The effects of VAT harmonisation with the EU on the Turkish economy: a CGE approach

THE EFFECTS OF VAT HARMONISATION WITH THE EU ON THE TURKISH ECONOMY: A CGE APPROACH

by

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Dedicated

to my parents, and Sevinc

Sevgili Anne, Babam,

ve Sevinc'e adanmistir.

Abstract

Turkey has recently applied to become a member of the European Union (EU). The ultimate goal is full membership of the EU and with this application Turkey is obliged to undertake changes to the structure of the economy as a means of preparing for membership. Turkey's integration into the EU will result in the strict adoption of certain EU principles. In particular, all applicants are expected to adopt EU fiscal structures, for example the use of VAT as the main turnover tax. With regard to this, Turkey introduced VAT in 1985 even before her membership and followed the developments in the EU as far as VAT harmonisation is concerned.

For Turkey, harmonisation as currently envisaged will involve an upward increase in VAT rates. The rise in the rates and changes in the structures of Turkish VAT will naturally affect the Turkish economy as a result of harmonisation. In this study, we analyse the effects of changes on the Turkish economy in the structure and rates of VAT to the levels proposed by the European Commission in 1987. Therefore, we develop a computable general equilibrium tax model of the Turkish economy to simulate the effects of VAT harmonisation with the EU on mainly relative prices, resource allocation, and income distribution and welfare changes between the households by using information contained in the Social Accounting Matrix for Turkey constructed for 1990.

We have simulated the effects of the tax policy changes considering three possible scenarios. Simulation results suggest that the tax policy changes would have small effects on production sectors relative to consumption sectors. Regarding production side, the changes would lead to a general price increase in many sectors. The activity levels of most production sectors decrease due to fall in demand for consumer goods. Also, the tax policy changes would give rise to an increase in consumer good prices in all sectors, and thus decrease the output in most of the sectors in all scenarios considered. Simulation results also suggest that the tax policy changes have a negative overall impact on income distribution after income tax, and welfare between household groups, whilst they improve the income distribution slightly regarding gross income amongst the households.

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List of Acronyms

CAP	Common Agricultural Policy
CES	Constant Elasticity of Substitution
CGE	Computable General Equilibrium
COM	Commission of the European Communities
CV	Compensating Variation
EC	European Community
ECOFIN	European Council of Finance Ministers
ECU	European Currency Unit
EEC	European Economic Community
EMU	European Monetary Union
ER	Exchange Rate
EU	European Union
EV	Equivalent Variation
GAMS	General Algebraic Modelling System
GDP	Gross Domestic Product
GNP	Gross National Product
IFS	Institute of Fiscal Studies
IMF	International Monetary Fund
I-O	Input Output
OECD	Organisation for Economic Co-operation and Development
RAS	Row and Column Sum
ROW	Rest of the World
SAM	Social Accounting Matrix
SEA	Single European Act
SIS	State Institute of Statistics
SPO	State Planning Organisation
TL	The Turkish Lira
TMOFC	Turkish Ministry of Finance and Customs
UK	The United Kingdom
US	United States

VAT	Value-added Tax

CHAPTER 1

INTRODUCTION

1.1. Background to the Study

Turkey has recently applied to become a member of the European Union (EU).[1] EU membership, no matter how far in the future, is the ultimate goal. Turkey's integration to the EU will result in the strict adoption of EU principles in a wide range of economic areas, such as, foreign trade, agricultural, industrial, and fiscal policies. One of the most important of these within an economic sphere is the adoption of EU fiscal principles. Therefore, as a part of Turkey's economic integration within the EU, the study of fiscal policy is highly significant as far as Turkey is concerned.

A limited number of academic studies have been concerned with the economic consequences of Turkey's possible entry into the EU. However, as far as Turkey is concerned, the area of fiscal harmonisation with the EU has not been studied in depth and there is a need for comprehensive research into the economic consequences of these policy shifts. For example, Baysan (1984) carried out a study of some economic aspects of Turkey's entry into the European Community (EC). [2] In this study, Baysan found out that the removal of trade barriers would give rise to the expansion of output of most agricultural products and manufactured products that are mostly agricultural based. He pointed out that Turkey seems to have a clear comparative advantage in such goods in relation to the EU. Togan (1983) studied the welfare costs of Common Agricultural Policy (CAP) for Turkey by using a multi-sectoral general equilibrium trade model. He found out that EU agricultural protectionism gives rise to substantial welfare losses in Turkey, and that the welfare costs of the CAP significantly depends on the choice of domestic economic policies. Harrison, Rutherford, and Tarr (1993) studied harmonisation of the tariffs in Turkey to the common external tariff of the EU

[1] The detail of the relationship between Turkey and the EU is given in detail later in this chapter.
[2] As the time of publication of Baysan's article, the European Union (EU) was called the European Community (EC).

using a multis-sectoral general equilibrium model, and concluded that the welfare effects on the Turkish economy would be small. Karlitekin's (1988) research explored the impact of membership of the European Community on the Turkish economy. He also employed a general equilibrium model, and concluded that Turkish industry would not collapse in the face of more liberal trade policies unlike what the popular opinion in Turkey suggested. As can be seen the majority of economic studies relating to Turkey's proposed membership concentrate on trade policy issues. However, there is a distinct lack of published research concerned with fiscal harmonisation as far as Turkey is concerned.

The main area of change in EU policy with regard to fiscal harmonisation has been concerned with indirect taxation, specifically Value-added Tax (VAT) and excise duties, since this is the area which leads to fiscal checks at frontiers between the member states. [3] There has also been considerable economic literature examining the proposed harmonisation of indirect taxation. The harmonisation of VAT has dual objectives: These have been both to unify structures and to approximate rates so that they will not cause trade distortions.[4]

As a natural consequence of the European Union's progress towards the completion of internal market in 1993, VAT harmonisation has become the key to the creation and development of the Single European Market. The Community abolished fiscal frontiers on January 1993. This has brought about the free movements of goods throughout the EU. Therefore, the achievement of the harmonisation of VAT has always been a crucial within the attainment of the internal market in the EU.

As it is explained in the chapter 2, the EU member states apply different rates and structures regarding VAT. As long as large differences in VAT persist, this will cause trade distortions among the member states. Since the member states apply different VAT rates and structures, it can be said that the Commission's proposals with regard to VAT harmonisation will likely have effects on all national economies. In this context, harmonisation of fiscal policy especially in the form of harmonisation of

[3] The aim of the study, however, is to concentrate on VAT.
[4] The objectives of VAT harmonisation are explained in Chapter 2 in detail.

VAT have gained significance as far as the EU is concerned. Despite the scale of these changes, there appears to be a lack of studies regarding the impact of VAT harmonisation on the national economies of the EU member countries and only a few of these use computable general equilibrium modelling.[5] These are discussed in detail in chapter 2. Symons and Walker (1990), Lee, Pearson, and Smith (1988), Whalley (1975), Wajsman (1992) are examples of studies dealing with VAT harmonisation issues with regard to the EU member countries.

Turkey introduced VAT to replace the existing production tax in 1985. One of the main objectives of introducing VAT in Turkey was to harmonise her tax structure with the EU members in anticipating of joining the EU in the future. The current EU proposals for indirect taxation imply quite radical changes in the structure and rates of indirect taxation within Turkey. Harmonisation will involve an upward increase in rates, and change in the structure of VAT. Thus, the rise in the rates and changes in the structures of Turkish VAT as a result of fiscal harmonisation will most likely have major economic effects on the Turkish economy.

Hence, the study of the impact of changes in fiscal structures concerning the economic effects of VAT approximation with the EU is of major importance as far as Turkey is concerned.

1.2. The Relations between Turkey and EU

The history of relations between the European Union and Turkey has not been without its problems and controversies for both parties. Turkey first applied for associate membership on 31 July 1959, a short time after the foundation of the European Union. However, it was not until September 1963 that negotiations were completed. As one of the first countries to apply for associate membership, Turkey, thus, took her first step towards membership of the Union after considering the economic and political structure of the world during this time.

[5] We have reviewed in detail the selected studies on national economies of the EU in chapter 2 and chapter 6.

The main reasons why Turkey requested EU membership are as follows:

- Turkey has adopted westernisation as a state policy since its foundation in 1923 and has been included in NATO, OECD, and such like. As a natural consequence of this policy, she had decided to become a member of the Union whose main aim is to have economic and political unity in Europe;
- Turkey expects to derive benefits from various customs duty reductions by the Union. This will tend to increase Turkish exports to the EU that has a very large share in Turkish foreign trade especially in textiles sector;
- She had also considered the financial aid that will come from the Union when she becomes a member as the poorest of the EU countries tend to have enjoyed such benefits from the Union through the EU budget and other channels;
- She expects the membership likely to bring more economic and political stability;
- Greece had also applied to be a member at the same time, and with the past and present conflicts between Greece and Turkey, the Turkish Government thought that it would leave Turkey in a less advantageous position if Turkey was not in the Union. For instance, the Cyprus problem has not been resolved between countries. Therefore, Turkey felt that the Greek influence would be used against her interests within the Union.

The original members of the Union, consisting of six industrialised countries in 1959, showed a positive response to Turkey's application. However, the Union decided that the Turkish economy was not developed enough to be able to take the responsibilities of full membership. As a consequence, initially, the Union felt that the Turkish economy had to be improved before granted a full membership. Finally, in 1963, the Union gave Turkey the status of an associate membership of the EU as it had also done to Greece.

The association agreement, which was signed in Ankara on 12 September 1963 and entered into force at the beginning of 1964, is based on Article 238 of Treaty of Rome.[6] This agreement with the EU is called Ankara Agreement through which Turkey would pass three stages on the way to full membership.

[6] See Commission of the European Communities (COM) (1963).

- A preparatory stage of at least five but up to nine years during which Turkey should strengthen her economy by means of receiving trade concessions and financial aid from the Union in order to be able to fulfil the obligations that would devolve upon it during the transitional and final stages. During the preparatory stage, the EU gave concessions to main agricultural products such as tobacco, raisin and hazelnuts, which together made up almost 40 % of Turkish exports to the Union and made provision for ECU 175 million of loans which were made available over five years to assist Turkey's development.
- A transitional stage of twelve to twenty years during which time the EU and Turkey would establish a customs union. In this stage, Turkey would progressively adopt the EU's common external tariff. In addition to that, both general economic policy alignment and the integration of specific sectors such as free movement of labour and capital, competition, transport and so on would occur.
- And a final stage which would be based on customs union and would require closer co-ordination of the economic policies of contracting parties. This stage would provide the possibility of Turkey to accede to the Union once economic policies of both parties have been co-ordinated.

Also the Ankara Agreement set up three bodies to co-ordinate economic and political relationships between the Union and Turkey:

- the Mixed Parliamentary Commission
- the Council of Association
- the Association Committee[7]

Turkey has negotiated the different stage of her relationships with the Union through these latter two bodies.

The preparatory stage might have ended in 1968. However, by the end of 1960s it was realised that neither Turkey nor the Union could fulfil their promises in full. Therefore, an Additional Protocol was eventually signed on 23 November 1970 and

[7] See Bridge (1976).

entered into force on 1 January 1973. The aim of this protocol was to establish targets to be achieved during the Transitional Stage. The Additional Protocol set up a timetable for the gradual establishment of freedom of movement for Turkish labour over the period 1976-1986, for the abandonment of quantitative restrictions in trade and for the elimination of customs duties with a view to aligning the Turkish customs tariff on common customs tariff , as far as EU is concerned.

Indeed, since the Additional Protocol was signed, several areas of disagreement have continued to strain relationships. The members of the Community have been reluctant to take steps that would allow the gradual introduction of free movement of workers over a period of ten years, as called for in the Agreement and Additional Protocol due to the slow-down in the economic activity in the Union. In addition, Turkey's desire for the expansion of the Union's concessions granted to her agricultural and cotton textile products have usually been satisfied only partially. Also there have been some problems with regard to implementation of financial protocols.

