred (i.e. if $z \neq \tilde{z}$), then the contract $(\tilde{z}, p(\tilde{z}))$ is enforced as follows: specific performance is enacted with probability 1 in the state sector, or a reliance damage measure is applied with probability λ in the market sector.

(6) Payoffs are realized.

3 Analysis

Given the sequential nature of the game, the appropriate solution method is backward induction: having determined the best strategy for the quality choice by an opportunistic seller in each sector at stage 4, I consider the buyers' best strategy for their choice of the contract at stage 3 and their choice of the sector at stage 2 given sellers' choice at stage 4. Costly provision of quality implies that the equilibrium quality in this setting will be determined by the proportion of opportunistic sellers and the extent of the formal contract enforcement.

The benchmark case, presented in section 3.1, is analysed assuming that the market contract price for quality $\bar{z}$ is fixed somehow between the value of $\bar{z}$ $(= \bar{z})$ to the buyer and

[10] $\lambda < 1$ can also represent the extent to which judiciary is unpredictable in resolving private disputes, or the information necessary for remedying the breach is partly verifiable.

[11] Assumptions (i) and (iii) are ruled out by the one-shot nature of the model. Incorporation of a positive litigation cost (relaxation of (ii)) is not expected to change the model's qualitative results.

[12] This could result in an excess demand for a given sector, e.g. when the market contract price is sticky. This consideration is dealt with in the analysis of section 3.1 below.

the cost of $\bar{z}$ (which is given by $\bar{c}$) to the seller. Fixed price may arise, for instance, when sellers have 'menu-costs'. With the fixed price, the benchmark predicts that inadequate enforcement will lead to a lower welfare in the economy undergoing decentralisation. Subsequent sections introduce various modifications into the basic model of 3.1. Section 3.2 endogenizes the enforcement technology in a way that introduces a negative enforcement externality. This modification leads to multiple equilibria in contrast to the uniquely determined equilibrium (of one of three different types) which is obtained in the benchmark case. The modification in section 3.3 allows corruption in the enforcement of market contracts: the probability of enforcement is then lower than in the benchmark case because of corruptibility of enforcers. Compared to the predictions of the benchmark case, the analysis in 3.3 suggests that corruption makes it harder to achieve a Pareto optimal outcome, except in one special case (when corruptible enforcers have strong bargaining power). The last modification in section 3.4 relaxes the assumption of fixed market contract price, which is maintained in sections 3.1–3.3, by analysing determination of the negotiated market contract price in the environment where a buyer's valuation of the market contract reflects the expected level of quality. This modification is shown to lead to multiple equilibria, which arise due to asymmetric information about market seller's type. All analysis is restricted to pure strategies.

3.1 Benchmark case

When provision of quality is costly, an opportunistic seller in either sector prefers to supply a lower level of quality than contracted upon. Perfect contract enforcement in the state sector, however, forces opportunistic sellers to abide by the contractual terms and thus guarantees that the medium level of quality $\underline{z}$ contractible in the state sector is delivered. Consequently, perfect enforcement implies that the buyer will optimally choose contract $(\underline{z}, \underline{p})$. The payoffs to the buyer and either type of seller are:

$$U_s(\underline{z}) = \underline{z} - \underline{p} \qquad \text{and} \qquad V_s(\underline{z}) = \underline{p} - \underline{c}. \tag{1}$$

It is reasonable to suppose that the planner will fix the state contract price for quality $\underline{z}$ at the level which is between the seller's cost and the buyer's valuation of quality $\underline{z}$:

Assumption 1 $\qquad \underline{c} < \underline{p} < \underline{z}.$ (A1)

Now consider contracting under imperfect market contract enforcement. Let the price in the market be fixed at some exogenous level as follows:

Assumption 2 $$p(\bar{z}) = \hat{p}, \quad \textit{and} \quad \bar{c} < \hat{p} < \bar{z}. \tag{A2}$$

Also let $q = \{0, 1\}$ denote the probability that an opportunistic seller will comply with his contract $(\bar{z}, \hat{p})$. Under the enforcement regime λ with the reliance damage measure $d = \hat{p}$, the expected payoffs to the buyer and each type of seller, superscripted by γ and $1-\gamma$, are:

$$U_m(\bar{z}, \lambda) = [1 - \gamma(1-q)] \cdot \bar{z} - [1 - \lambda\gamma(1-q)] \cdot \hat{p}, \tag{2}$$

$$V_m^{\gamma}(\bar{z}, \lambda) = [1 - \lambda(1-q)] \cdot \hat{p} - q \cdot \bar{c}, \tag{3}$$

$$V_m^{1-\gamma}(\bar{z}, \lambda) = \hat{p} - \bar{c}, \tag{4}$$

if contract $(\bar{z}, \hat{p})$ is agreed, or 0 otherwise. (If the buyer and the seller fail to agree on $\hat{p}$, it is implicitly assumed that taking her outside option is more attractive to the buyer than contracting for $z = 0$.)[13] In the above, q is set by the opportunistic seller so that (3) is maximised. Given the sellers' payoff-maximising value of q, the buyer expects to obtain $\bar{z}$ in all cases except when she is matched with a breaching opportunistic seller (with probability $\gamma(1-q)$) and she expects to pay the price $\hat{p}$ up front unless the breached contract is enforced (with probability $\lambda\gamma(1-q)$). An honest seller complies with his contract $(\bar{z}, \hat{p})$, and thus expects the payoff given by (4). An opportunistic seller expects to retain the up front payment $\hat{p}$ unless his breach is enforced (with probability $\lambda(1-q)$), while he expects to incur the cost of supplying high quality only if he complies (with probability q). In deciding whether to contract or take her outside option when in the market sector, the buyer takes into account the sellers' optimal choice of q and chooses the larger of the two payoffs: $U_m(\bar{z}, \lambda \mid q)$ or 0.

In order to analyse each buyer's equilibrium choice of a sector, I introduce the following additional notation. Let $f \in [0, 1]$ be the fraction of buyers who choose the market sector and $\beta \in [0, 1]$ be the probability that a given buyer chooses the market sector. Separate notation for the equilibrium choice of all buyers (f) as opposed to the choice of an individual buyer (β) allows to check whether an individual deviation from the equilibrium behaviour is profitable. In deciding on her choice of the sector, each buyer will attempt to go to

[13] This can be justified by assuming that signing a contract involves a small cost. It is clear that an incorporation of this cost into the analysis will not change the results.

the sector that gives her the largest expected payoff. However, the assumption of a single contract per seller implies that the success of a buyer in contracting in her preferred sector is determined by the size of the sector and the proportion of buyers who choose that sector. With the fixed market contract price, there is likely to be an excess demand for one of the two sectors. Whether the excess demand is a feature of the equilibrium in the setting with a fixed market contract price will depend on the assumption made about contracting possibilities of buyers who were not successful in obtaining a contract in their preferred sector. Formally, assume that:

Assumption 3

The buyer who is not successful in obtaining a contract in her preferred sector has the opportunity to contract in the other sector. (A3)

(A3) states that excess demand for a given sector is absorbed by the other sector. This seems to be a reasonable assumption for a setting in which the price is sticky and cannot adjust in response to excess demand. (At the end of this section I briefly discuss the implications of reversing this assumption and allowing excess demand in equilibrium.)

Assuming (A3), the buyer's problem of sector choice at stage 2 is stated as follows:

$$\max_{\beta} \quad \left[\beta \cdot \left(\min\left\{\frac{\mu}{f};1\right\} \cdot \max\left\{0,U_m\right\} + \left(1-\min\left\{\frac{\mu}{f};1\right\}\right) \cdot U_s\right) + \right.$$
$$\left. + (1-\beta) \cdot \left(\min\left\{\frac{1-\mu}{1-f};1\right\} \cdot U_s + \left(1-\min\left\{\frac{1-\mu}{1-f};1\right\}\right) \cdot \max\left\{0,U_m\right\}\right)\right]. \qquad (5)$$

When f buyers choose the market sector, the individual choice of a buyer is determined by comparing her ex ante expected payoff from the market sector (factored by β in (5) above) and her ex ante expected payoff from the state sector (factored by $1-\beta$). If the buyer chooses to go to the market sector (with probability β), given the fraction of buyers who prefer market (f), then the buyer expects to succeed in finding a contractual partner with probability μ/f for $\mu < f$, or with certainty for $\mu \geq f$. The two conditional probabilities form factor $\min\{\mu/f;1\}$ of the first term in the first round bracket in (5). The second factor in this term reflects the buyer's two possibilities: going ahead with the market contract if $U_m > 0$, or taking her outside option otherwise. Should the buyer fail to find a contractual partner in the market (with probability $1-\min\{\mu/f;1\}$), she has the opportunity to contract in the state sector and obtain U_s.

If the buyer chooses to go to the state sector instead (with probability $1-\beta$), while the fraction of the buyers who prefer the state sector is $1-f$, then the buyer expects to succeed in finding a contractual partner in the state sector, and hence to get the payoff of U_s, with probability $(1-\mu)/(1-f)$ for $1-\mu < 1-f$, or with certainty for $1-\mu \geq 1-f$. As before, the two conditional probabilities form factor $\min\{(1-\mu)/(1-f); 1\}$ of the first term in the second round bracket. If, having chosen the state sector, the buyer fails to find a contractual partner in the state sector (with probability $1-\min\{(1-\mu)/(1-f); 1\}$), the buyer could go to the market sector where she will be choosing between the greater of the two values: U_m and 0.

Consider possible equilibria of the sequential game. It is noted above that opportunistic sellers in the market may choose to breach ($q=0$) or honour ($q=1$) their contract for quality $\bar{z}$. Also, seller of either type prefers contracting to no contracting by assumption. Buyers who end up in the state sector prefer contracting for $\underline{z}$ to their outside option since $U_s(\underline{z}) > 0$ under the perfect enforcement of state sector contracts. Buyers who end up in the market sector prefer contracting for $\bar{z}$ to their outside option if $U_m(\bar{z}, \lambda \mid q) > 0$, or take their outside option if $U_m(\bar{z}, \lambda \mid q) \leq 0$. Under assumption (A3), we therefore have

TABLE 1: *Description of equilibria (with absorbed excess demand).*

Equilibrium		*Contracting in which sector?*	*Economy trade surplus*
Strong enforcement (SE)	$q=1$	state and market	$(1-\mu)(\underline{z}-\underline{c})+\mu(\bar{z}-\bar{c})$
Intermediate enforcement (IE)	$q=0$	state and market	$(1-\mu)(\underline{z}-\underline{c})+\mu(1-\gamma)(\bar{z}-\bar{c})$
Weak enforcement (WE)	$q=0$	state only	$(1-\mu)(\underline{z}-\underline{c})$

three candidates for equilibria in this game and these are listed in Table 1. Which of these surpluses are attained is given in Proposition 1 below.

Proposition 1 *Assume (A1)–(A3), and let* $\hat{\lambda} \equiv [\hat{p} - (1-\gamma)\bar{z}]/(\gamma\hat{p})$. *There exists a unique equilibrium of the game and it is*

(i) SE *if* $\lambda > \bar{c}/\hat{p}$,

(ii) IE *if* $\hat{\lambda} < \lambda \leq \bar{c}/\hat{p}$ *and* $\gamma < \frac{\bar{z}-\hat{p}}{\bar{z}-\bar{c}}$, *or*

(iii) WE *if* $\lambda \leq \min\left\{\hat{\lambda}; \bar{c}/\hat{p}\right\}$.

The intuition behind the proposition is straightforward. A sufficiently high probability of formal contract enforcement (case 1i) forces opportunistic sellers to comply with the terms of their contract thus making it attractive for the buyers in the market to contract for quality $\bar{z}$. For a given size of the sector and assuming (A3), all beneficial trades are realized in the entire economy. In contrast, a low probability of enforcement (case 1iii) makes the market contract inferior compared to the buyers' outside option and beneficial trades in the market are lost. In the intermediate equilibrium (case 1ii), the probability of enforcement is high enough while the proportion of breaching sellers is small enough, so that the combination of these two parameters makes the buyer's expected payoff from the market contract for $\bar{z}$ larger than her outside option and thus induces those buyers who are in the market to contract even though enforcement is not sufficient to deter breach by opportunistic market sellers.

FIGURE 1: *Pure strategy equilibrium with a fixed market contract price.*

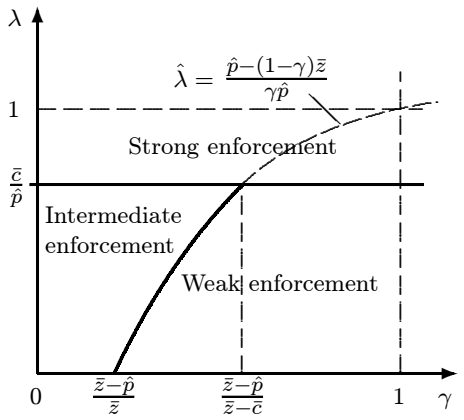


Figure 1 illustrates Prop.1 and suggests that the SE equilibrium would disappear if $\hat{p}$ is close to $\bar{c}$. In other words, it is more difficult to achieve compliance when the bargaining power of the buyers is high. If this is so, then even a relatively high probability of formal

contract enforcement is not sufficient to deter breach of market contracts by opportunistic sellers. Intuitively, when the buyers can extract most of the trade surplus, opportunists do not have a large enough stake in the contract $(\bar{z}, \hat{p})$ and would prefer to breach it even when enforcement is highly likely.

It immediately follows from Proposition 1 that liberalization of the economy (a rise in μ) leads to a higher welfare when enforcement of market contracts is strong (1i) and/or proportion of opportunists is low (1ii). Otherwise (1iii), an increase in the size of the market leads to an inferior outcome for this economy, since a large number of potentially beneficial trades are lost.

To complete the analysis of the benchmark case, consider the alternative to (A3) which under the fixed market price allows excess demand for a given sector in equilibrium.

Assumption 4

The buyer who is not successful in obtaining a contract in her preferred sector, has no opportunity to contract in the other sector and hence gets her outside option. (A4)

Under (A4), the buyer's problem of sector choice at stage 2 is now stated as follows:

$$\max_{\beta} \Big[\beta \cdot \min\Big\{\frac{\mu}{f}; 1\Big\} \cdot \max\Big\{0, U_m\Big\} + (1-\beta) \cdot \min\Big\{\frac{1-\mu}{1-f}; 1\Big\} \cdot U_s\Big]. \tag{6}$$

The difference between the expression above and that in (5) reflects (A4), namely that the buyer is forced to take her outside option of zero when being unsuccessful in finding a contractual partner in her preferred sector. This happens either when (a) having chosen the market sector (probability β), she fails to find a market seller to contract with (probability $1 - \min\{\mu/f; 1\}$), or (b) having chosen the state sector (probability $1-\beta$), she fails to be matched with a seller in the state sector (probability $1 - \min\{(1-\mu)/(1-f); 1\}$).

Due to rationing of contracts, individual rationality of a given buyer in equilibrium with $f = 1$ dictates $\mu \max\{U_m, 0\} > U_s$ which in turn implies:

$$\mu > \frac{U_s(\underline{z})}{U_m(\bar{z}, \lambda \mid q)}. \tag{7}$$

(7) suggests that demand for market sector contracts will exceed their supply in equilibrium when, firstly, the market price, which is fixed by (2), is fixed at a sufficiently low level (necessary condition):

$$\hat{p} < \Delta z + \underline{p}, \tag{8}$$

and, secondly, the market sector is not too small (sufficient condition):

$$\mu > \frac{\underline{z} - \underline{p}}{(1-\gamma)\bar{z} - (1-\lambda\gamma)\hat{p}}. \tag{9}$$

Assuming that these two conditions hold, the equilibria under (A4) are now described by Table 2. It is easy to check that under the alternative assumption (A4) the analysis of this

TABLE 2: *Description of equilibria (with unabsorbed excess demand).*

Equilibrium		*Contracting in which sector?*	*Economy trade surplus*
Strong enforcement (SE)	$q = 1$	market only	$\mu(\bar{z} - \bar{c})$
Intermediate enforcement (IE)	$q = 0$	market only	$\mu(1-\gamma)(\bar{z} - \bar{c})$
Weak enforcement (WE)	$q = 0$	state only	$(1-\mu)(\underline{z} - \underline{c})$

section will lead to the statement of results which is the same as in Proposition 1 above, except for the qualifications given by (8), (9), and Table 2. Not surprisingly, the analysis of the benchmark case under the alternative assumption suggests that when rationing of contracts leads to excess demand in equilibrium, the economy will have a lower level of welfare compared to the situation under (A3) in which absorption of excess demand is possible. Furthermore, assumption (A3) seems more plausible since coercion of the kind implied by assumption (A4) is not generally observed in reality. For this reason, (A3) is maintained in subsequent sections, unless stated otherwise.

3.2 Enforcement externality

Suppose now that the resources devoted to enforcement are fixed, and therefore the likelihood of enforcement declines with the rise of the fraction of breached market contracts. Formally, let $\lambda(q) = \underline{\lambda} \cdot (1 - \delta \cdot (1-q))$, where $\underline{\lambda}$ is the exogenous level of enforcement available in the economy, q is the probability with which opportunistic sellers comply with their market contract, and $\delta \in (0,1)$ is the enforcement externality parameter, introduced to capture fixed resources available for enforcement. For a given proportion of breaching opportunists, the larger the externality, δ, the lower is the probability of enforcement,

$\lambda(q)$. By construction, enforcement is more likely the fewer breached contracts there are: $\lambda(0) = \underline{\lambda} \cdot (1-\delta) < \underline{\lambda} = \lambda(1)$.

Similar to the analysis in section 3.1, the following cut-off value functions are derived for the exogenous level of enforcement:

$$\text{if} \quad \underline{\lambda} > \frac{\bar{c}}{\hat{p}} \equiv \lambda_1 \quad \text{then} \quad V_m^{\gamma}(\bar{z},\lambda)|_{q=1} > V_m^{\gamma}(\bar{z},\lambda)|_{q=0}, \tag{10}$$

$$\text{if} \quad \underline{\lambda} \leq \frac{\bar{c}}{\hat{p}(1-\delta)} \equiv \lambda_2 \quad \text{then} \quad V_m^{\gamma}(\bar{z},\lambda)|_{q=1} \leq V_m^{\gamma}(\bar{z},\lambda)|_{q=0}, \tag{11}$$

$$\text{if} \quad \underline{\lambda} \leq \frac{\hat{p} - (1-\gamma)\bar{z}}{\gamma\hat{p}(1-\delta)} \equiv \lambda_3 \quad \text{then} \quad U_m(\bar{z},\lambda; q=0) \leq 0. \tag{12}$$

Comparison of these three cut-offs for $\underline{\lambda}$ suggests that, in contrast to the results in section 3.1, the equilibrium may no longer be unique.