On her side, Turkey was unable and unwilling to implement the scheduled tariff reductions, since her economic situation started to deteriorate in 1977. Therefore, the result was that by the end of 1977 tariff reductions had amounted to only 20 % and 10 % depending on industrial product in question, instead of being 100 % and 40 % respectively. The EU, on its side, was not prepared to maintain the full commercial concessions made to Turkey. As a result, it imposed import quotas and restrictions on cotton yarn and textiles to protect domestic manufacturers in the member states. Turkey, on the other hand, took some measures against imports of iron and steel. At the end of 1981, the Union froze the financial aid of ECU 600 million which was provided for under the fourth financial protocol due to military intervention in Turkey in September 1980.

Turkish-EU relations has become animated since the re-establishment of elected civilian Government in 1983. The new Government was committed to the deregulation of both foreign trade and the domestic economy. The new economic policy has aimed to open the Turkish economy to the world and thus assist to Turkey to integrate her economy to the EU.

The Ozal Government which came into power on 6 November 1983, eventually submitted a formal application for accession to the EU on 14 April 1987 as was her right under the Ankara Agreement. With this application Turkey has been preparing to embark upon the final stage of full membership in the EU. The Turkish application not only reflects the strong desire to take a place within the Union, but at the same time to help the Union clarify its mind towards eventual Turkish membership. In response, the European Commission prepared an official Opinion which was announced on 18 December 1989. The Commission decided that Turkey is eligible for membership of the Union in accordance with the Ankara Agreement. However, it concluded that the Union could not enter into negotiations for accession with applicant countries until after the completion of single market in 1993 and did not suggest any particular date on which they would likely to begin.[8] The Commission finalised its package of proposals on 12 June 1990, including such elements as the completion of the customs union by the beginning of 1996, implementation of the fourth financial protocol that provided for ECU 600 million, industrial and technological co-operation, and reinforcement of political and cultural links.[9] These proposals were a potentially important development in EU and Turkey relations.

On 10 November 1992, at a delayed Association Council meeting, it was agreed that both sides would continue to work towards the establishment of Customs Union by the beginning of 1996, and that a timetable would be set for the eventual introduction of free movement of labour and economic co-operation. Eventually, Turkey signed an agreement to join the customs union in November 1995 which came into effect on 1 January 1996. Hence, one of the two main objectives set out in the EU and Turkey Association Agreement has been achieved on time since the establishment of the customs union.

According to past agreements between the EU and Turkey, it is assumed that Turkey's full membership will ultimately be realised, since both sides are committed by the Ankara Agreement and the Additional Protocol to the eventual Turkish membership

[8] See Hale (1994)
[9] Commission of the European Communities (1990), Communication to the Council on Relations with Turkey, SEC (90) 101/Final, Brussels, 12 June 1990.

as explained above. Therefore, Turkey is under obligation to prepare for full EU membership. This is the ultimate goal, even though it may not be realised for the foreseeable future.

1.3. Background Information about Turkish Economy

Turkey can be classified as a middle income developing country with income per head substantially lower than that of the EU average (see Table 1.1). The main economic problem stems from the level of Turkish development and comparative weaknesses as demonstrated by her main economic indicators. Although the Turkish economy has grown rapidly in recent years compared with the European Union average, a noticeable gap between the EU and Turkey still exists. These main economic indicators are shown in Table 1.1. They not only give information about the Turkish economy, but also offer comparisons with the EU averages.[10]

[10] As we employ 1990 as base data in this study, we give the main economic indicators regarding that year and compare them with the EU average in order to see the comparative weakness of Turkish economy regarding the EU.

Table 1.1. Turkey and the European Union: Some Comparative Data (1990)

Main Economic Indicators	Turkey	EU 12*
Population (million)	56	326
GDP Growth (%)	9.7	2.9
GDP per capita, current prices (US$)	2675	16190
Sectoral breakdown of civilian employment by main sectors (%)		
Agriculture	49.9	2.9
Industry	14.9	48.7
Services	35.2	48.4
Value Added Share by main sectors in GDP (%)		
Agriculture	17.3	6.7
Industry	23.7	33.2
Services	57.9	60.1
Unemployment rate	10.4	8.4
Inflation (%)	59.3	6.2
Final Private Consumption as % of GDP	67.1	60.1
Government consumption as % of GDP	11.0	16.5
Gross Fixed capital as % of GDP	23.1	21.0
Changes in stock as % of GDP	3.2	0.6
Net trade balance (Exports -Imports) as % of GDP	-4.3	0.3

*The 12 countries that were the members of the EU in 1990.

Sources: State Institute of Statistics (SIS) (1992) Statistical Yearbook of Turkey; State Planning Organisation (SPO) (1991) Main Economic Indicators; Eurostat Yearbook' 95: A Statistical Eye on Europe (1995); OECD (1992) Economic Outlook.

As can be seen, Turkey's GDP per capita is substantially lower than that of the EU average (US$ 2675 and US$ 16190 respectively). In spite of the fact that the agricultural sector has declined in relative importance, it still continues to dominate the economy. The agricultural sector employs around 50 % of labour force (54.9% in 1980) and constitutes 17.3% of value added produced in the economy. Compared with the Union average of 2.9% in 1990 (6.7% in 1980) the share of the agricultural sector remains very high. Moreover, the inflation rate is substantially higher (59.2%) in Turkey than in the EU (6.2%) and appears likely to remain high. Thus, compared with relatively low inflation rate in the EU, the high inflation rate will create problems not

least the question of the ability of Turkey to compete in the EU market if her membership is realised. Finally, the unemployment rate is relatively high in Turkey (10.4%).

In spite of the fact that Turkey is undoubtedly much poorer than the EU, its economy is growing at a faster rate. Between 1980 and 1989 GDP rose by an average of 5.4 %, compared with an average of 2% for member states. Returning to Table 1.1, we can see that GDP growth rate was relatively high in 1990 (9.7%). Turkey needs a substantial high growth rate in her economy to approach average level of the EU economy. Also, total foreign trade volume has increased considerably, from $19.5 billion in 1985 to $35.5 billion in 1990 (See SIS, 1991). However, the difference between exports and imports has also increased remarkably from -$2.9 billion to -$9.6 billion in 1990. The net trade balance accounted -4.3% of GDP in Turkey compared with 0.3 % of GDP in the EU. Private consumption, which accounts 67.1% of GDP appears to have been the mainstay of domestic activity in 1990 although this only marginally higher than the EU average.

Hence, major structural shortcomings in the Turkish economy as indicated by a low GDP per capita, low productivity and the high proportion of the labour force in the agricultural sector, a high inflation rate, and a high rate of unemployment have been the main concern of the EU as far as her membership is concerned. Therefore, Turkey, has to improve her economy before her membership can be realised.

1.3.1. The Economic Gains from Membership of the EU

There are at least five major economic advantages that Turkey may obtain from joining the Union;

- The most important one will be benefits accruing from the expanded market that will be created by membership of the Union. The expanded market could stimulate Turkish growth through an increase in demand for Turkish exports. Thus, increased exports may encourage capital movements and increase domestic capital formation.

- There will, in the long term, be large benefits to the Turkish economy following upon the entry of Turkish labour force into the EU labour market, as there will be free movement of labour.
- The economic instabilities that exist in Turkey will likely be reduced by the stabilising effect of economic integration into the Union.
- The financial aid which will come from the Union's institutions, such as the European Investment Bank and the EU budget, will make considerable contribution to the Turkish economy.
- Lastly, the developments of institutionalisation of market economy, in accordance with the EU economic system and structure, will provide some advantages. For example, the membership of the Union require a substantial rationalisation of industrial structures to create firms of viable size. As a result, Turkish firms, which tend to be small and thus fail to exploit economics of scale, will have to be restructured. Moreover, increased competition in the event of membership will tend to give rise to greater efficiency in Turkish industry.

These economic advantages in the case of membership may assist Turkey's economic development. However, some of these expectations might not be realistic in the event of Turkey's accession to the Union. For example, the mutual removal of tariffs and other trade barriers would create trade expansion for the European Union members and Turkey in the case of enlargement, despite the fact that it is impossible to predict with certainty the amount of expansion. In this case, Turkey's agricultural products and industrial products such as textiles will tend to have a larger market, whilst Turkish industry will suffer from free trade because of its inability to compete. Moreover, Turkey, cannot realistically expect much assistance from the Union to solve her labour market problems as far as labour force is concerned, since unemployment has already been a continuous problem in the most of present union members in recent years. Moreover, as there has already been some dispute over receipts and payments sides of the Union budget, Turkey's expectations from the budget may not be realised.

1.4. The Aim of the Study

In this study we are not interested in whether Turkey has the necessary qualifications to join in the EU either now or in the near future. Instead, it is assumed that Turkey's full entry into the EU will ultimately be realised according to past agreements between Turkey and the EU. As a part of economic integration Turkey will have to approximate her VAT structure and rates with the EU after her full membership. The approximation of Turkish VAT to the EU entails quite radical changes in the structure and rates of Turkish VAT as far as the 1987 proposals of the European Commission are concerned. Therefore the changes in the Turkish tax system will likely have effects on the various productive and consumption sectors of the economy in addition to the income distribution and welfare between different household groups in Turkey.

The aim of the study is, therefore, to investigate the effects that required tax reforms may have on the Turkish economy. However, investigating all facets is beyond the scope of this study. Therefore, the primary aim of this study is to analyse quantitatively the impact of the VAT harmonisation with the EU on relative prices, resource allocation, welfare, and income distribution between the households using the information contained in the recent Social Accounting Matrix for Turkey for the year 1990.

As we are interested in quantifying possible economic effects of simulated changes in the Turkish VAT, formulating a model that is appropriate for a system incorporating a large number of sectors, households, taxes and so on is very important. There has been a well established and rapid growing body of literature focusing on tax policy evaluations using disaggregated computable general equilibrium (CGE) models. The popularity of a CGE approach is not surprising, given that this approach has several advantages over more macro-oriented models or analytical partial equilibrium analysis.[11] The main idea underlying general equilibrium analysis of tax policy is that, in order to evaluate the effects of changing a major tax, important economy-wide effects must be taken into consideration. When analysing tax policy changes, CGE

[11] We discuss the advantages of CGE modelling in chapter 4 in more details.

analysis allows all feedback effects to be taken into account, whilst detailed features of tax system can be captured and discrete and large policy changes can be considered.

Since VAT approximation with the EU requires large changes in Turkish VAT rates, CGE modelling seemed to be a good choice for the purpose of the study. Thus, we develop a static Social Accounting Matrix (SAM) based computable general equilibrium tax model of the Turkish economy to simulate the effects of changing the Turkish VAT rates to the levels proposed by the European Commission. The CGE model employed in this study follows the tradition of applied general equilibrium tax models pioneered by Shoven and Whalley (1972, 1973). The Shoven-Whalley framework has been the source of inspiration for many large-scale CGE models in the area of tax policy issues. The CGE model we utilise in this study is a one-stage static multi-sector general equilibrium model and incorporates several industries, households, goods and factors. The specification of the model follows to the some extent the standard CGE models currently in use, described in Dervis et al. (1982).

1.5. Structure of the Thesis

The thesis contains eight chapters. The initial chapter has given an introduction to the subject of the thesis. In chapter 2, we give some background information about harmonisation of VAT and its possible economic effects on EU member countries. Chapter 3 discusses the major aspects of the Turkish tax system and outlines the treatment of each component of this system within the CGE model of Turkey. This chapter also presents a comparison of Turkish tax system to that of EU countries. Chapter 4 presents the fundamentals of CGE modelling with emphasis on tax policy issues and reviews the literature on general equilibrium tax models, particularly static models. In chapter 5, we present the full specification of our CGE model. In this chapter, a list of the industry, consumer goods, household groups that are considered is given. We also describe the functional forms, the methods of treatment of the government sector, foreign sector, savings and investment together with the other features of the model. Chapter 6 deals with model implementation issues. In this chapter, we present a complete description of the benchmark equilibrium data set that we have constructed for 1990 and describe the parameterization methods. Our

simulation results are presented in chapter 7 together with an analysis of them. The final chapter summarises our main results and gives the main conclusions drawn from the analysis of the results.