Proposition 2 *Assume (A1)–(A3). Then for any $\delta \in (0,1)$ there exists an equilibrium of the game.*

2.1 The equilibrium is unique if

(i) $\underline{\lambda} > \lambda_2$ *and* $\delta < 1 - \bar{c}/\hat{p}$ *(SE); or*

(ii) $\lambda_3 < \underline{\lambda} \leq \lambda_1$ *(IE), or*

(iii) $\underline{\lambda} \leq \min\{\lambda_1, \lambda_3\}$ *(WE).*

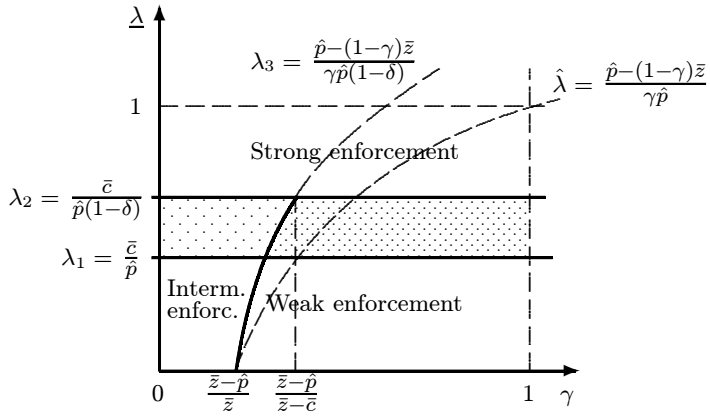
2.2 Otherwise, if $\lambda_1 < \underline{\lambda} \leq \lambda_2$ *the equilibrium is not unique:*

(i) if $\max\{\lambda_1; \lambda_3\} < \underline{\lambda} \leq \min\{\lambda_2, 1\}$ *then SE and IE equilibria coexist;*

(ii) or if $\lambda_1 < \underline{\lambda} \leq \min\{\lambda_2, \lambda_3, 1\}$ *then SE and WE equilibria coexist.*

Figure 2 illustrates the proposition for the case when $\delta < 1 - \bar{c}/\hat{p}$ and therefore $\lambda_2 < 1$. The shaded area in the figure depicts the range of parameters in which the two pure strategy equilibria coexist: SE and IE (sparse shading), or SE and WE (dense shading). The intuition behind the existence of multiple equilibria is linked to the negative enforcement externality which makes equilibrium determination dependent upon each seller's belief about other sellers' behaviour. If a given seller believes that all other sellers are breaching their market contract, then the cost of his individual compliance is larger than the benefit from his individual breach which is detected with a low probability: fixed resources devoted to enforcement are spread too thinly over the large number of breaches. Similarly, a seller's

FIGURE 2: *Equilibria when enforcement is endogenous.*



belief of other sellers' compliance makes individual breach too costly due to high detection probability. Fig.1(b) also highlights the significance of the enforcement externality: if it is sufficiently high ($\delta \geq 1-\bar{c}/\bar{p}$), then $\lambda_2(\gamma)$ shifts out to the level of 1 or beyond, and multiple equilibria exist for any reasonably high value of the exogenous enforcement level, $\underline{\lambda} > \bar{c}/\bar{p}$. These predictions are in line with observed recent economic and institutional performance in CEE, as highlighted in the introduction.

The argument above yields the following policy implication for transition economies. Decentralisation of economic activity will increase the size of the market sector, μ, which in turn will require more enforcement. Citizens' perception of effectiveness of enforcement may, however, vary over the sectors.[14] If everyone believes that the market transactions are unpoliced, then everybody in the market sector will find it optimal to breach their contract, further undermining the public perception of the effectiveness of formal contract enforcement. The larger the enforcement externality, the more detrimental could decentralisation turn out to be because the multiplicity of equilibria is more likely for higher δ. The reformers-in-charge should aim to reduce this externality by means of, for example, publicizing new laws and improving transparency and accountability of courts.

[14]Scholars of legal transition argue that a perception of inadequacy may arise if new laws to support markets are legal transplants from the West and run counter to local informal norms (Pistor 1996, Rubin 1997).

3.3 Corruptible enforcers

Suppose now that at date 5 *Nature* determines whether the market contract $(\bar{z}, \hat{p})$ between a given buyer-seller pair is 'enforceable' (with probability λ) or 'not enforceable' (with probability $1 - \lambda$). Crucially, the realized state of the world with regard to enforceability of the contract is now private information of the enforcer (while the value of λ is common knowledge, as before). Thus the source of corruption in market contract enforcement is due to the informational advantage possessed by the enforcer.[15] A contractual breach, when it occurs, is remedied by a self-interested enforcer who may well prefer not to take any enforcement action in exchange for a bribe from the seller. If the contract is not enforceable—whether genuinely so or because of corruption in enforcement—no further action is taken by the enforcer. To maintain the focus on imperfect enforcement of contracts in the market, I continue to assume that there is no uncertainty with respect to enforceability of contracts in the state sector (i.e. the enforcer of the state contract does not possess any private information regarding contract enforceability).[16] The level of corruption in the economy is assumed to be exogenous: a contract enforcer is corruptible with probability $0 < r \leq 1$ in which case he will accept a bribe $b > 0$ in exchange for concealing the information regarding enforceability of the market contract.[17]

Consider the bribe payment which the seller will be prepared to pay to the enforcer in order to conceal the fact that the contract is, in fact, enforceable. If the enforcer agrees to conceal, then the seller expects no enforcement at the cost of the bribe payment, $\hat{p} - b$. Otherwise, in the absence of a collusive agreement with the enforcer, the seller expects to obtain $\hat{p} - d = 0$. For bribery to occur, therefore, the bribe cannot exceed $\hat{p}$. Let $b = k\hat{p}$ with $0 < k < 1$ representing the bargaining power of the enforcer.

Before calculating the players' expected payoffs in the modified game, observe that an honest seller's expected gain from the market contract $(\bar{z}, \hat{p})$, as specified in (4), is not affected by considerations of corruption simply because corruption is only possible once a

[15] This is a reasonable assumption in the context of complicated or overlapping legislation with loopholes present in the initial years of CEE reforms (Gray 1993, Pistor 1996, Hay and Shleifer 1998).

[16] Corruption of enforcers in the state sector is also possible and several scenarios can be envisaged to give rise to a negative spillover effect on the enforcement of market contracts. The results presented in this section will then be even stronger.

[17] The analysis of the incentives of the enforcer to get corrupt is therefore left out.

contract is breached and honest sellers are assumed to comply with their contracts without fail.[18] On signing contract $(\bar{z}, \hat{p})$ in the environment with corruptible enforcers, the expected payoff of a buyer and an opportunistic seller respectively becomes:

$$U_m(\bar{z}, \lambda, r) = \Big[1 - \gamma(1-q)\Big] \cdot \bar{z} - \Big[1 - \lambda\gamma(1-q)(1-r)\Big] \cdot \hat{p}, \tag{13}$$

$$V_m^{\gamma}(\bar{z}, \lambda, r) = \Big[1 - \lambda(1-q)[1 - r(1-k)]\Big] \cdot \hat{p} - q\bar{c}, \tag{14}$$

where q is chosen by the opportunistic seller in order to maximise (14), as before. In the above, the seller expects to incur the cost of providing the high quality if he complies with the contract (probability q). He will keep the buyer's up front payment, $\hat{p}$, unless he breaches the contract (probability $1-q$). In the latter case, the breach is either remedied by an honest enforcer (with probability $\lambda(1-r)$), and the seller loses the up front payment; or the breach is not remedied because the enforcer is bribed (with probability λr), the seller then loses k portion of the up front payment. When enforcers are corruptible, the buyer's gain, (13), from the contract $(\bar{z}, \hat{p})$ is smaller by $\lambda\gamma(1-q) \cdot r \cdot \hat{p}$, as compared to the no corruption market contract payoff (2), namely it is smaller by the expected loss of the up front payment in all circumstances except when the breach is remedied by an honest enforcer.

Proposition 3 *Assume (A1)–(A3) and* $0 < k < 1$. *Then there exists a unique equilibrium of the game with corruptible enforcers and it is WE equilibrium, unless*

(i) $\lambda > \bar{c}/[\hat{p}(1 - r(1-k))]$ *and* $r \leq \min\{[\hat{p} - \bar{c}]/[\hat{p}(1-k)];\ 1\}$, *in which case it is SE; or*

(ii) $[\hat{p} - (1-\gamma)\bar{z}]/[\gamma\hat{p}(1-r)] < \lambda \leq \bar{c}/[\hat{p}(1 - r(1-k))]$, $\gamma < (\bar{z} - \hat{p})/(\bar{z} - \bar{c})$, *and* $r < [\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c})]/[\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c}) + k(\hat{p} - (1-\gamma)\bar{z})]$, *in which case it is IE.*

The intuition behind Prop.3 is simple. For buyers to prefer contracting in the market to their outside option, enforceability of contract $(\bar{z}, \hat{p})$ must be sufficiently high, as in either (3i) or (3ii). In addition, for an opportunistic seller to prefer compliance, and thus for SE equilibrium to exist cost of breach must be large enough (e.g. the number of corruptible enforcers is relatively small). As before, in IE equilibrium some contract enforceability per se is not sufficient to deter breach by all opportunistic sellers in the market. Nevertheless,

[18] Allowing for framing or blackmail by enforcers may well reverse this conclusion. See Polinsky and Shavell (2001) for an analysis of framing in law enforcement.

the buyers prefer market contracting because the expected value of $(\bar{z}, \hat{p})$ contract is higher than their outside option. In the environment with corruptible enforcers, this would be the case when both the proportion of breaching sellers as well as the level of corruption among the enforcers is small enough. When neither of this two scenarios is possible, then it is less harmful for the buyers to opt out of market contracting altogether. Two observations immediately follow from Prop.3:

Remark 1 *SE equilibrium is more difficult to sustain when enforcers are corrupt.*

The proof is a straightforward comparison of the λ cut-off in the statement of Prop.3(i) with its analogue in the no-corruption environment ($\bar{c}/\hat{p}$ in Prop.1 of section 3.1). Clearly, the former exceeds the no-corruption cut-off for any $0 < k < 1$ and $0 < r \leq 1$. The remark implies that when contract enforcers are corruptible the institution of formal contract enforcement needs to be more effective (the probability that the contract is enforceable has to be higher) for opportunistic sellers to choose compliance in equilibrium.

Remark 2 *Assume (A1)–(A3) and $r = 1$. If additionally $k > \bar{c}/\hat{p}$, then SE equilibrium prevails despite the high level of corruption in enforcement of market contracts.*

Intuitively, breach of market contracts will not occur when all enforcers are corrupt, have sufficiently strong bargaining power, and are large in number. To prove this result, note that by Prop.3(i), in the specified range of parameters the opportunistic sellers optimise by setting $q = 1$, thus making the buyers in the market to prefer contract $(\bar{z}, \hat{p})$ over their outside option. The key to understanding this result is the strong bargaining power enjoyed by the corrupt enforcer when formal enforcement is relatively effective (λ is high enough): since all enforcers are corrupt, a breached contract is certain to attract an enforcer's demand for a bribe (due to $r = 1$), and thus the breaching seller stands to lose a large part of the gain from his breach (due to $k > \bar{c}/\hat{p}$). It is cheaper for the seller to comply with his market contract than to get involved in the bribing game. Hence, corruptibility of enforcers who can extract large bribes serves as a deterrent for contract breach. This result highlights the relative importance of strengthening formal institutions in an economy with a high level of corruption (i.e. increasing the value λ above the threshold given by Prop.3i). An improvement in formal institutions supporting markets is beneficial in curbing opportunistic behaviour of both private agents (sellers) and holders of public office (enforcers).

3.4 Endogenous market contract price

This section presents a modification of analysis contained in section 3.1 by allowing the contractual price of quality $\bar{z}$ to adjust with the buyers' demand for market sector contracts. Intuitively, we expect that the sellers will raise the market contract price at the negotiating stage, if the aggregate demand for the market sector (the proportion of buyers who prefer the market sector, f) is larger than the size of the market. (The assumption of a one-to-one contracting plays a crucial role here.) At the same time, we expect that at the negotiating stage of the contract on quality $\bar{z}$, the buyers will take into account the average quality, denoted by $\dot{z}$, supplied by market sellers. This is exactly the first term, $[1-\gamma(1-q)]\cdot\bar{z}$, in the expression of the buyer's expected market contract payoff in (2). The average quality is just $\bar{z}$ when all opportunistic sellers comply with their contracts ($q=1$), and otherwise (if $q=0$) it is less than $\bar{z}$. Since a buyer cannot distinguish between the two types of sellers when negotiating and signing her contract, the market contract price now has to reflect the average quality: higher expected quality will command a higher price.

As a shorthand, denote by $\bar{p}$ the market contract price when the average quality is known to be the same as the contracted upon quality (if $q=1$ then $\dot{z}=\bar{z}$), and by $\dot{p}$ when the average quality is known to be less than the contracted quality ($q=0$, $\dot{z}<\bar{z}$). Of course, it has to be $\bar{p}>\dot{p}$ for buyers to be willing to trade when the expected quality in the market is lower than $\bar{z}$. The expressions for the players' expected payoffs, once in a given sector are the same as in section 3.1, except that one has to substitute $\hat{p}$ with $\dot{p}$ when analysing the equilibria with $q=0$, and $\hat{p}$ with $\bar{p}$ when considering the equilibrium with $q=1$.

Recall that section 3.1 introduced two alternative assumptions (A3) and (A4) which determined whether the buyer who failed to obtain a contract in her preferred sector had the opportunity to contract in the other sector. According to (A3) the buyer has such opportunity, but according to (A4) she is forced to take her outside option. These two alternative assumptions were shown to lead to two different formulations of the buyer's sector choice problem at stage 2: (5) under (A3), or (6) under (A4). The analysis of the problem with a fixed market contract price in section 3.1 suggested that in the situations with $U_m>0$ (i.e., in SE and IE equilibria) the buyer's equilibrium choice of the sector i ($i=s,m$) was determined from $\max_i\{U_m;U_s\}$ under (A3), or from $\max_i\{\mu\cdot U_m;U_s\}$ under (A4).

It turns out that with an endogenous market contract price, i.e. when the market

price can adjust in response to an imbalance in supply/demand for market contracts, the equilibrium in which market contracting takes place (i.e. SE and IE equilibrium) will exhibit a balanced demand/supply of market contract under either (A3) or (A4).[19]

Claim 1 *In equilibrium with market contracting* ($\beta > 0$)*, the market contract price is determined by balanced demand in each sector* ($f = \mu$) *which makes the buyers indifferent between the two sectors* ($U_m = U_s$)*.*

The intuition behind the statement of the claim is simple. If there is an excess demand for market contracts, $0 < \mu < f \leq 1$, then the price for the average quality supplied in the market is 'too low', which makes the buyers' expected net gain from the market contract on quality $\bar{z}$ strictly greater than their expected net gain from the state contract on quality $\underline{z}$: $0 < \mu < f \leq 1$ implies $U_m > U_s$ in both (5) and (6). Due to rationing ($\mu < 1$ and one-to-one contracting), market sellers can exploit excess demand and improve their payoff by negotiating a higher price for the given average market quality. A price increase, however, reduces the expected net gain of the buyer and would also reduce the demand for market contracting. If the market price is increased too much, the state contract becomes more profitable from the buyers' viewpoint, which leads to an excess demand for the state contracts: $0 \leq f < \mu < 1$ implies $U_m < U_s$ in both (5) and (6). In such a case the market price is too high for the average quality supplied in the market when compared to the price-quality mix in the state sector. In equilibrium with market contracting, the sellers would therefore be charging the price which, firstly, balances aggregate supply (μ) of the market contracts with the aggregate demand (f) for market contracts, and secondly, in the setting with identical buyers makes every buyer indifferent between contracting in the market and contracting in the state sector ($U_m = U_s$).

Because of buyers' indifference between the two sectors in SE and IE equilibria (by Claim 1), the equilibrium allocation of buyers across sectors will be μ buyers in the market sector and $1 - \mu$ buyers in the state sector. This in turn implies that the description of equilibria given by Table 1 (section 3.1, page 10) is appropriate for the present analysis, provided that the market contract price ($\bar{p}$ when $q = 1$, or $\dot{p}$ when $q = 0$) is determined by balanced demand according to Claim 1.

[19]It is immediately clear that $\beta = 0$ is optimal when $0 \geq U_m$. In such a case the level of the market contract price is irrelevant because there is no contracting in the market.

Determination of $\bar{p}$ is immediate: in equilibrium with $q = 1$, we must have balanced demand $f = \mu$ and $\beta \in (0,1)$ is such that every buyer is indifferent between entering the state sector or the market sector: $U_m(\bar{z}, \lambda \mid q = 1) = \bar{z} - \bar{p} = \underline{z} - \underline{p} = U_s(\underline{z})$ where $\underline{p}$ is given by (A1). The market contract price when $q = 1$ is therefore equal to:

$$\bar{p} = \Delta z + \underline{p}. \tag{15}$$

In the case of $q = 0$ an analogous argument gives $U_m(\bar{z}, \lambda \mid q = 0) = (1-\gamma)\bar{z} - (1-\lambda\gamma)\dot{p} = \underline{z} - \underline{p} = U_s(\underline{z})$, and therefore the market contract price when $q = 0$ is given by:

$$\dot{p} = \frac{(1-\gamma)\bar{z} - (\underline{z} - \underline{p})}{1-\lambda\gamma} = \frac{\bar{p} - \gamma\bar{z}}{1-\lambda\gamma}, \tag{16}$$

where the second equality sign takes into account (15).

In order to simplify the exposition of the main result stated below, I introduce the following threshold value functions of the enforcement probability:

$$\lambda^\sharp \equiv \lambda(\gamma) = \frac{\gamma\bar{z} - (\bar{p} - \bar{c})}{\gamma\bar{c}} \qquad \text{and} \qquad \lambda^\flat \equiv \lambda(\gamma) = \frac{\bar{c}}{\bar{p} - \gamma(\bar{z} - \bar{c})}, \tag{17}$$

with $\bar{p}$ calculated according to (15). The origin of these cut-offs is the following. For a given value of γ, $\lambda > \lambda^\sharp$ implies that the market contract price in the case of $q = 0$ (namely $\dot{p}$ in (16)) is above the cost of supplying quality $\bar{z}$, making it attractive for all sellers in the market to contract for delivery of quality $\bar{z}$. The reverse, $\lambda \leq \lambda^\sharp$, implies $\dot{p} \leq \bar{c}$, and the honest sellers would refuse to contract in the market. Honest sellers' refusal in turn suggests that the only quality that is deliverable under the market contract $(\bar{z}, \dot{p})$ is the zero quality, since only opportunistic sellers would sign contracts in this case, and all opportunistic sellers breach their market contracts with certainty. Consequently, the buyers would not be willing to contract in the market sector. The other cut-off, $\lambda^\flat$, determines opportunistic sellers' preference for (if $\lambda \leq \lambda^\flat$) or against (if $\lambda > \lambda^\flat$) breaching their market contract.