CHAPTER 2

THE HARMONISATION OF VALUE-ADDED TAX AND ITS ECONOMIC IMPACTS ON THE EUROPEAN UNION MEMBER COUNTRIES

2.1. Introduction.

The European Commission has produced several proposals and has implemented several measures as a part of its drive to complete a single European market. Some of these proposals are related to the harmonisation of indirect taxes, as the Commission views harmonisation of indirect taxes (particularly VAT and excise duties) as an important prerequisite for completing the internal market. Thus, as a natural consequence of the European Union's (EU) progress towards completion of the internal market in January 1, 1993, tax harmonisation has become the key to the creation and development of the European Common Market. [1] As the EU became an internal market on 1 January 1993, fiscal frontiers have disappeared since then in the Union. This has facilitated the free movement of goods throughout the EU. Therefore, tax harmonisation has become an extremely pertinent subject recently. Having mentioned the importance of tax harmonisation in the context of European economic integration, we should define what is meant by tax harmonisation.

Tax harmonisation is generally understood as a procedure of adapting tax systems of different jurisdictions in the line of common policy. Dosser (1973) defined tax harmonisation as tax co-ordination. However, as Prest (1979) argues, we should distinguish the notion of tax coordination from tax harmonisation. "Coordination" is tantamount to a low-level meaning of tax harmonisation, because it could well be 'interpreted to be some process of consultation between member countries or, loose agreements between them to levy tax on a similar sort of base or at similar sorts of

[1] After "Maastricht Treaty", which came into force on 1 November 1993, created the European Union (EU), European Community (EC) is called as European Union. Therefore, we sometimes refer EU as EC when necessary.

rates'. The fiscal constitution determines the degree of tax coordination in federal tax systems, whereas on a supranational level tax coordination is determined by international agreements on a bilateral base such as double taxation treaties or on a multilateral base such as the EEC-treaty. Thus, one might say that the institutional framework for tax policy of governmental policies is determined by tax coordination. El-Agraa defines tax harmonisation as "the identical unification of both base and rates, given the same tax system and assuming that everything else also is unified" (El-Agraa, 1994, p.293), whereas Burke defines it as "the process of compressing the differences and removing the disparities in national tax provisions to the point where they no longer affect the allocation of economic resources" (Burke, 1980, p.1). Similarly, Westaway defines it as " the process of removing disparities in national tax structures to the point where they no longer affect the operation of free markets and hence the allocation of resources between member states" (Westaway, 1992, p.82). Therefore, we might say that the major objective of tax harmonisation schemes within the wider process of economic integration is to remove distortions of trade between countries (including factor movements) within the integrating area.

The main area of concern in EU policy with regard to fiscal harmonisation has been indirect taxation, particularly VAT, as this is the area which leads to checks at frontiers between the member states. Also, most debate in the economic literature has been stimulated in this area. The main indirect taxes that have been included in the harmonisation programme are value-added tax (VAT) and excise duties.[2] The objective of the harmonisation of indirect taxes has been both to unify structures and to equalise rates so that they will not cause trade distortions. As long as large differences in VAT persist, this will cause trade distortions among member states[3]. Therefore, the theory of fiscal harmonisation is largely concerned with the neutrality criterion applied to goods and factors moving within the Community and the tax harmonisation policies of the Community have been undertaken primarily from the standpoint of trade. It should not be the case that goods from one country are preferred

[2] More precisely, we will mainly focus on VAT harmonisation and its possible effects on the EU member countries in this chapter to be consistent with the subject of the study.
[3] How the large differences create trade distortions is explained later in the chapter.

simply because they carry a lower rate of tax in that country than the goods in another country.

Hence, harmonisation of VAT has always been a crucial step for the internal market. The single European Act (SEA), which came into effect in 1987, defines the internal market as "an area without internal frontiers in which free movements of goods, persons and services and capital is ensured" in accordance with the provisions of this treaty. The harmonisation of indirect taxes in the Community can be seen as a three stage process which consists of the following (Guieu and Bonnet, 1987, p210):

"a) establishment of fiscal neutrality in intra- community trade;
b) simplification of administrative procedures in this trade;
c) creation of an internal market".[4]

All of these stages are nearing completion , although the Union is still working on the harmonisation of indirect taxes.

There are mainly two approaches in which commodities entering international trade can be brought into domestic taxation. The first is the so-called destination principle in which taxes depend upon where a good is consumed, rather than where it is produced. Application of this system requires border tax adjustments to ensure that exports leave with no tax and imports enter subject to full domestic taxation. The destination principle was applied in the European Union before the abolition of fiscal frontiers. However, an interim system, which is transitional, is in operation at present.[5] This system is described as a 'flexible' destination system (see Penketh, K. , 1993) and was due to be replaced by a definitive system based on origin principle at the start of 1997. [6] However, the definitive system has not been introduced yet. The second approach is the origin principle under which tax rates depend upon the country of production. This system is originally proposed to be applied in the Community by the

[4] Creation of an Internal Market requires the abolition of all controls and formalities on intra-Union trade. In this context, harmonisation of VAT gains importance as far as the Union is concerned.
[5] Since the abolition of fiscal frontiers, tax controls have been abolished at intra-Union frontiers. This means the imposition of VAT on imports between the member countries has ceased.

Commission. However, Shibata(1967) introduced another alternative which is called restricted origin principle. According to this principle, trade within the Community should be taxed in terms of the origin principle, whereas destination principle should be applied to trade with the rest of the world.

The European Commission has made several proposals in respect of the harmonisation of indirect taxes. However, in the area of indirect taxation, most progress has been made with respect to value-added tax. In spite of the fact that the value-added tax has been applied in all the member states, the EU countries have applied VAT in different ways. Some charge zero rates to certain goods whilst most have differences in the rates of VAT applied. While some countries have applied a single standard rate, others employ a range of tax bands, namely, reduced, standard and increased rates (see Table 2.1). Therefore, the problem is that the harmonisation of VAT as currently envisaged involves EU member countries adjusting their tax rates towards the closer approximation of VAT. With regard to this, one might say that some of the member states face difficulties in harmonising their existing tax rates to the proposed bands of the Commission. The Commission's proposals with regard to VAT harmonisation will inevitably give rise to economic consequences for each individual country. [7] How important these economic consequences are depends upon the country's VAT rates and structures. Apart from its budgetary effects, VAT harmonisation will have effects on industries, prices, trade, income distribution, consumer demand in member countries.[8] Consistent with the budgetary estimates, the simulated effects of VAT harmonisation are negligible for most member states particularly the largest ones as discussed later in this chapter.

The aim of this chapter is to give some background information about harmonisation of VAT and its possible economic effects on the EU member countries. Firstly, therefore, historical developments in the area of VAT are identified. Also, this chapter explores the current policy in the EU for the harmonisation of VAT. In accordance

[6] This system is sometimes called a "mixed system" or "origin system" in the literature. (see, for example, Lockwood, de Meza and Myles (1995), Penketh (1993).
[7] Aside from its economic effects, VAT harmonisation will have administrative effects on the member countries. However, in this chapter we deal with the economic effects of VAT harmonisation only.
[8] These economic effects will be discussed in detail later in this chapter.

with this, the applications in the rates and the proposals that have been made by the Commission are given with regard to VAT. Moreover, comparison of the destination principle with the origin principle is made in this chapter. Also, this chapter explains the need for tax harmonisation in the Community. Furthermore, we discuss possible effects of VAT harmonisation and give the results of the quantitative studies that are related to EU member countries on commodity tax harmonisation. The final section is the conclusion of the Chapter.

2.2. Harmonisation of the Value Added Tax

The desire to harmonise indirect taxes within the European Union is not new. It was a part of the founding principle and was explicit in the Article 99 of the Treaty of Rome which was signed in 1957 and empowered the European Commission to submit proposals for harmonising taxes. Five articles, 95-99, of the Treaty of Rome provide for the harmonisation of indirect taxes both in structures and rates. Article 99 of the Treaty specifically refers to the harmonisation of indirect taxes and indicates that the Commission shall consider how to further the interests of the Common Market by harmonising the legislation of the various member states concerning turnover taxes, excise duties and other forms of indirect taxation. Harmonisation here was seen important, particularly because the removal of tariffs would leave taxes as the main source of intra-EEC trade distortion.

Over the years, some progress has already been made with regard to VAT. The Commission has drawn up various proposals for the approximation of VAT rates. Within the Union all member Countries had to adopt VAT as their turnover tax following the recommendations of Neumark Committee in 1963. In spite of the fact that the European Council issued six directives with the aim of achieving conformity between the different practices of the member countries, there was not a common VAT base until the sixth directive on VAT. The Sixth Council Directive, adopted and implemented by all member countries in 1977, provided for common definitions and a uniform basis for VAT (see Council of the European Communities 1977a). Also, the Commission's decision of 21 April 1970 set down that from 1975 onward the Community Budget would be financed from the EC's own resources. Thenceforward,

a proportion of the VAT base has been an element in the Community's 'own resources'. Thus, harmonisation of indirect taxes has become linked to the Community budgeting.

As mentioned earlier, most of the developments in the area of indirect taxation have been made in the field of VAT. The main decision was taken by the Neumark Committee in 1962 (See Neumark Committee Report 1963). The abolition of fiscal frontiers was a main preoccupation of the Neumark Committee. The Committee proposed that the existing turnover taxes should be replaced by a common value-added tax of the type already in place in France and under active consideration in Germany. Afterwards, the Council of Ministers of the EEC proclaimed a First Directive on 11 April 1967, requiring all member states to introduce a value added tax before the end of 1970. The basic structure of the tax was specified by a second directive which was issued on the same date. France was exempt from this requirement as she had already applied the tax. Despite the fact that the application date was postponed a few times, all states , including the new entrants, namely, Denmark, Ireland and the United Kingdom had introduced the tax by 1973. Next, Greece applied the tax in 1987. The latest members, Spain and Portugal applied VAT following their entrance to the Community in 1986.

Before the Rome Treaty was signed, all the member states, apart from France, had applied cumulative taxes. These taxes have the main disadvantage of being cumulative from one stage to the next, making it impossible to determine the amount of tax actually included in the production chain. The amount of tax depends upon the number of stages in the production chain. On the other hand, VAT is a tax that is levied on the value-added to the goods and services by each business entity at various levels in the production and distribution chain. The tax is levied on consumption and is borne by the final consumer of goods and services. Thus, it is easy to calculate the amount of tax paid at every stage.

As mentioned before, after the Treaty of Rome, a series of VAT directives were proposed by the Commission. Six directives were issued from 1967 to 1977 in order to achieve conformity between the different practices of the member states with regard

to VAT. The first two of these directives were only concerned with administrative procedures and with setting out which goods and services should be subject to the tax and which should not. However, it was the sixth directive ,adopted in 1977, that took a remarkable step towards establishing a common VAT base in member states, based on the adoption of common basic concepts and the specification of a list of allowable exemptions. The Sixth Directive of the Commission also prepared the necessary conditions for the final stage of harmonisation and for the collection of VAT as the basis for the EC's 'own resources' that were destined to finance its common policies. Since the Sixth Directive, several other directives have been brought into effect to complement these three key directives.

Later, the Commission's original proposals for tax harmonisation were set up in the White Paper in 1985 (COM 85, 310 Final). The White Paper concluded that the harmonisation of indirect taxes would be essential for the single market proposals, once the fiscal frontiers were abolished, since applying different tax rates would cause trade distortions as mentioned before. Therefore, the Commission proposed that the following measures would be needed as far as VAT is concerned;

a) an approximation of VAT rates in order to lessen the risks of fraud, tax evasion and distorted competition . With regard to this, the white paper concluded that each member state should be permitted to set only two rates of VAT, namely, standard rate which would lie between 14% to 20% and a reduced rate which would lie between 4% to 9%.

b) the substitution of the destination principle by the origin principle. This means that exports would no longer be subject to special treatment, because the VAT rate would become the rate that is applicable in the country of origin. As a consequence of this, exports from one EU country to another would be treated in exactly the same way as transactions entirely within one member state.

c) the establishment of a Community clearing mechanism so that member states would not lose revenue from indirect taxes as a result of traders in their country

being able to claim as input tax any VAT paid on purchases from businesses in other member states.

The Single European Act (SEA) which was signed in 1985 and came into force in 1987, amended Article 99 of the Rome Treaty. The SEA redefined the Community's the criteria for harmonising indirect taxes. With regard to this, harmonisation of indirect taxes is stated to be necessary to ensure the 'establishment and functioning of the internal market by the end of 1992'. Thus, the main aim of harmonising indirect taxes in the Union is to secure the abolition of fiscal frontiers.

In August 1987, as a part of the process of establishing a single market by the end of 1992, the European Commission produced the requested package of proposals (COM 87, 320 Final). These proposals were largely part of the programme of action based on the 1985 Commission White Paper, Completing the Internal Market, that aims to create a single integrated internal market within the Community by the end of 1992. The Commission proposed that all member countries should apply only the two VAT rates as proposed by the White Paper, standard and reduced rate, no later than 1 January 1993 (see Table 2.1). The Commission decided that the reduced rate would cover the items of basic necessity. It would apply to the following goods, which constitute about one-third of the Common VAT base:

- foodstuffs (excluding alcoholic drinks)
- energy products for heating and lighting
- supplies of water
- pharmaceutical products
- books, newspapers and periodicals
- passenger transport

The Commission proposed that the increased VAT rates should be abolished. Although a VAT system that consists of a single rate is, in theory, the simplest and most efficient structure, this approach would have undesirable consequences for some member country governments and would probably be unacceptable to the Union as a whole. Therefore, the Commission proposed a two-rate system, since a more than two

rate system would create more complications for taxpayers and national administrations. Thus, the Union aimed at the two rate system rather than requiring those member states which had not applied an increased rate to introduce one. As a result, the increased rate has been abolished since 1 January 1993.

Despite the fact that most member states were prepared to agree in principle to the basic ideas produced by the Commission, some member states, especially Denmark and Ireland reacted unfavourably to these proposals, as they would face a substantial budgetary shortfall due to the needs to lower their VAT rates. Also, the Union members felt that the clearing house system proposed by the Commission was either too complex or too unreliable and open to fraud.

In spite of the fact that the VAT rates proposed in 1987 were based on the then-present situation in most of the member countries, there was much resistance against the proposals of the Commission. For example, the United Kingdom took the opposite view, that it did not want to achieve harmonisation by law; rather, it argued, international competition on commodity markets could deal with the problem more adequately. Some other countries also had various reasons to object to the Commission's initial proposals. In order to solve these problems, the Commission suggested a more flexible approach in 1989 (COM 89, 260 Final). It decided that it would be sufficient to set a minimum rate applicable from January 1, 1993 above which member states would be free to choose their own rate as far as the standard rate of VAT is concerned. However, it continued to support the reduced rate band. Also, it decided that the clearing house system could be based on macro economic data and this might well simplify the procedures.

Although the Commission's initial proposal for two rate bands constitutes the basis for the discussion within the Council and Parliament, after much discussion new agreements was eventually reached by ECOFIN (European Council of Finance Ministers) on 24 June 1991. The new agreements set a minimum standard VAT rate of 15%, and one or two reduced rates with a minimum of 5% applicable until the end of 1996 (see Gordon, L. 1993). Also, the temporary retention of existing zero rates in some countries and extra low rates such as below 5% was authorised.

Afterwards, the Council adopted a directive on the approximation of VAT rates which was a follow up to ECOFIN's agreement on VAT (see Official Journal L 316, 31.10.1992). This directive sets the transitional VAT arrangements applicable, in theory, from 1 January 1993 to 31 December 1996. Under the new arrangements, standard VAT rate must be at least 15% in each member state and also one or two reduced VAT rates of at least 5 % for certain good and services. (see Table 2.1). Also, the Council decided the zero rates and extra-low rates (below 5%) existing on 1 January 1991 might be maintained, in principle, until 1997. However, the Council abolished the increased rates. The new arrangements had to be reviewed before 31 December 1996, as the Commission has not withdrawn its initial proposals on VAT rates. As a result, the new arrangements have given rise to reductions in the number of VAT rates. Also, there has been increases or decreases in the standard VAT rates in some member states, as tax controls have been abolished at intra-Union frontiers. In this context the main focus will be on Commission's initial proposals on VAT when we do simulations for the purpose of the study.

Although the ultimate goal of the Community is to apply the definitive principle (based on origin principle), from 1 January 1993 to 31 December 1996, a " Transitional Period" exists based upon the destination principle at present. Moreover, after 1996, the statistical information on movements will be used to calculate debits and credits for the "clearing house" mechanism required under the origin principle.

2.3. The Present VAT Rates and Structure in the European Union

As mentioned earlier, there are still marked differences in the application of VAT between the member states, although the VAT systems in the member states have, since the start, been developed in line with the policy decisions of the European Community.

Table 2.1 presents the summary information on VAT in the European Union Members in 1990[9]. It shows the rates and the structure (tax base, number of rates, etc.) of VAT

[9] Since 1990, there have been changes in the VAT rates in the Union. The detail of the developments with regard to these changes are given later in the chapter. However, as we construct the model by using data for the year 1990 for Turkey, the data for this year is taken into consideration with regard to the indirect taxes in the Union.

in the Union members[10]. Also, it illustrates the initial and the latest proposed rates by the European Commission.

Table 2.1 VAT Rates in the EU Member States (1990) and the Commission's Proposals .

Country	Year of Introduction	Statutory Rates (%)		
		Reduced Rate	**Standard Rate**	**Increased rate**
Belgium	1971	1, 6	19	25, 33
Denmark	1967	-	22	-
France	1968	2.1, 5.5	18.6	25
Germany	1968	7	14	-
Greece	1987	3, 6	16	36
Ireland	1972	0, 5, 10	23	-
Italy	1973	4, 9	19	38
Luxembourg	1970	3, 6	12	-
Netherlands	1969	6	18.5	-
Portugal	1986	0, 8	17	30
Spain	1986	6	12	33
United Kingdom	1973	0	15	-
Commission Proposal		4 -9	14-20	abolished
Minimum rates 1993-97		5	15	abolished-

Source: 1) Westaway, (1992, p.94)

2) COM(87) 320 final and Council of the European Communities (1992).

As shown in Table 2.1, nine member states introduced the value-added tax between 1967 and 1973. Portugal and Spain followed in 1986 and Greece in 1987 after becoming members. As can be seen from the table, the VAT rates vary from country to country at the present. Also, the structure of VAT rates varies in the member states. With regard to this, the UK and Denmark, currently apply one rate to most of the goods and services, whereas a number of member states operate multiple rate systems, including standard rate, one ore more reduced rates and higher rates applied to certain luxury products. Also, the UK applies a zero-rate to some basic necessities, such as

[10] As explained in chapter 1, the Union is now composed of 15 states after Austria, Sweden and Finland joined on 1 January 1995. However, we only take the previous 12 member countries into account, since we use 1990 data for the CGE model of Turkey.

food, children clothing. Moreover, Portugal and Ireland apply a zero rate to some goods and services.

As the table illustrates, wide disparities exist in the effective rates of VAT in the member states of the Union. Thus, for example, the VAT rates range from zero rating of certain goods and services, such as basic foods, newspapers, and children's clothing, in Ireland, the United Kingdom, and Portugal, to rates reaching as high as 38% on specific luxury items in Italy. Also, standard rates of VAT range from a low of 12% in Spain and Luxembourg, 14% and 15% in Germany and the United Kingdom respectively, to a high of 22% in Denmark and 23% in Ireland. These differences between the member states have created the "Martelange Factor" named for a town that lies on the border of Belgium and Luxembourg.[11] In Martelange one side of the main street is filled with petrol stations, which also sell spirits, wine and tobacco in addition to diesel and petrol. This side of the street belongs to Luxembourg, where the VAT is only 12%. On the other hand, the other side of the street falls in Belgium where goods are taxed at 19%. This wide difference leads rise to cross-border shopping, and it is not surprising that the store owners have a hard time staying in business in Belgium. Thus, we might say that these differences are clearly too wide to allow the abolition of fiscal frontiers without serious economic consequences. Therefore, the spread of rates must be narrowed down to a point where the difference between the upper and lower limits will not create undesirable price differences between the member countries. In this context, there has been significant convergence in standard rates towards the harmonisation of VAT since 1990. Since 1990, Spain and Luxembourg have increased their standard VAT rates to 15% and 19% relatively in the direction of the European Single Market. Ireland reduced its standard VAT rate from 23% to 21%, while the United Kingdom has increased the standard rate from 15% to 17.5%. Thus, the difference in rates has narrowed from 8% to 3.5% between Ireland and the UK (see Penketh, K, 1993, p.52). The standard rates in the rest of the member countries have remained the same as in 1990. On the other hand, the higher rates which are applied to luxury goods and are a characteristic of the VAT structure in half of the member states have been abolished since the creation of the Single Market in 1 January 1993. As far as reduced and zero rates are concerned,

some arrangements were made for a transitional period (1993-1997) after strong opposition by some member countries, especially the UK. Under the new arrangements, the temporary retention of existing zero rates and extra-low rates such as below 5% was authorised. However, these arrangements were to be reviewed before 31 December 1996.

Hence, most of the EU member countries have made significant changes in their VAT tax structure as well as in the rates with regard to tax harmonisation in the EU. However, as the minimum rates are only for the transitional period and to be reviewed before 31 December 1996, some member countries, such as Denmark, the UK, and Ireland, would have to make some changes in their tax rates and structures with regard to VAT harmonisation if the Commission's original proposal were applied (see Table 2.1).

2.4. The Destination and Origin Principles

Taxes on consumption goods entering intra-community trade can be imposed mainly according to one of two principles, namely, the destination and origin principle. Despite the fact that the Union applied the destination principle prior to 1993 with respect to intra-community trade, the Community's ultimate goal is to implement the mixed system after 1996 as a means of avoiding border controls that appear to be required to administer border tax adjustments. Under the destination principle goods are taxed in the country where they are consumed. To ensure that goods are taxed in the country of consumption, zero rates are applied to them when they are exported from one member state to another.[12] Then, the same sales tax that is applicable in the country of consumption is levied on imported goods as it is imposed on domestically produced goods. This process of destination principle clearly requires border tax adjustments for imported goods. Therefore, the current 'flexible' destination principle was applied after the abolition of fiscal frontiers. [13] On the other hand, if the good is taxed in the country in which it is produced and it continues to bear the tax of origin,

[11] See Culp, C.L (1989, P.9)
[12] Zero rates applied to exports mean that any tax paid to that point is refunded to exporters.
[13]The transitional system of taxation presently in force is described in detail in Keen, M. (1993), Smith, S. (1993), European Commission(1994).

it is said to be taxed on the basis of origin principle. As a result of this, visible adjustments are not required as far as origin principle is concerned. In effect, there is no import taxation and no rebate is given in terms of exports (Cnossen and Shoup, 1987, p.67). In practice, a value-added tax can be levied on either of these bases, but the Union's choice has been to move from the destination principle to the origin principle as a natural result of single market in which border controls are abolished. The Union is likely to apply a definitive system based on the origin principle after the transitional period, but a clearing house acts to redistribute revenues in such a way that the outcome is the same as the old destination principle. The definitive system has sometimes been called an "origin system" or mixed system in the literature as explained earlier. However, it will actually give rise to an identical final allocation of tax revenues as the existing destination principle (see Locwood, de Meza and Myles, 1995). The main operational differences are that goods bear taxes before they cross the border, and hence it satisfies the identifying criteria of an origin system, and the clearing-house functions to reallocate tax revenues between the member countries under the proposed definitive system. Lockwood, de Meza and Myles, (1995) argue that the European Union should adopt a system of origin taxation for its definitive tax system. They argue that the origin system would be administratively simpler compared to the destination system and would eliminate the possible problems of cross-border shopping. One of the major advantages of origin principle is that it is the key to getting rid of border controls (Cnossen, 1987).