Proposition 4 *Assume (A1) and (A2). There exists an equilibrium of the game.*

4.1 The equilibrium is unique if

(i) $\lambda > \lambda^\flat$ *(SE); or*

(ii) $\lambda^\sharp < \lambda \leq \bar{c}/\bar{p}$ *(IE), or*

(iii) $\lambda \leq \min\{\lambda^\sharp,\ \bar{c}/\bar{p}\}$ *(WE).*

4.2 Otherwise, if $\bar{c}/\bar{p} < \lambda \leq \min\{\lambda^\flat; 1\}$ *the equilibrium is not unique:*

(i) if $\max\{\bar{c}/\bar{p}; \lambda^\sharp\} < \lambda \leq \lambda^\flat$ *then SE and IE equilibria coexist;*

(ii) or if $\bar{c}/\bar{p} < \lambda \leq \min\{\lambda^\sharp; 1\}$ *then SE and WE equilibria coexist.*

The market contract price is given by (15) in SE equilibrium, or by (16) in IE equilibrium.

FIGURE 3: *Pure strategy equilibria with endogenous market contract price.*

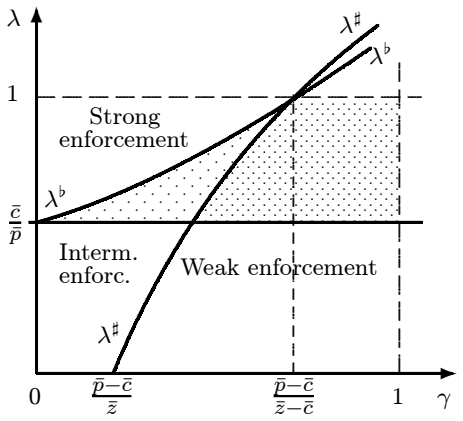


Figure 3 illustrates Proposition 4. In Figure 3, the (γ, λ) combinations for which each type of equilibrium exists are similar to the regions for the case of exogenously fixed market contract price (Figure 1, page 11). When the market price is endogenously determined by the aggregate demand for market sector contracts, a relatively high enforcement probability is necessary to support the strong enforcement equilibrium ($\lambda > \bar{c}/\bar{p}$). The weak enforcement equilibrium cannot be avoided (in other words, it is unique) in the region of relatively low enforcement probability combined with a high proportion of breaching sellers, while the intermediate enforcement equilibrium is unique when both the enforcement probability and the fraction of breaching sellers is relatively low. (These ranges look similar in both figures except for the threshold value function of λ which determines buyers' preference for or against market contracting: $\hat{\lambda}$ in Figure 1 and $\lambda^\sharp$ in Figure 3.)

The crucial difference between the results in these two sections is highlighted by the shaded area of Figure 3 which depicts the range of parameters for which two equilibria coexist: SE and IE (sparse shading), and SE and WE (dense shading). The key to the existence of multiple equilibria lies in the price difference $\bar{p} \neq \dot{p}$ which reflects $\bar{z} \neq \dot{z}$, that is the difference between the contracted quality and the expected quality upon delivery in the market sector.

For the intuition behind the coexistence of equilibria, consider, for example, the sparsely shaded region, $\max\{\bar{c}/\bar{p}; \lambda^\sharp\} < \lambda \leq \lambda^\flat$, where the strong and intermediate enforcement equilibria coexist. Suppose the buyers believe that all opportunistic sellers are going to play $q = 1$. Then the buyers are willing to pay the price $\bar{p}$. Is it individually rational for a given opportunistic seller to deviate from $q = 1$ by playing $q = 0$? The answer can be found by comparing the two expected payoffs. In either case, the opportunist gets $\bar{p}$ up front. In the case of no deviation the opportunist expects to lose $\bar{c}$, while in the case of a deviation he expects to lose $\lambda\bar{p}$. The comparison between the two payoffs is therefore equivalent to the comparison between $\bar{c}$ and $\lambda\bar{p}$. But in the sparsely shaded region we have $\lambda\bar{p} > \bar{c}$. Hence, if the buyers believe that all market sellers comply, it is individually rational for every opportunistic seller to comply. Essentially, the expected loss of the up front payment following the enforcement of the seller's breach is greater than his saving of cost $\bar{c}$.

Suppose instead that in the same range of λ (the sparsely shaded area of Figure 3, as before) the buyers believe that all opportunistic sellers are playing $q = 0$. In such a case, the buyers would be willing to contract in the market only if the market contract price is equal to $\dot{p}$. In the sparsely shaded region, $\lambda > \lambda^\sharp$ which is equivalent to $\dot{p} > \bar{c}$ (see the proof of Proposition 4 in Appendix 4). The honest sellers in the market will therefore be willing to contract for $\bar{z}$. With all honest sellers willing to sign contract $(\bar{z}, \dot{p})$, and all opportunistic sellers subsequently breaching it, the no deviation payoff to an opportunistic seller is $(1 - \lambda)\dot{p}$, while by deviating and playing $q = 1$ he would expect to get $\dot{p} - \bar{c}$. The comparison of the two payoffs is now equivalent to the comparison of the loss of $\lambda\dot{p}$ with the loss of $\bar{c}$. In the relevant range of parameters $\lambda \leq \lambda^\flat$ which turns out to be exactly equivalent to $\lambda\dot{p} \leq \bar{c}$ (see the proof of Proposition 4). A unilateral deviation does not bring any extra gain and therefore is shown again to be unprofitable.

It is clear from the argument above that the key to the coexistence of the two equilibria is the endogenously determined price which falls with a decline in expected quality. In such a case, the buyers' beliefs play a crucial role, since it is the belief that all market sellers comply that leads the buyers to agree to the highest price, $\bar{p}$, for quality $\bar{z}$, and thus induces all opportunistic sellers in the market to comply. Alternatively, the belief that all opportunistic sellers are going to breach their contracts makes it impossible for the buyers to agree to pay anything but $\dot{p} < \bar{p}$ for quality $\bar{z}$.[20]

[20]The model does not address the issue of how a particular type of buyers' belief arises in equilibrium. One mechanism might be that of collective reputations, suggested in Tirole (1996).

The intuition behind the coexistence of the strong and weak enforcement equilibria in the densely shaded area of Figure 3 is essentially the same: it again involves the buyers' beliefs regarding the opportunistic sellers' choice of action once the up front payment has been made. The argument for the case of the weak enforcement equilibrium is, however, more subtle: when the buyers believe that opportunistic sellers are going to play $q = 0$, the price acceptable to the buyers in the market, $\dot{p}$, now has to be below $\bar{c}$ in order to compensate the buyers for the high probability of losing the up front payment (due to the high value of γ). This price, of course, would drive away the honest sellers since it will not cover their cost of supplying $\bar{z}$. We therefore have in this case the celebrated 'lemons' problem due to Akerlof (1970): the honest sellers are unable to separate themselves from opportunists and this leads to the break down in market contracting.

In order to derive the policy implications of the analysis of this section, notice that the economy trade surplus in each of the three possible equilibria with endogenously determined price is the same as that identified for the case of exogenously fixed market contract price (section 3.1, Table 1 on page 10). This is due to the balanced demand in the strong and intermediate enforcement equilibrium, and no market contracting in the weak enforcement equilibrium. Consequently, the conclusions drawn from the analysis of section 3.1 apply here *a fortiori*: the inferior outcome—namely, the beneficial market contracting not being pursued in the weak enforcement equilibrium—is now possible even when the level of enforcement is relatively high (the densely shaded area in Figure 3). Thus it is shown that the model developed in this paper helps explain the output fall puzzle as arising from the problem of asymmetric information, rather than technology. A transition economy which undergoes liberalization of its economic activity may experience a large output fall if economic agents believe that a large proportion of market traders are opportunistic and would breach their contracts with certainty.[21]

4 Concluding comments

The results of this paper highlight the importance of institutions for the transition from 'plan' to 'market': absent or inadequate institutions lead to a loss of beneficial decentralized

[21] Some support for this conjecture can be found in a path-breaking comparative survey of attitudes towards markets by Shiller, Boycko and Korobov (1991) who find that 'relatively more Soviets [when compared to Americans] do tend to expect more businessmen to be less honest' (p. 395).

contracts. Moreover, when formal contract enforcement exhibits a negative externality, then even for a relatively large amount of fixed resources devoted to enforcement bad equilibrium may prevail, because the equilibrium is determined by trader's perception of the effectiveness of enforcement. The larger the externality, the harder it is to achieve the good equilibrium in which all traders comply with their contractual obligations. The effect of a large externality on the welfare of the economy is indirect and feeds through the overall trading surplus. The larger the size of the market, the higher is the proportion of the beneficial trades which are lost in the weak enforcement equilibrium. This conclusion is likely to become even more grim if we accept that a large-scale change in the organisation of economic activity (e.g. a change 'from plan to market') is likely to require new laws which are better suited to the new economic order. In the notation of the model this means that the probability of enforcement, λ, may decline (or the enforcement externality, δ, rise) due to, perhaps a perception of, inadequacy of the old legal framework. And this, as the epigraph to this paper suggests, seems to be exactly what has happened in some transition economies. Perhaps more importantly, the analysis also suggests that institutions to support market interaction have a first order effect on the success of liberalization in an environment of endemic corruption. This is because an adequate legal framework helps to curb the high level of corruption in enforcement, as well as opportunism in contracting, by exposing the breacher to the enforcer's extortionary demands.