In order to see clearly how these two systems work in practice, one example of the process for each principle is illustrated in Figure 2.1.

Figure 2.1 Examples of the Processes of Destination and Origin Principle.

a) ***Destination Principle***

UK		GERMANY
Supplier		Company(Purchaser)
Materials DM 100		Selling Price DM 200
VAT zero-rated ⟹	VAT imposed ⟹	Plus 15 % VAT
for export	on imports at 15 %	= DM 230
	VAT paid	Output VAT = DM 30
	on import = DM 15	
		Input VAT = DM 15
		VAT paid at this stage = DM 15
Net VAT paid in the UK = 0		Net VAT paid in Germany =30

b) ***Origin Principle***

UK		GERMANY
Supplier		Company(Purchaser)
Materials DM 100		Selling Price DM 200
Plus 17.5 % VAT ⟹	Good exported ⟹	Plus 15 % VAT = 230
VAT paid at	bearing the UK VAT	Output VAT = DM 30
this stage = DM 17.5		Minus input VAT DM 17.5
		VAT paid at this stage = 12.5
Net VAT paid in the UK= DM 17.5		Net VAT paid in Germany DM 12.5

According to these examples, the supplier in the UK produces a good value at DM 100 which is used as an input to production by a firm located in the Germany. As far as the destination principle is concerned, the good leaves the UK as zero rated. Then the importing company has to pay VAT at the importing country's national tax rate for VAT which is supposed to be 15% for Germany. Later, after further value is added, the good is resold for DM 200 in Germany. After applying 15% VAT rate, the total

inclusive price becomes DM 230. The import VAT might be deducted, as a result, net VAT paid at this stage is DM 15. However, the total VAT that the product carries is DM 30 which is borne by the final customer. It is exactly the same as if domestically produced components were used. All this VAT accrues to the revenue authorities of the importing country.

With regard to the origin principle, the Commission proposes the new introduction of a new VAT treatment of intra-EU trade, in which exported goods would bear the exporting country's VAT and credit would be given for this in the importing country. Figure 2.1 (b) illustrates the origin principle. As can be seen from the figure, VAT on exports (17.5%) is levied at the rate prevalent in the UK just as if the sale were to trader in the home country. The good, then, is exported to Germany without any border controls. Afterwards, the importing company can resell the good paying VAT at the rates applicable in Germany (15%). The German company reclaims input VAT (DM 30) from the domestic revenue authorities, including the VAT which the exporter paid over the revenue authorities of the exporting country (DM 17.5) as well as any VAT paid on inputs purchased from domestic suppliers (DM 12.5).

As the Commission proposes a VAT clearing house mechanism which would redistribute VAT revenues between the member States in order to restore the current allocation of revenues, those member states which are net exporters or which have high VAT rates would gain revenue compared with the status quo.

Although some authors are in favour of the origin principle (see for example Berglas, 1981, Giersch 1987), other authors (Grossman 1980, Lockwood, de Meza, and Myles 1995) argue that the view of the switch to the origin principle is misguided). Cnossen (1987) argues that the destination principle is desirable in terms of economic efficiency and fairness and of administrative aspects, despite the fact that the origin principle appears to abolish border controls and hence reduces the paperwork connected with the application of VAT when goods cross the frontier. Shibata (1967) says that if each member state applies a truly general commodity tax, a production tax of uniform rate, and if there are no intermediate commodities, or a value added tax applied to all goods, then as long as exchange rates are variable and prices are

perfectly flexible, it makes no difference in real terms whether goods are taxed in terms of the origin or the destination principle. However, if there is no flexibility in exchange rates, then substituting one system for the other will, initially, result in an imbalance in the balance of payments on current account and a redistribution of foreign reserves. Giersch (1987) claims that a switch over from the destination principle to the origin principle can remove the border controls without any need for a harmonisation of VAT rates. However, this switch over would not only conflict with the character of VAT as a general consumption tax, but would also lead to distortions in resource allocation.[14] Using relatively simple trade models, a number of authors such as Shibata (1967), Dosser (1967) have found that the origin principle cannot improve the allocation of resources. The best one may expect is that (at the margin and under specific conditions) the two principle are equivalent (see Whalley 1979, Berglas 1981). However, the conditions for equivalency theorem can be reasonable only under extreme conditions (Berglas, 1981, Cnossen, 1983, and Robson 1987). As these authors argue, this theorem depends upon the underlying assumptions of perfectly flexible prices and exchange rates, of a comprehensive and completely uniform VAT, of initial equilibrium of trade balances between the member countries and of complete immobility of production factors between countries. In reality some of these assumptions would not hold, as member states have many different VAT and excise rates as mentioned earlier. Therefore, it is necessary to unify the number of rates as well as equalising the ratios between the various kinds of VAT and excise rate across the Community. One might say that substitution of a 'relative' rate harmonisation for an absolute one will be required to take advantage of a switch-over to the origin principle. In the light of these arguments, it can be said that the origin principle is preferable for the purpose of fiscal harmonisation, since fiscal harmonisation aims at removing the fiscal frontiers.

Also, in recent years some thoughts have been given to the restricted origin principle which was first introduced by Shibata in 1967. According to this principle, member states apply the origin principle for intra-community trade, but maintain the

[14] If there is a switch from destination principle to origin principle, then in principle , the consumers will purchase goods in the low-tax country (cross-border shopping). Thus, cross-border shopping will have effects on resource allocation. See Lockwood, de Meza, Myles (1995) for more detailed discussions.

destination principle for trade with the rest of the world. Shibata (1967), using a two commodity customs union model, argues that, under the restricted origin principle, differences in tax rates would not give rise to trade distortions or to transfer of real income between countries. However, Berglas (1981) shows that if member countries apply the destination or origin principle, no distortions or redistribution of income occurs even though their tax rates differ using a multiproduct custom union model. He argues that different tax rates give rise to trade distortion and income redistribution under the restricted origin principle. He concludes that the origin principle is superior to other tax principles. Georgakopoulos (1989) develops Berglas' approach and concludes that the restricted origin principle causes production effects even when trade deflection is allowed. His conclusion is different from the one obtained by Berglas, because his results show that production effects are positive whereas they can be either positive or negative according to Berglas.

2.5. The Need for Harmonisation of VAT in the Union

Harmonising VAT within the EU was initially deemed crucial as a step toward eliminating market distortions, since the community's aim was to have a single market by the end of 1992. As the border controls have been eliminated between the Union members since 1993, there have been some changes in the operation of the indirect tax system of the countries involved. However, fiscal harmonisation has also become linked to the Union's financing, because a proportion of the VAT revenue has become an important element in the funding of the European Union's budget, since the Union started financing itself by 'own resources'. Moreover, harmonisation of VAT has become an element in the Union's drive towards Economic and Monetary Union (EMU), since EMU project requires standardisation of the Union's common turnover tax as well as harmonisation of other indirect taxes and direct taxes. [15]

As Musgrave (1983) points out, two fundamental tax co-ordination criteria. namely, tax neutrality and tax base entitlement, are important for tax co-ordination. The first one is embodied in the Rome Treaty and is central to the White Paper for creating a

[15] As mentioned before, divergence between national tax systems distorts competition between the enterprises of different member states. Thus, this distortions might give rise to economic instability in the Union. However, the EMU needs economic stability in each member state.

more favourable environment for stimulating enterprise, competition and trade (COM, 1985). This criterion requires that member states should rearrange their tax systems in such a way that taxes do not distort the free movement of goods and factors. The second one requires that property rights in the tax base should be based on allegiance or residence principle or the territoriality or source principle in order to give a fair entitlement to tax revenues.

Some authors, such as Bos and Nelson (1988) and Pearson and Smith (1988) claim that some approximation of VAT rates might be desirable but is not strictly necessary. Pearson and Smith argued that the abolishing of fiscal checks does not need uniformity in the rates of indirect taxation between member states. Smith (1988) argues that the elimination of excise duty differentials are not crucial for the completion of the internal market.

However, the main justification for Union intervention in member states' indirect tax rates with regard to harmonisation would be the need to keep the problem of cross-border shopping within acceptable bounds. As Cnossen (1990) argues consumers in the border areas of high-tax countries will find it advantageous to shop in low tax member countries. Hence, manufacturing location decisions might well be affected in favour of the countries which apply lower rates. Thus, cross-border shopping could have some serious effects on member countries and on consumers, since nearly 15% of the Union's residents live near the border areas. In order to limit the extend of cross-border shopping, the rates on the two sides of any border should be sufficiently close, as when frontier controls were to be abolished, the commission believes that cross-border shopping by individuals would be entirely unrestricted. Thus, any distortion of trade between boundary countries is more likely to happen. In this context, if the single market is to function fairly and efficiently, particularly along its internal borders, the multiplicity of the indirect tax rates and structures has to be tackled. As Sinn (1990) points out, if rates are not harmonised sufficiently, massive cross-border shopping in low tax countries have to be reckoned with. Although one might say that the costs of cross-border shopping are borne by the member state setting a higher rate than its neighbour , therefore, individuals countries should be free to set tax rates at whatever level they can sustain, this does not support a free for all in

the setting of tax rates. Therefore Community action is required to prevent countries setting a tax rate below that of their neighbours in order to take advantage of cross-border shopping. The high tax member states would suffer from the revenue losses as a result of cross-border shopping if the differentials on tax rates were appreciable. Also the resource costs of journey across the border to make tax savings and the disruption and adjustment forced on retailers on the high tax side of border should be taken into consideration. In the light of these arguments one might say that abolition of fiscal frontiers without tax harmonisation would create trade distortions since individuals could evade taxes by buying those goods in the neighbouring countries which were subject to a lower tax rate.

Moreover, as the Union is planning to apply the definitive system based upon the origin principle, wide differences in the tax rates produce a distortion in the pattern of production, because under this principle products from a high tax country may well be more expensive than identical products from a low tax country even if the high tax country were the more efficient producer. For instance, given that the UK currently imposes zero rate VAT on children's clothes whilst some other members impose rates of up to 22 per cent. Thus, the origin principle of taxation might give UK children's clothes companies an artificial advantage in the single market. This also tend to affect the location of producers in the extreme cases, because the producers may choose the lowest tax country. These distortions and location effects might be overcome if each member country applied similar tax rates, and so the notion of the harmonisation of tax rates arises again. Hence, the harmonisation of indirect taxes could reduce the distortions introduced into the relative prices of goods and services by widely different rates of tax.

As a result, VAT harmonisation appears to be necessary so as not to distort competition and patterns of trade in the single unified market.

2.6. The Economic Impacts of VAT Harmonisation on Current EU Member Countries

As mentioned earlier, the European Commission has felt it necessary to propose changes to the VAT rates levied in member states in order to create a single integrated internal market within the EU. The changes would include, for instance, adoption of a two-rate system of VAT, and extension of the VAT base to cover currently zero rated items as far as VAT is concerned. This means that member states have to alter their VAT structures and rates in line with the Commission's proposals. Hence, the changes in VAT rates will naturally have economic effects on the member states. This section deals with the theoretical discussion of the possible economic effects of VAT harmonisation. Afterwards, we summarise the results of existing empirical works on the individual member countries.

2.6.1. A Discussion of the Possible Economic Effects of VAT Harmonisation

Generally, the impacts of taxation are analysed with regard to its incidence. This issue can be approached by dividing it into three parts. The first question deals with identifying who pays any particular tax, and with aggregate distribution of liabilities. With respect to this subject, we are especially concerned with the distribution among households, but also with the way in which the tax is allocated among different production factors or categories of taxpayer. However, the tax structure itself changes the equilibrium configuration of outputs and prices in the economy. Consumers tend to purchase fewer heavily taxed commodities, production levels change, and the relative costs of inputs and outputs are altered. The second question is concerned with the measurement of these effects, such as the impact of taxation on labour supply, savings, risk-taking or commodity demand. As a consequence of these changes in the quantities of goods and services that are produced or consumed, the tax system has welfare consequences distinct from the pattern of gains and losses which result from tax payments themselves. Consumers who choose to consume less because of taxes on goods suffer from dead-weight losses. Also, dead-weight losses might indeed fall on some consumers who do not pay tax at all. On the other hand, if levying a tax on a particular factor of production gives rise to an increase in its price, the loss to the

supplier of that factor may be less than the amount he has to pay in tax. Hence, the third question is about how to measure and analyse the amount and distribution of welfare losses which result from the tax system.

Changes in VAT, like those of most other taxes would influence such variables as prices, efficiency, investment and savings, employment, foreign trade, income distribution, public sector size, and so on. The effects of changes in VAT on prices depend upon the aim of changing the tax rates. For example, if the purpose of changing the VAT rate is to raise revenue for the government, it might have an anti-inflationary effect as increased revenue can be used by the government to reduce the budget deficit so that the government does not need to borrow and /or print money. Also, increasing VAT rate might reduce consumption and thus total demand for goods and services. However, when the government changes VAT by following an equal yield tax policy, this would not affect the general price level rather it may lead to changes in relative prices.[16] Relative price changes affect the pattern of consumption depending upon the tax rates on commodities. The changes in VAT rates will naturally affect the output pattern of production sectors.

The commonly accepted case against VAT is that it is regressive, because it reduces the real consumption of low-income groups by a greater percentage than that for high-income groups. As one would expect, the increase in VAT rates would increase the price of consumer goods. [17] The low-income groups tend to suffer more than the high-income groups as a result of increase in the price of consumer goods, since the former spends a relatively large proportion of their income on consumer goods. This argument depends upon many particular assumptions about which taxes the VAT is replacing, the exemptions, and zero ratings, and special compensatory features.

Hence, convergence of VAT rates, the reclassification of goods in different VAT bands would generate significant effects on the structure of consumption in various member countries as far as VAT harmonisation is concerned. Relative price changes

[16] Equal yield tax policy is explained in Chapter 6 in detail.
[17] In order to evaluate the effects of price changes, the usual technique is to build a partial or general equilibrium of the model of the economy that serves a basis for the simulations

shift consumption patterns away from commodities which are subject to tax rate increments to reach minimum standard VAT rate as a result of VAT approximation within each member.[18] Meanwhile, changes in the volume of producer goods are determined through price elasticities of supply and also by tax changes adopted by other member states in the case of tradable goods. Thus, mobile factors from sector that face a decline in demand due to increased commodity tax rates move to the sectors in which demand is on the rise.

Relative changes in either consumer or producer prices which accompany the allocative effects may have major implications for the distribution of income among households in the member states as a result of the VAT harmonisation.[19] In the member states, VAT rate approximation will require a reduction in the progressivity of taxing products with highly income-elastic demand, through the abolition of higher VAT rates. Depending on the VAT structure and rates of the member states, convergence of VAT rates tends to have a favourable (adverse) effect on income distribution, because rates are reduced (increased) to the proposed rates. In general, we might say that the proposals would widen income inequalities in most member states. Particularly higher taxes on food, fuel, and children's clothing as a result of abolishing the zero VAT rate would affect the poor negatively.[20]

The macroeconomic effects of VAT harmonisation and removal of fiscal frontiers are reflected largely in changes in aggregate supply and aggregate demand. The impact of changes in the effective tax rate on government budget, as well as on household and enterprise incomes, is further transmitted by several rounds of repercussions on domestic absorption with regard to the demand side. Harmonisation of VAT rates should initially involve corresponding changes in the retail prices that include the VAT in the member states. Thus, the removal of fiscal frontiers tends to lower the price level throughout the Union, as all countries have to abolish increased rates. The

[18] To which extend consumption of goods can be shifted depends upon the own-price and cross-price elasticities of demand.

[19] In order to evaluate the distributional consequences of policy changes better, we need to know the nature of measures undertaken in any member state on the expenditure and revenue side of the budget to compensate for the net revenue gain or loss associated with a specific harmonisation.

[20] However, there might be better ways of helping the poor as far as fiscal policies are concerned. For example the government might help the poor by using income tax.

response to commodity and factor price changes as a result of harmonisation engenders a likely increase in capital formation, employment and output growth through the reallocation of resources as far as the supply-side of the economy is concerned. The supply side effects would tend to be relatively strong in member states with tax rates that show great internal dispersion and are different from the proposed band or minimum rates in states that are about to remove remaining obstacles to factor movements.

Demand side effects of VAT harmonisation can be expected to materialise over a short-term horizon, while the supply-side effects should take place in the medium run. Broadly, the initial decrease in revenue as a result of tax rate cut that is reflected in a tax-induced fall in retail prices enhances the purchasing power of households. Consequently, private consumption tends to expand and spurs fixed investment and employment by reinforcing the improved profitability of enterprises.

The static budgetary effect-excluding secondary repercussions- of VAT harmonisation may be expected to be concentrated in member countries with relatively high VAT rates. For most countries, convergence of VAT rates could lead to an immediate revenue change. For example, Denmark and Ireland are expected to lose revenue, while some countries, such as Greece, Portugal, and Spain are likely to benefit from a revenue gain.

Hence, harmonising the VAT rates and structure would have some effects on the economies of member states. We need to mention that we should have a medium-term computational framework with sufficiently dissaggregated commodity and factor markets in order to estimate the macroeconomic effects of VAT harmonisation quantitatively.

2.6.2. Results of Empirical Works on the Estimation of the Possible Impacts of VAT Harmonisation on National Economies of Current EU Member Countries

From the variety of these rates, it can be said that the proposed bands of the Commission will have effects on national economies. In this context, harmonisation of fiscal policy, especially in the form of harmonisation of VAT, has gained significance as far as the EU is concerned. Despite the scale of these changes, a relatively small segment of the existing public finance literature deals with the possible economic impacts of VAT harmonisation on the national economies of the member countries, of which an even smaller proportion utilises CGE modelling to investigate the impact of VAT changes.[21] The quantitative studies on commodity tax harmonisation seem to have three distinct strands.

The first type of models is characterised by the exclusion of any behavioural reactions. These models only rely on so-called first round calculations. These studies usually incorporate remarkable institutional detail and might well be appropriate if distributional issues are the key interest, yet they are definitely not suitable to deal with efficiency problems. The European Commission used this type of model when computing the transfers to and from the clearing institution (see Commission of the European Communities, 1989b).

The second type of models includes behavioural reactions. However, this type is restricted to partial equilibrium considerations. Studies that employ this type of modelling usually allow for a dissaggregated household sector in a single country and rely on econometric estimates of demand parameters by employing some functional form, such as the almost ideal demand system. linear expenditure system. Apart from dealing with efficiency effects, this approach also deals with the distributional effects of tax harmonisation issues.[22] Lee, Pearson and Smith (1988) and Symons and Walker (1988) for the UK, Brugiavini and Weber (1988) for Italy, and Nichele and Robin (1995) for France may be cited as typical examples of this type of models.

[21] We have surveyed the existing literature that uses CGE methodology regarding VAT harmonisation in chapter 5. Therefore, we do not give the results of these studies in this chapter.

[22] Disadvantage of this type of modelling is discussed in Chapter 4 when we evaluate CGE methodology.

The final type of models contains all of the macroeconomic simulation models. These studies can be subdivided into two broad categories. The first contains all macroeconomic simulation studies that focus on the inflation, employment, and GNP effects of VAT harmonisation. The OECD's interlink model (Commission of the European Communities 1989b) and Bradley and FitzGerald (1989) are typical representatives of these studies. The welfare effects of tax VAT harmonisation cannot be dealt with adequately in these studies, due to the weak microeconomic foundations in the modelling. The second subgroup of macroeconomic models contains CGE models and sectoral models. Whalley (1976), Fehr *et al* (1993, 1995), Wajsman (1995), Haufler (1993) are examples of CGE models as far as VAT harmonisation is concerned Although these models are essentially static in nature, Perraudin and Pujol (1990) and Frenkel, Razin, and Symansky (1991) present dynamic CGE models with regard to VAT harmonisation issues in the EU.[23] The sectoral models follow the model and sectoral classification that is used in HERMES project. [24] Leeuwen and Tang (1995) is the classic example of a sectoral model.

Having outlined the types of the models used to study the possible effects of VAT harmonisation on various member countries, we give the results of the studies.[25] Among others, Symons and Walker (1989) have investigated the distributional, efficiency and revenue consequences of changes to the structure of indirect taxation in the UK implied by proposals for tax harmonisation across the EEC. [26] They assume a standard rate of 15% (unchanged) and a 4% reduced rate for zero-rated goods such as food and children clothing. Their results suggest that tax revenue would increase by around £1 billion. Their results also suggest a small increase in the inequality in the distribution of welfare across households. Moreover, they estimated that food consumption would fall by about 3 %, assuming the repeal of zero rating of food. Lee, Pearson, and Smith (1988) have carried out research to address the same questions for the UK. They estimate almost the same increase in the UK's indirect tax revenue with

[23] See Chapter 4 for more details about these models.
[24] See Italiner (1986).
[25] As it is beyond the scope of this chapter to give the results of all studies, instead we give only the results of key studies.
[26] The EU was called the European Economic Community (EEC) then.

regard to Commission's full package of proposals in 1987.[27] Their results suggest that the poorer households would spend more on consumption if zero rating were abolished as a result of harmonisation. Brugiavini and Weber (1988) studied the welfare effects of indirect tax harmonisation on Italy. They concluded that the Commission's proposals appear to move in the direction of an increased social welfare. They estimated that instead of losing revenue, as is suggested by ignoring volume changes, in fact the Italian Government could find an increase in its revenue. For instance, their results suggest that with a 5% reduced rate of VAT, a rise in the basic rate from 18% to 20% to compensate for the loss of higher VAT rates, and excise duty rates as proposed by the European Commission, indirect tax revenue could increase by 7%. Nichele and Robin (1995) assess the consequences of a form of VAT harmonisation which is close to initial EC proposals. They obtain estimates through using the property of perfect aggregation over households of the Almost Ideal demand system on pooled micro data from different sources. They suggest that tax reform leads to a general decrease in prices apart from food, drink, and tobacco as far as VAT harmonisation is concerned. They also suggest that the VAT harmonisation has the expected negative effect on government revenue. Leeuwen and Tang (1995) tried to quantify the effects of tax harmonisation for Luxembourg with the use of a sectoral model.[28] They estmated that there would be a decrease in production which would lead to a decline in non-labour income and, owing to a lagged effect on employment, to a decrease in wage income. As a consequence of this, the consumption of residents would fall on average with 1.1 %.