The significance of perceptions of institutional quality suggested by the analysis above merits further investigation, both theoretically and empirically. It is intuitive to expect that once institutional improvements are introduced a (perhaps, gradual) change in perceptions is likely. A theory of how perceptions are formed would therefore be useful for a better understanding of market interaction, as well as better policy design for a smooth transition. Such a theory calls for a repeated game framework and may encompass the Tirole (1996) mechanism of collective reputations. The analysis also suggests a novel perspective for evaluating empirically the impact of perceptions of legal infrastructure on economic performance in CEE.[22] Cross-country variation in output fall and corruption can be explained by differences in perceived legal effectiveness, which is either measured directly (EBRD 1999), or approximated by the measures of enforcement externality such as legal legacy and the previous exposure to private contracting and democracy.

[22]It can be noted, however, that the present theoretical analysis is in agreement with case-study evidence of transition in CEE: see, for example, Gray and Hendley (1997), and Greif and Kandel (1995).

Extending the theoretical analysis to repeated interaction could also help evaluate the relative significance of formal enforcement mechanisms versus informal ones. Survey-based evidence for CEE economies (McMillan and Woodruff (1999b, 1999a, 2000); Johnson, McMillan and Woodruff (2002)) indicates that inadequacy of the legal infrastructure of laws, courts and police inherited from the years of directives and planning forces businesses to rely on reputation (e.g. gossip, social and/or business networks). Informal enforcement supported by information sharing cannot however substitute for formal enforcement entirely: while reputation helps to sustain established trading partnerships, effective courts encourage formation of new relationships by lowering switching costs and reducing risks.[23] These empirical findings therefore call for a detailed theoretical analysis of the relative merits of a particular enforcement mechanism in different types of economic environment.[24] Finally, the issue of financing formal enforcement, e.g. by means of taxes, could also be explored. The existing literature suggests[25] that excessive taxation is typically the reason for the growth of the unofficial economy, which in some notable instances has led to the rise of organized crime and further undermined the development of adequate institutions that support well-functioning markets.

[23]The results presented in section 3.2 also suggest that reliance on a reputational mechanism such as trust to support cooperation when formal enforcement mechanisms are ineffective may be problematic: if economic agents believe there is a high probability of opportunism, then lack of formal institutions combined with lack of trust will force the economy into a bad equilibrium.

[24]Dixit (2001) offers a framework in which such a comparative study can be fruitfully tackled.

[25]E.g. Johnson et al. (2000) and Roland (2000, pp. 174–8).

References

Acemoglu, Daron and Thierry Verdier, "Property Rights, Corruption, and the Allocation of Talent: A General Equilibrium Approach," *The Economic Journal*, October 1998, *108*, 1381–1403.

Akerlof, George, "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism," *Quarterly Journal of Economics*, 1970, *84*, 488–500.

Bardhan, Pranab, "Corruption and Development: Review of Issues," *Journal of Economic Literature*, 1997, *35*, 1320–46.

Blanchard, Oliver and Michael Kremer, "Disorganization," *Quarterly Journal of Economics*, 1997, *112* (4), 1091–1126.

Blanchard, Olivier, *The Economics of Transition in Eastern Europe* Clarendon Lectures, Oxford, UK: Oxford University Press, 1997.

___ **and Andrei Shleifer**, "Federalism with and without Political Centralization. China versus Russia," *IMF Staff Papers*, 2001, *48*, 171–9.

Dewatripont, Mathias and Gérard Roland, "The Virtues of Gradualism and Legitimacy in the Transition to a Market Economy," *The Economic Journal*, 1992, *102*, 291–300.

Dixit, Avinash, "On Modes of Economic Governance," 2001. Presidential Address, Econometric Society.

EBRD, *Transition Report: Ten Years of Transition*, EBRD: London, 1999.

Frye, Timothy and Andrei Shleifer, "The Invisible Hand and the Grabbing Hand," *American Economic Review*, 1997, *87* (2), 354–8.

Gray, Cheryl W., "Evolving Legal Frameworks for Private Sector Development in Central and Eastern Europe," July 1993. Washington, DC: World Bank Discussion Paper # 209.

___ **and Kathryn Hendley**, "Developing Commercial Law in Transition Economies: Examples from Hungary and Russia," in Jeffrey D. Sachs and Katharina Pistor, eds., *The Rule of Law and Economic Reform in Russia*, WestviewPress, 1997. Harvard University Russian Research Center.

Greif, Avner and Eugene Kandel, "Contract Enforcement Institutions: Historical Perspective and Current Status in Russia," in Edward P. Lazear, ed., *Economic Transition in Eastern Europe and Russia: Realities of Reform*, Hoover Institution Press, 1995.

Gustafson, Thane, *Capitalism Russian-Style*, Cambridge University Press, 1999.

Hay, Jonathan R. and Andrei Shleifer, "Private Enforcement of Public Laws: A Theory of Legal Reforms," *American Economic Review*, 1998, *88* (2), 398–403.

IMF, *World Economic Outlook: Focus on Transition Economies*, IMF: Washington, DC, October 2000.

Johnson, Simon, Daniel Kaufmann, John McMillan, and Christopher Woodruff, "Why Do Firms Hide? Bribes and Unofficial Activity after Communism," *Journal of Public Economics*, 2000, *76*, 495–520.

___, John McMillan, and Christopher Woodruff, "Courts and Relational Contracts," *Journal of Law, Economics and Organization*, 2002, *18* (1), 221–277.

Kroll, Heidi, "Breach of Contract in the Soviet Economy," *Journal of Legal Studies*, January 1987, *16*, 119–148.

McMillan, John and Christopher Woodruff, "Dispute Prevention Without Courts in Vietnam," *Journal of Law, Economics and Organization*, 1999, *15* (3), 637–658.

___ and ___, "Interfirm Relationships and Informal Credit in Vietnam," *Quarterly Journal of Economics*, 1999, *114*, 1285–1320.

___ and ___, "Private Order under Dysfunctional Public Order," *Michigan Law Review*, 2000, *98*, 2421–2458.

Murphy, Kevin, Andrei Shleifer, and Robert Vishny, "The Transition to a Market Economy: Pitfalls of Partial Reform," *Quarterly Journal of Economics*, 1992, *107*, 889–906.

Pistor, Katharina, "Supply and Demand for Contract Enforcement in Russia: Courts, Arbitration, and Private Enforcement," *Review of Central and East European Law*, 1996, *22* (1), 55–87.

Polinsky, A. Mitchell and Steven Shavell, "Corruption and Optimal Law Enforcement," *Journal of Public Economics*, 2001, *81*, 1–24.

Roland, Gérard, *Transition and Economics: Politics, Markets, and Firms*, Cambridge, Massachusetts: The MIT Press, 2000.

Roland, Gérard and Thierry Verdier, "Transition and the Output Fall," *Economics of Transition*, 1999, *7* (1), 1–28.

Rubin, Paul H., *Promises, Promises: Contracts in Russia and other Post-Communist Economies* The Shaftesbury Papers, 11, Edward Elgar, 1997.

Shiller, Robert J., Maxim Boycko, and Vladimir Korobov, "Popular Attitudes Toward Free Markets: the Soviet Union and the United States Compared," *American Economic Review*, 1991, *83* (3), 385–400.

Shleifer, Andrei and Robert Vishny, "Corruption," *Quarterly Journal of Economics*, 1993, *108*, 599–617.

Tirole, Jean, "A Theory of Collective Reputations (with Applications to the Persistence of Corruption and to Firm Quality)," *Review of Economic Studies*, 1996, *63*, 1–22.

World Bank, *World Development Report: Building Institutions for Markets*, IBRD: Washington, DC, 2002.

Appendix

Proof of Proposition 1

Suppose $\lambda > \bar{c}/\hat{p}$. Then $V_m^{\gamma}(\bar{z}, \lambda \mid q = 1) = \hat{p} - \bar{c} > (1 - \lambda)\hat{p} = V_m^{\gamma}(\bar{z}, \lambda \mid q = 0)$ and hence $q = 1$ is optimal, which in turn leads to $U_m(\bar{z}, \lambda \mid q = 1) = \bar{z} - \hat{p} > 0$, i.e. buyers who are in the market will prefer contracting over their outside option. The buyers' choice of a sector is determined by the sign of the difference $(\bar{z} - \hat{p}) - (\underline{z} - \underline{p})$ which may or may not be positive. Due to (A3) and irrespective of the sign of the difference, in equilibrium μ buyers will end up in the market sector and $1 - \mu$ in the state sector. This proves part (i) of the proposition.