In spite of the fact that these model-based simulations have been performed on the economic effects of the Commission's 1987 proposals, comparison of the results is made difficult by differing assumptions about the implementation of proposals, alternative policy assumptions, and different model structures. Most of the models used for such simulations does not seem to approximate sufficiently closely the medium-term, multi-sectoral computational framework that in principle would be useful for such an exercise. In particular, most of the models for the most part do not

[27] We must mention these studies like many others, see for example, Leewuen and Tang (1995), Nichele and Robin (1995) also include the harmonisation of excise duties in their simulations.
[28] They use Commission's HERMES model as mentioned before.

capture the allocative response to tax-induced price changes that underlies the macroeconomic effects and is likely to be the most important over the medium term.[29]

With regard to this, among the various models applied in the area of tax harmonisation, the Commission's HERMES model seems to contain the richest sectoral disaggregation, while the OECD's INTERLINK can, in principle, capture the transmissions of the effects of exogenous changes among the economies of member states. In the INTERLINK model, the medium term macroeconomic effects of VAT rate approximation under the 1987 proposals are simulated (see Commission of the European Communities 1989b). In the simulations, standard and reduced rates are fixed at 16.5% and 6.5% respectively with a 2.5% point variation around the central rates. The simulations are based upon a number of simplifying assumptions, such as fixed tax rates other than VAT and fixed real government expenditures. In general, the results suggest that the static macroeconomic effects of the proposals would be negligible for most countries, especially the largest ones.[30] According the simulation results, Denmark would experience the strongest macroeconomic response stemming from the initial dramatic fall in consumer goods prices.[31] In Denmark, real GDP would rise about 4% above its baseline level, whereas prices would decrease about 7% below their baseline level over the medium term. In Ireland, on the other hand, the price response to VAT harmonisation would be small, since the effects of the cut in the standard rate is compensated by the effect of the abolishing the zero rate. As far as France is concerned, the liberalised deductibility of VAT would give rise to inflationary pressures induced by a stimulus to economic activity that over time offsets the initial decrease in prices. In the UK, in which VAT rates rise and the repeal of zero rate is assumed, a similar mechanism would give rise to a small decline in the price level of approximately 0.5% in the medium term. With regard to Portugal, the initial deflationary level on the price level remains unchanged at about 0.6%. The effect on the external current account balance is small, since changes in international competitiveness and domestic absorption largely compensate in the external account.

[29] In this context, CGE modelling would be appropriate and has been used by some economist to study the effects of VAT harmonisation in medium-term and in more detail as mentioned earlier.
[30] However, notable exceptions are Denmark and France where the effects would be larger.
[31] This is not surprising as Denmark has only one rate of VAT and it is one the highest VAT rates among the member states.

In general, countries that decrease VAT rates experience a modest deterioration in their external balance relative to its baseline level.

Hence, the harmonisation of VAT rates in the Community would lead to significant effects on the economies of member countries, as is also explained in chapter 4. The degree of effects depends on the individual member state's VAT rates and structures.

2.7. Conclusion

The Commission's proposals for the harmonisation of VAT are a vital element in the completion of the internal market, as this requires the abolition of fiscal frontiers. The Union abolished fiscal frontiers on 1 January 1993, as a part of the programme to complete the internal market. Although many developments have been made in the area of VAT, especially after the creation of the European Single Market, much work still needs to be done in this area to run the new system since, as mentioned earlier, currently there are large differences in the tax rates of member states. As long as these differences in tax rates exist, this will give rise to trade distortions for the reasons explained. The Commission has already shown itself to be very flexible as far as tax harmonisation is concerned. It has proposed new arrangements for VAT. Although the Commission's initial proposal for two rate bands constitutes the basis for the discussion within the Council and Parliament, after much discussion new agreements were eventually reached by ECOFIN in June 1992. The new agreements set a minimum standard VAT rate of 15%, and one or two reduced rates with a minimum of 5% applicable until the end of 1996. Also, the temporary retention of existing zero rates in some countries and extra low rates such as below 5% is authorised. The new agreements have given rise to reductions in the number of VAT rates and to appreciable cuts in those rates for some countries, as explained in this chapter, while some countries had to increase their standard VAT rates in line with the minimum rate. Moreover, although the destination principle has been implemented in the Union, the ultimate aim is to apply the origin principle as an appropriate system in the area of indirect taxation.

As explained in this chapter, most of the member countries would be required to make substantial changes in their VAT rates and structures as far as the Commission's proposals regarding VAT harmonisation are concerned. Hence, these changes would naturally affect the national economies of the member states. How the proposals would affect the economies in member states would largely depend on the structure and rates of VAT in the individual state.

In this study, like most of the studies on VAT harmonisation, we focus on the Commission's 1987 proposals in order to see the effects of tax harmonisation on the Turkish economy with regard to VAT. Also, we consider the Commission's proposals on rates of VAT and in the context of the retention of the destination principle.

CHAPTER 3

A REVIEW OF THE TURKISH TAX SYSTEM

3.1. Introduction

As Turkey wants to become a member of the European Union (EU), as a part of the economic integration, the harmonisation of the Turkish tax system into the EU has gained importance. However, as the most important part of tax harmonisation in the EU has been in the area of indirect taxation, such as VAT, and excise duties, the main focus will be on indirect taxation, specifically VAT, in this chapter. The Turkish tax system basically includes direct taxes, such as income tax, capital tax, and social security contributions and indirect taxes such as VAT and excise duties.[1]

The aim of this chapter to describe the structure of each of major Turkish taxes and to outline their treatment in the CGE model of Turkey. The chapter also presents a comparison of the Turkish tax system with those of the EU countries to bring out its harmonies and disharmonies, especially in the light of the debate held at the Community level on the elimination of fiscal barriers. Moreover, this chapter examines the potential effects of European Union membership on the Turkish indirect tax structure and rates as far as the harmonisation of indirect taxes in the EU is concerned.

However, as the model is calibrated to the data for Turkey for the year 1990, the structure of direct and indirect taxes that actually applied at that time is taken into consideration.

[1]The relative importance of the taxes is given in Table 3.5

3.2. Direct Taxes

In this section the structure of indirect taxes, namely, income tax, corporation tax, and social security tax is described briefly, and their treatment in the model is outlined.

3.2.1. Income Tax

The Turkish income tax is an annual tax at progressive rates on incomes of "taxable units". In order to be subject to the income tax, the income must have been acquired as a product of commercial activities or capital holdings of a real person. Therefore, the income tax has the characteristics of a personal nature. An independent tax system is applied with regard to income tax in Turkey. In this form of taxation, the individual elements of income are not taxed individually, rather all the earnings and revenues secured during a single year are added together, and taxed as a whole. As a result income is regarded as being general.

In principle, income tax is based on one's declaration and the validity of declarations and their appropriateness are checked by fiscal authorities. Income taxation is based on the principle of the calendar year which runs for the twelve-month interval between January 1st and December 31st. An annual fixed tax free allowance, called special allowance, is given to tax payers and also fixed amount of some personal income is exempt from income tax. However the amount of the special allowance is very small, e.g., 432.000 Turkish Lira (TL) and also the first 120.000 TL is exempt from income tax. When income is taxed, it is considered on the basis of its net value. This means that the amount remaining after expenses incurred in the acquisition of income and revenues have been deducted is the basis for one's tax assessment.

When income is determined and taxed, its real and net amounts are taken into account, unless a stipulation to the contrary is made in the income tax code. According to the Turkish Income Tax Act the earnings and revenues that are subject

to the income tax - which is to say the elements of income- are divided into following seven categories: [2]

1. Commercial earnings that arise from commercial and industrial activities of whatever nature
2. Agricultural earnings that arise from agricultural activities
3. Wages, salaries and fees
4. Self-employment earnings
5. Income from immovable properties
6. Income from movable properties that are dividends, interest rates, rents and similar form of income derived from capital that consists of cash or assets representable in terms of money apart from the owner's commercial, agricultural, or professional activities.
7. Miscellaneous earnings and income that arise from appreciation (capital gains) and occasional earnings. However, the business with which they are involved must not be conducted in the form of a continuous habitual occupation.

The rate structure of the tax is characterised by a basic rate of 25 %, and a top marginal rate of 50 % on earned incomes. Income from all sources is summed together for tax purposes. The basic rate mainly covered the majority of income recipients in the late 1980s and early 1990s. The basic rate is the initial marginal bracket rate. Table 3.1 shows income subject to the income tax in 1990 and the following year.

[2] Kocahanoglu (1991). Tax Acts.

Table 3.1: The Income Tax Rates in 1990

Income Brackets	%
Up to and including TL 12 million	25
Up to and including TL 24 million: TL 3 million for the first TL 12 million and on the excess	30
Up to and including TL 48 million: TL 6,6 million for the first TL 24 million the and on the excess	35
Up to and including TL 96 million: TL 15 million for the first TL 48 million and on the excess	40
Up to and including 192 million : TL 34,2 million for the first TL 96 million and on the excess	45
Over TL 192 million: TL 77,4 for the first TL 192 million and on excess	50

Source: Kocahanoglu(1991)

In the CGE model of Turkey, the income tax will be treated as the dominant part of a model-equivalent income tax system in which personal income tax, capital gains tax, capital tax and social security contributions are considered to operate as a single system of income taxation. Taxable income is determined by valuing ownership of factors (labour and capital) at current factor prices. Lump-sum transfers from government to the households are considered tax exempt. Effective average rates are calculated by taking the income classification of households into account.

3.2.2. Corporation Tax

In Turkey, the corporation tax was introduced as a separate tax on corporation profits in 1950. This tax is collected on the earnings of companies with share capital, public owned economic enterprises, and the commercial enterprises of associations, unions, societies, and foundations.[3] The elements of income are the same as those in the case of income tax. The tax is a flat rate annual tax on the trading and other profits of the companies. For corporations, the tax year is the same as their fiscal (accounting) year. The corporate tax rate is 46% and deprecations are allowed as deductions in the tax system.

[3] Kocahanoglu (1991). Tax Acts

In the model, corporate taxes are not treated separately. We treat them implicitly under income tax, as households receive gross income from capital.

3.2.3. Social Security Contributions

Like most countries, Turkey operates a system of social security taxes. Social security contributions are contributed as a flat-rate tax on all income earned by all those in work and by their employers to the government operated funds which finance benefits.[4] Contributions are loosely tied to benefits paid to qualifying individuals (retired and disadvantaged). There are no unemployment benefits in Turkey, unlike in western countries.

In the model, social security contributions are not treated separately. Like capital taxes they are considered to operate under income tax as mentioned before.

3.3. Indirect Taxes

The structure of indirect taxes in Turkey is characterised by value added tax, a general sales tax, and a supplementary tax, a high rate tax levied on tobacco products and all kinds of alcoholic drinks. In addition to these taxes, the following indirect taxes are in force in Turkey:

1. Motor vehicles acquisition tax
2. Stamp duty
3. Petroleum consumption tax
4. Banks and insurance companies tax
5. Fees

However, for the purpose of the study the main focus will be on VAT as far as Turkish indirect taxes are concerned. In this section, the development of the Turkish

[4]Currently, employees pay 14% if they are wage earners, and 11% if they get salaries on all income earned after taxes.

indirect tax system is given briefly and then the Turkish VAT system is explained. Also, the treatment of VAT and the other indirect taxes is explored very briefly.

3.3.1 The Development of Turkish Indirect Tax System

The application of turnover taxation goes back as far as the 1920s, the first years of the Republic. After the Turkish Republic was founded in 1923, there existed customs duties and consumption taxes from some goods that were produced under state monopolies. The new administration had made some changes to the inefficient system of taxes that existed prior to 1923. As a result of the changes turnover taxes were included in the indirect tax system. If monopoly taxes and customs duties are ignored, the Turkish indirect tax system relied on turnover taxes until the reforms in tax policy in 1957.[5] In the years that followed the declaration of the Republic, a turnover tax was applied under the name of "General Consumption Tax" and between 1926 and 1957 different forms of turnover taxes were applied. In addition, new taxes such as a consumption tax on sugar, gasoline, energy, transportation and other consumption taxes on coffee, rubber, window glass, cardboard and thread were included in the tax system.

In 1957, turnover taxes were removed and "Outlay Taxes" that created a new system were introduced. Outlay taxes constituted a group of taxes comprising turnover taxes.[6] They included taxes on production and imports, single consumption taxes on fuel, electricity and gas, turnover taxes on banks and insurance companies and service taxes that replaced transportation taxes. After 1957, the outlay taxes constituted the most important revenue-raising tax item in the budget.

Production taxes are of a different nature from turnover and consumption taxes. The most important difference is that they are a single stage tax levied at the manufacturing stage. Examples of types of goods that were subject to this tax are

[5]State monopolies produce goods, such as cigarettes, alcoholic drinks matches and so on. A single stage tax, applied at the production stage, was imposed on the products. This tax is referred as a monopoly tax.

[6] The turnover tax was a single stage tax imposed on manufactured goods, including exported and imported goods.

thread, cement, mines, raw materials, energy, liquid combustible, matches and some beverages. The importation of these products was also taxed under this system. The first products were taxed because they might enter into the market as a manufactured good.