Suppose instead that $\lambda \leq \bar{c}/\hat{p}$ and hence $q = 0$ is optimal. Substituting $q = 0$ into (2), it is checked that $U_m(\bar{z}, \lambda \mid q = 0) \leq 0$ if

$$\lambda \leq \frac{\hat{p} - (1 - \gamma)\bar{z}}{\gamma \hat{p}} \equiv \hat{\lambda}, \quad \text{where} \quad \hat{\lambda} \in [0, 1] \quad \text{when} \quad \gamma \in \Big[\frac{\bar{z} - \hat{p}}{\bar{z}}; 1\Big]. \tag{18}$$

If (18) and $\lambda \leq \bar{c}/\hat{p}$, or re-stating, if:

$$\lambda \leq \min\Big\{\hat{\lambda}, \frac{\bar{c}}{\hat{p}}\Big\}, \tag{19}$$

then due to $U_s > 0 \geq U_m(\bar{z}, \lambda | q = 0)$ every buyer prefers the state sector, but when unsuccessful in obtaining the state contract she will opt out of market contracting. This proves part (iii).

Finally, when $\hat{\lambda} < \lambda \leq \bar{c}/\hat{p}$, then $q = 0$ and $U_m(\bar{z}, \lambda \mid q = 0) > 0$, while $U_m(\bar{z}, \lambda \mid q = 0)$ could be either lower or higher than $U_s(\underline{z})$. The buyers who ended up in the market sector will to contract for $\bar{z}$ despite the certainty of the breach by opportunistic sellers. ■

Proof of Proposition 2

For the proof of the claim we consider all ranges of $\underline{\lambda}$ which are determined by the three cut-off values λ_1, λ_2 and λ_3 defined in (10)–(12). It is easy to check that $\lambda_1 < \lambda_2$ for any $\delta \in (0, 1)$; $\lambda_2 \leq \lambda_3$ if $\gamma \geq (\bar{z} - \hat{p})/(\bar{z} - \bar{c})$; and $\lambda_2 < 1$ if $\delta < 1 - \bar{c}/\hat{p}$. The key to the proof is the definition of the three cut-offs on $\underline{\lambda}$ given in (10)–(12). With these definitions in mind, the following statements are easily established.

If $\underline{\lambda} \leq \min\{\lambda_1, \lambda_3\}$, then the unique optimal choice of opportunistic sellers is $q = 0$ and buyers prefer not to contract in the market due to $U_m(\bar{z}, \lambda | q = 0) \leq 0$. Therefore,

WE equilibrium exists and it is unique. If $\lambda_3 < \underline{\lambda} \leq \lambda_1$, then for the unique equilibrium choice of $q = 0$ by opportunistic sellers, the buyers now prefer to contract in the market due to $U_m(\bar{z}, \lambda | q = 0) > 0$, thus making IE equilibrium unique for this range of $\underline{\lambda}$. If $\underline{\lambda} > \lambda_2$ (provided that $\lambda_2 < 1$ which is equivalent to $\delta < 1 - \bar{c}/\hat{p}$), then the opportunistic sellers' unique choice at stage 4 of the game is $q = 1$. Assuming (A3), the buyer will prefer contracting to her outside option irrespective of the sector in which she ends up (since $U_s > 0$ and $U_m > 0$). Therefore in this range SE equilibrium is feasible and unique. Thus the first part of the proposition is established.

To check that the validity of the proposition regarding the multiple equilibria, it suffices to observe that the choice of action at stage 4 by opportunistic sellers is not unique when $\lambda_1 < \underline{\lambda} \leq \min\{\lambda_2, 1\}$. This choice could be either $q = 1$ or $q = 0$ depending on the belief of every opportunistic seller about the choice all other opportunistic sellers are going to make. If $q = 1$ is played in equilibrium, then the optimal choice of buyers in the market is to contract for $\bar{z}$ (thus the strong enforcement equilibrium is feasible). If the sellers' equilibrium choice is $q = 0$, then the buyers' optimal choice will depend on the sign of $U_m(\bar{z}, \lambda \mid q = 0)$. If it is positive (this would be the case for $\underline{\lambda} > \lambda_3$) then IE equilibrium is feasible. Alternatively, when it is non-positive then WE equilibrium is feasible. ■

Proof of Proposition 3

For SE equilibrium, the opportunistic sellers must optimally set $q = 1$, which gives $V_m^\gamma(\bar{z}, \lambda, r)|_{q=1} > V_m^\gamma(\bar{z}, \lambda, r)|_{q=0}$. The latter gives the condition on λ stated in Prop.3(i). As previously, when $q = 1$, the buyers in the market will prefer contracting to their outside option. Thus part 3(i) of the proposition is proved.

In IE equilibrium, all opportunistic sellers optimally breach their contract $(\bar{z}, \hat{p})$, while the buyers prefer market contracting to their outside option despite the certainty of the breach by opportunists. These two conditions translate into the following:

$$V_m^\gamma(\bar{z}, \lambda, r)|_{q=1} \leq V_m^\gamma(\bar{z}, \lambda, r)|_{q=0}, \tag{20}$$

$$U_m(\bar{z}, \lambda, r \mid q = 0) > 0. \tag{21}$$

Writing out the payoffs, as specified by (13) and (14), and substituting the relevant values for q, the two inequalities above result in

$$\frac{\hat{p} - (1-\gamma)\bar{z}}{\gamma \hat{p}} \cdot \frac{1}{1-r} \overset{(21)}{<} \lambda \overset{(20)}{\leq} \frac{\bar{c}}{\hat{p}} \cdot \frac{1}{1 - r(1-k)}, \tag{22}$$

Note that the first inequality sign will be true for any $\lambda \in (0,1)$ if $\gamma \leq (\bar{z}-\hat{p})/\bar{z}$. Therefore, consider

$$\gamma > (\bar{z}-\hat{p})/\bar{z}. \tag{23}$$

For the existence of IE equilibrium, the two end points of the range given by (22) must be compatible, which after re-arranging translates into:

$$\bar{z}-\hat{p}-\gamma(\bar{z}-\bar{c}) > r \cdot \Big\{\bar{z}-\hat{p}-\gamma(\bar{z}-\bar{c})+k\cdot[\hat{p}-(1-\gamma)\bar{z}]\Big\}. \tag{24}$$

Denoting the term in curly brackets by $\{D\}$, the solution to (24) is given by:

$$\text{If} \quad \{D\} > 0, \quad \text{then} \quad r < \frac{\bar{z}-\hat{p}-\gamma(\bar{z}-\bar{c})}{\bar{z}-\hat{p}-\gamma(\bar{z}-\bar{c})+k\cdot[\hat{p}-(1-\gamma)\bar{z}]}, \tag{25}$$

$$\text{if} \quad \{D\} < 0, \quad \text{then} \quad r > \frac{\bar{z}-\hat{p}-\gamma(\bar{z}-\bar{c})}{\bar{z}-\hat{p}-\gamma(\bar{z}-\bar{c})+k\cdot[\hat{p}-(1-\gamma)\bar{z}]}, \tag{26}$$

$$\text{if} \quad \{D\} = 0, \quad \text{then} \quad 0 < r \leq 1 \quad \text{and} \quad \gamma < \frac{\bar{z}-\hat{p}}{\bar{z}-\bar{c}}. \tag{27}$$

It needs to be checked in (25)–(27) above that $k \in (0,1)$ and, if relevant, $r \in (0,1]$. Specifically, since $k > 0$, the condition $D = 0$ in (27) implies $\gamma > [\bar{z}-\hat{p}]/[\bar{z}-\bar{c}]$, which is a direct contradiction to the statement in (27). In (26), $\{D\} < 0$ together with (23) and $k > 0$ implies $\gamma > [\bar{z}-\hat{p}]/[\bar{z}-\bar{c}]$, which in turn implies that the inequality with r in (26) has the RHS > 1, and hence is impossible to satisfy when $r \in (0,1]$. Lastly, turning to (25), $\{D\} > 0$ implies that either $k > [\gamma(\bar{z}-\bar{c})-(\bar{z}-\hat{p})]/[\hat{p}-(1-\gamma)\bar{z}]$ and $\gamma > (\bar{z}-\hat{p})/(\bar{z}-\bar{c})$, or $k \in (0,1)$ and $\gamma \leq (\bar{z}-\hat{p})/(\bar{z}-\bar{c})$. If $\gamma > (\bar{z}-\hat{p})/(\bar{z}-\bar{c})$ while $\{D\} > 0$, then the inequality with r has the RHS < 0, and thus cannot be satisfied for $r \in (0,1]$. We are therefore left with the solution $k \in (0,1)$ and $\gamma \leq (\bar{z}-\hat{p})/(\bar{z}-\bar{c})$ to (24), which together with $r < [\bar{z}-\hat{p}-\gamma(\bar{z}-\bar{c})]/\{\bar{z}-\hat{p}-\gamma(\bar{z}-\bar{c})+k\cdot[\hat{p}-(1-\gamma)\bar{z}]\}$ and (22) supports IE equilibrium. By completeness, in all other ranges of parameters (except those listed in parts (i) and (ii) of the Proposition), $q = 0$ is optimal while $U_m(\cdot\,|q=0) < 0$. Therefore buyers in the market opt out of contracting. ■

Proof of Claim 1

Consider the case of $q = 1$ (the argument for the case $q = 0$ is analogous) under each of the two alternative assumptions (A3) and (A4). Substitute $q = 1$ into 2, and both of these into the buyer's problem of sector choice in (5) under (A3) and (6) under (A4). Suppose there is (a) an excess demand for the market sector ($\mu < f$), (b) an excess demand for the state sector ($\mu > f$), and (c) there is no excess demand for either sector ($\mu = f$).

Since all buyers are identical, then under (A3) we must have:

$$\text{If (a) then} \qquad f = \beta = 1 \quad \text{and} \quad \bar{z} - \bar{p} > \underline{z} - \underline{p}. \tag{28}$$

$$\text{If (b) then} \qquad f = \beta = 0 \quad \text{and} \quad \bar{z} - \bar{p} < \underline{z} - \underline{p}. \tag{29}$$

$$\text{If (c) then} \qquad f = \mu,\ 0 < \beta < 1 \quad \text{and} \quad \bar{z} - \bar{p} = \underline{z} - \underline{p}. \tag{30}$$

while under (A4) we must have:

$$\text{If (a) then} \qquad f = \beta = 1 \quad \text{and} \quad \mu(\bar{z} - \bar{p}) > \underline{z} - \underline{p}. \tag{31}$$

$$\text{If (b) then} \qquad f = \beta = 0 \quad \text{and} \quad \bar{z} - \bar{p} < (1 - \mu)(\underline{z} - \underline{p}). \tag{32}$$

$$\text{If (c) then} \qquad f = \mu,\ 0 < \beta < 1 \quad \text{and} \quad \bar{z} - \bar{p} = \underline{z} - \underline{p}. \tag{33}$$

Solving the above expressions for the market price, we obtain:

$$\text{If (a) then} \qquad \bar{p} \overset{A3}{<} \bar{z} - (\underline{z} - \underline{p}) \quad \text{or} \quad \bar{p} \overset{A4}{<} \bar{z} - \frac{1}{\mu} \cdot (\underline{z} - \underline{p}), \tag{34}$$

$$\text{if (b) then} \qquad \bar{p} \overset{A3}{>} \bar{z} - (\underline{z} - \underline{p}) \quad \text{or} \quad \bar{p} \overset{A4}{>} \bar{z} - \frac{1 - \mu}{1 - f} \cdot (\underline{z} - \underline{p}), \tag{35}$$

$$\text{if (c) then} \qquad \bar{p} \overset{A3,A4}{=} \Delta z + \underline{p}. \tag{36}$$

The RHS of (34) and (36) is smaller than $\bar{z}$, and thus the buyers are willing to sign market contracts if either (a) or (c). Notice also that $\bar{z} - \frac{1}{\mu} \cdot (\underline{z} - \underline{p}) < \Delta z + \underline{p} < \bar{z} - \frac{1-\mu}{1-f} \cdot (\underline{z} - \underline{p})$, which suggests that in (a) the market price is too low, while in (b) the market price is too high, as compared with the price when demand is balanced in (c). Therefore, in the situation of excess demand the sellers could increase the price slightly and still get the buyer to trade, hence this cannot be an equilibrium. Likewise, in the situation of excess demand for the state sector, the market contract price could be reduced so that those market sellers who previously were unable to find contractual partners can now do so. Thus (b) cannot be an equilibrium either. It is therefore shown that (a) is the equilibrium outcome: the demand is balanced, both the buyers and the sellers are willing to trade, and the market price cannot be changed without changing the demand for market contracting. ■

Proof of Proposition 4

To prove the proposition, I show that

$$\text{SE equilibrium exists} \quad \text{if} \quad \lambda > \bar{c}/\bar{p} \text{ and } \bar{p} = \Delta z + \underline{p}. \tag{37}$$

$$\text{IE equilibrium exists} \quad \text{if} \quad \lambda^{\sharp} < \lambda \leq \lambda^{\flat} \text{ and (16)}. \tag{38}$$

$$\text{WE equilibrium exists} \quad \text{if} \quad \lambda < \min\{\lambda^{\sharp}, 1\}. \tag{39}$$

SE equilibrium

For SE equilibrium to exist it is necessary that $q = 1$ is the optimal choice of opportunistic market sellers, honest market sellers are willing to trade, and, by Claim 1, the market contract price is such that the buyers are indifferent between the two sectors:

$$V_m^{\gamma}(\bar{z},\lambda)|_{q=1} = \bar{p} - \bar{c} \;>\; (1-\lambda)\cdot\bar{p} = V_m^{\gamma}(\bar{z},\lambda)|_{q=0}, \tag{40}$$

$$V_m^{1-\gamma}(\bar{z},\lambda) = \bar{p} - \bar{c} \;>\; 0, \tag{41}$$

$$U_m(\bar{z},\lambda|q=1) = \bar{z} - \bar{p} \;=\; \underline{z} - \underline{p} = U_s(\underline{z}). \tag{42}$$

In the above, (41) can be ignored since it is implied by (40). It is therefore immediate that the strong enforcement equilibrium exists if (37).

IE equilibrium

For IE equilibrium to exist opportunistic sellers must optimally choose $q = 0$, honest market sellers must be willing to trade at price $\dot{p}$, and the buyers must be indifferent between the two sector contracts:

$$V_m^{\gamma}(\bar{z},\lambda)|_{q=0} = (1-\lambda)\cdot\dot{p} \;\geq\; \dot{p} - \bar{c} = V_m^{\gamma}(\bar{z},\lambda)|_{q=1}, \tag{43}$$

$$V_m^{1-\gamma}(\bar{z},\lambda) = \dot{p} - \bar{c} \;>\; 0, \tag{44}$$

$$U_m(\bar{z},\lambda|q=0) = (1-\gamma)\cdot\bar{z} - (1-\lambda\gamma)\cdot\dot{p} \;=\; \underline{z} - \underline{p} = U_s(\underline{z}). \tag{45}$$

Re-statement of the necessary conditions for IE equilibrium in terms of the market contract price gives the following:

$$\dot{p} \;\leq\; \frac{\bar{c}}{\lambda}, \tag{46}$$

$$\bar{c} \;<\; \dot{p} \;<\; \bar{p}, \tag{47}$$

$$\dot{p} \;=\; \frac{(1-\gamma)\cdot\bar{z} - (\underline{z}-\underline{p})}{1-\lambda\gamma}. \tag{48}$$

(Equation (48) is the same as (16), and re-stated here for ease of reference.) Notice that (47) takes into account both that honest sellers (first inequality sign) as well as buyers (second inequality sign) must be willing to trade at price $\dot{p}$ when the average quality is known to be less than $\bar{z}$.

The solution to (46)–(48) must satisfy the following:

$$\bar{c} < \dot{p} = \frac{(1-\gamma)\cdot\bar{z} - (\underline{z}-\underline{p})}{1-\lambda\gamma} \qquad \Leftrightarrow \qquad \lambda > \frac{\gamma\bar{z} - (\bar{p}-\bar{c})}{\gamma\bar{c}} \equiv \lambda^{\sharp}, \tag{49}$$

where the expression of the cut-off value function $\lambda^\sharp$ makes use of $\bar{p} = \Delta z + \underline{p}$. Additionally it is verified that:

$$0 \leq \lambda^\sharp \leq 1 \quad \text{if} \quad \frac{\bar{p} - \bar{c}}{\bar{z}} \leq \gamma \leq \frac{\bar{p} - \bar{c}}{\bar{z} - \bar{c}}. \tag{50}$$

It remains to be checked that (48) satisfies (46) as well as the second inequality in (47). It is easy to see that when $\lambda \leq \bar{c}/\bar{p}$ then (46) is implied by (47) and can be ignored. Then the second inequality in (47) combined with (48) gives:

$$\lambda < \frac{\bar{p} - (1-\gamma)\bar{z} + (\underline{z} - \underline{p})}{\gamma \bar{p}} = \frac{\bar{z}}{\bar{p}}, \tag{51}$$

which is satisfied for any $\lambda \in (0,1)$ since $\bar{z} > \bar{p}$. If alternatively $\lambda > \bar{c}/\bar{p}$ then the solution to (46)–(48) must satisfy

$$\dot{p} = \frac{(1-\gamma) \cdot \bar{z} - (\underline{z} - \underline{p})}{1 - \lambda\gamma} \leq \frac{\bar{c}}{\lambda} \quad \Rightarrow \quad \lambda \leq \frac{\bar{c}}{\bar{p} - \gamma(\bar{z} - \bar{c})} \equiv \lambda^\flat, \tag{52}$$

where again $\bar{p} = \Delta z + \underline{p}$ is used. It is also checked that

$$\text{if} \quad 0 \leq \gamma \leq \frac{\bar{p} - \bar{c}}{\bar{z} - \bar{c}} \quad \text{then} \quad \frac{\bar{c}}{\bar{p}} \leq \lambda^\flat \leq 1 \tag{53}$$

Collecting all the parts of the solution, namely (48), (49) and (52), we have the necessary conditions for the existence of IE equilibrium as stated in (38).

WE equilibrium

For existence of WE equilibrium, the necessary conditions are (43), (45) and (54):

$$V_m^{1-\gamma}(\bar{z}, \lambda) = \dot{p} - \bar{c} \leq 0. \tag{54}$$

In words, in WE equilibrium all opportunistic sellers optimally breach their market contracts. The breach makes the market contract price which would be acceptable to the buyer (and that would make the buyers indifferent between the two sectors) too low for the honest sellers to be willing to contract in the market. Notice that (54) is the reverse of (44), while (43) is implied by (54). The solution to (54) and (45) is therefore immediate:

$$\bar{c} \geq \dot{p} \qquad \Leftrightarrow \qquad \lambda \leq \min\{\lambda^\sharp, 1\}, \tag{55}$$

which gives the statement (39). ■