As far as excise duties are concerned, since the foundation of the republic, excise duties have always been subject to the Tax Law. The excise duties developed under three main branches: [7]

1. Internal excise duties on sugar, glucose, liquid combustibles, electricity and gas, beer, wine, sparkling wine, whisky, and matches.
2. Excise duties on some goods (coffee, tea, cocoa, cocoa fat, rubber products, matches, window glass, paper and cardboard, leather products, cotton thread, wool and hair thread, every kind of iron and steel, copper and its amalgam).
3. Excise duties on goods produced under state monopoly (tobacco, alcoholic beverages, tea, and salt) are collected in form of "Monopoly Gross Revenue" and an additional "defence tax" also levied on these products specifically to raise revenue for defence expenditure.

The then Turkish tax system had arisen as a result of fiscal difficulties reoccurring in the government sector. Therefore, the system was inharmonious and in disorder.[8] Regarding indirect taxes, the structure became a target of criticism from various aspects and suggestions were made for its adjustment before the application of VAT. Some of the suggestions were implemented before the application of VAT and some with VAT, and some are still in the process of adoption. In a period when western countries started adopting VAT as a consumption tax, the Turkish government had been concerned with applying a similar tax in Turkey. However, it was not until 1985 that Turkey introduced the tax. While preparing the VAT draft, the European practice had been taken into consideration, as Turkey was planning for EU membership.

[7]However, after the introduction of VAT, most excise duties were abolished.

[8] Kizilyali, H (1969). Turk Vergi Sisteminin Ekonomik Analizi (Economic Analysis of the Turkish Tax System)

The main reasons why Turkey abolished the production tax and replaced it with VAT can be explained as follows:

1. The production tax had a more distorting impact on the economy because of being levied at a single stage. For instance, the products that did not pass through the manufacturing stage could not be taxed. Thus, this distorted both production patterns and consumer choices. On the other hand, VAT tends to have less distorting effects on the economy, as it would be applied at each stage of the production and distribution process.
2. It was complicated to calculate the production tax liability, because it was calculated as a certain sum per unit of quantity for some goods. On the contrary, VAT liability is easier to calculate in relative to production tax, since it is calculated as a percentage of the value of the goods.
3. VAT may encourage exports by employing a fully rebated tax system. On the other hand exports could not be encouraged under the production tax, since exporters could not receive the tax credit on taxes previously paid on their inputs.
4. The production tax had a regressive impact on consumers, as the tax applied at a relatively high rate to some basic consumption goods (especially food items) used by low income groups. Thus, tax burden was borne by low income groups to a great extent. VAT, on the other hand, allows for different rates and exemptions for different consumer goods. Therefore, one might say that the low income groups are better off as a result of paying lower tax, or zero tax for some basic needs, such as food and medicine. Thus, VAT in Turkey is considered to be a progressive tax.
5. Investment was not encouraged under the production tax, as capital goods were not exempt from the tax, while the tax credit method of VAT would encourage the use of capital goods in investment, contributing to economic development
6. Turkey has always wanted to be a member of the European Union (EU) as mentioned before. Therefore she was willing to not only adopt VAT but also approximate her VAT with the EU, so that she would not have difficulties when her membership was realised.
7. The production tax was not an efficient revenue source since it was levied only on industry at the stage of manufacturing. VAT, on the other hand, would be a more efficient means to raise revenue for the government, as it is applied at each stage

of production and distribution of goods and services. In other words, the base of VAT is wider than that of the production tax, and thus its ability to raise tax revenue is higher as far as VAT is concerned.

8. Under the production tax, it was easier to evade tax relative to VAT, since there was no cross-checking mechanism between traders. On the other hand, it is relatively difficult to evade VAT since it provides a cross-checking mechanism.

3.3.2 VAT

In 1985, Turkey introduced a VAT on similar lines to that had already been applied in EU member states. As in the EU, VAT is based on the destination principle where imports are subject to tax while exports are exempt. The tax replaced the former production taxes and taxes on certain sales, transportation, postal services, advertising, sugar, and the authorised public betting (Spor-Toto) taxes.

VAT is levied at each stage of the production and distribution process. The liability for the tax falls on the person who supplies the goods and services. However, the real burden of VAT is borne by the final consumer under normal circumstances. This result is achieved by a tax-credit method where the computation of the VAT liability is based on the difference between the VAT liability of a person on his sales and the amount of VAT he has already paid on his purchases (input tax). Thus, the basic principle of VAT is that it is a sales tax chargeable to the sellers of all output with the provision that in computing their liabilities, firms may deduct any VAT that has been imposed on inputs into their products. The main advantage of VAT is that it is a method of levying a tax on all commodities that enter consumption while effectively exempting all intermediate goods- those who buy goods for further processing receive a refund of the tax that they have been charged with, and only those who are the final consumer of the goods bear the burden.[9]

[9] Exempting all intermediate goods does not result in the traditional problem of sales tax, the cascading effect of the tax. Thus, VAT appears to be an ideal tax with respect to the first of the principles of indirect taxation that there should not be taxes on intermediate goods. However, the changes in VAT rates will affect demand for intermediate goods. For example, if VAT rates increase, then the demand

A tax payer is defined in Article 8 of the Turkish VAT act as a person who is engaged in taxable transactions, irrespective of their legal status or nature and their position with regard to other taxes.[10] Taxable transactions are defined in Article 1 of the act and include the supply of goods and services, importation of goods and services, other performances and appropriation of business property to non-business purposes of the owner.

The following transactions carried out are subject to VAT (see Turkish VAT act, Article 1).

1. Supply of goods and services within the scope of commercial, industrial, agricultural or independent professional activities.
2. Importation of all kinds of goods and services
3. Others, such as:

a) Postal, telephone, telegram, telex, and other similar services; radio and television services;

b) Organising all kinds of betting, gaming, and lotteries including authorised public lotteries (Spor- Toto and Milli Piyango);

c) Organisation of shows, concerts, and sporting events with the participation of independent professional artists and professional sportsmen;

d) Sales at bonded warehouses and auctions;

e) Transportation of petroleum and gas, and their products through pipelines;

f) Leasing of the goods, such as land, buildings, mines, and rights such as all kinds of motor vehicles, machines, and equipment, ships, literary, artistic and commercial copyrights, commercial or industrial know-how, patents, trade marks, licences, and similar intangible properties and rights;

g) Deliveries (supply of goods) and services that are of commercial, industrial, agricultural or professional nature enterprises that belong to national and local

for final good may fall. This may give rise to fall in demand for domestic output, and thus may decrease demand for intermediate goods.

[10] Turkish VAT Act (in Kocahanoglu (1991).

government agencies and establishments, universities, associations, foundations and all types of professional organisations; [11]

h) Deliveries and services deemed to be taxable upon application for optional liability to avoid distortions of competition.

There are two basic forms of exemption under the Turkish VAT act.[12] The first one is an exemption without credit for previously paid VAT, i.e., the input tax on purchased goods, services, and imports is not creditable by the entrepreneur. Transactions which are subject to "exemption without credit for previously paid VAT" are the supply of goods and services for cultural, educational, recreational, scientific, social and military objectives and certain other exemptions. The second one is granted with full credit for previously paid VAT (zero-rating), i.e., the input tax on purchased goods, services, and imports is creditable by the entrepreneur. For some transportations the legislature aims to clear the VAT paid at all stages. Thus, certain transactions are not taxable and at the same time the taxable person has the right to claim the credit or refund. This mechanism operates under the name "exemption with credit for previously paid VAT" and is used principally for exports.

The Turkish VAT system employs multiple rates. The VAT tax rates in 1990 are shown in Table 3.2.

[11] The Turkish VAT Law uses the term delivery rather than supply of goods. In this context, delivery is defined to be the transfers of the right to dispose of goods by the owner or by third party acting on their behalf to the recipient or to a third party acting on behalf of the latter See Turkish VAT Acts in Kocahanoglu (1991, p592.).

[12] Appendix A1 gives the exemptions and zero-rated goods and services under VAT law.

Table 3.2: The VAT rates in 1990

Goods and Services	Tax Rates (%)
For all transactions subject to tax except the services and deliveries mentioned below (standard rate)	10
For the deliveries and Services mentioned in List No:1[a] (super reduced rate)	1
For the basic food Stuffs and books, newspapers and etc. mentioned in List No:2[b] (reduced rate)	5
For the deliveries of goods mentioned in List No:3[c] (higher rate)	20

Source: Kocahanoglu (1991). Turkish Tax Acts.

a: See Appendix A2

b: See Appendix A3

c: See Appendix A4

However, in October 1990, the standard rate was increased to 11 %. Later, on 1 December 1990, the standard rate was increased to 12 % and reduced rates for the goods in list number two increased to 6 %. Afterwards, on 1 June 1991, the reduced rate for the goods in list number two was increased to 8 %, while the other rates remained the same. Effective from January 1993, the reduced rate for the goods in list number two was reduced to 6 %. In November 1993, the standard rate was increased to 15 %. However, as the model will be calibrated to the data for the year 1990, the rates in 1990 will be taken into consideration.

Since its introduction in 1985, the contribution of VAT to the total tax revenue has been between 20.6 and 23.4%. Table 3.3 shows the percentage of VAT in total tax revenue in Turkey.

Table 3.3: The Percentage of VAT in Total Tax Revenue and GDP.

VAT as	1985	1986	1987	1988	1989	1990
% of Total Tax Revenue	23.3	22.8	23.4	22.9	20.6	21.9
% of GDP	4.6	5.2	5.6	5.2	4.8	5.3

Source: OECD (1993), Taxation in OECD countries.

As can be seen from Table 3.3, VAT has a great importance in total tax revenue and GDP. More than 20 % of total tax revenue is obtained from the VAT, and also the tax accounts for approximately 5 % of GDP.

In the model, as in other tax models (see Pigott and Whalley, 1985, Ballard, Fullerton, Shoven, and Whalley, 1985) VAT will be treated as an ad valorem tax on nine consumer goods due to complexities in explicitly modelling all of the features of the tax, since it is applied to intermediate transactions. Exports are free of the tax, and the tax is applied to imports for final use (which corresponds to the destination principle). The effective average VAT rates in our model are computed from the information supplied by the Turkish Social Accounting Matrix as explained later in the study. We should mention that the effective average tax rates take all the exemptions into account. When performing the simulations, the statutory tax rates are used rather than the effective tax rates.

3.3.3. Excise Duties

Before the introduction of VAT, the delivery of tobacco products and alcoholic drinks and their importation were subject to production tax. The rates that were applied to tobacco products were 50%-70%. Also, the rate for alcoholic drinks were between 45% and 62 % for the state monopoly products, otherwise the rates were between 5% and 70% for alcoholic and non-alcoholic drinks for the non-state monopoly products.

However, with the introduction of VAT, the production taxes on these products were abolished, and replaced by a supplementary tax. The supplementary tax (VAT Act, Article 60) is imposed to compensate for the difference between the application of the prior production tax rates and the new VAT rates on certain products and alcoholic and non-alcoholic drinks. The tax applied only at the production stage and the tax paid on inputs can only be credited against the supplementary tax charged, not against the VAT.

The taxable base is the same as for VAT. VAT is excluded from the taxable base, however, supplementary tax is included in the taxable base. The tax is to be shown as

a separate item on invoices and customs receipts. The same rates apply for assessment, computation, collection, and other issues to implementation of the supplementary tax as for VAT.

The following goods are subject to supplementary tax at the corresponding normal rates listed when imported or delivered by their producers (VAT Act, Article 60) :

- Tobacco products 100%
- All kinds of alcoholic drinks (including sparkling wine and vermouth, excluding other wines and beer) 100%
- Other wines and beer 15%
- All kinds of non alcoholic drinks 10%
- All kinds of spirits and fuel oil 50%
- Playing cards (excluding toy cards) 60%
- X-Ray films 60%

Also, the specific production taxes on mineral oils and petroleum products were abolished with the introduction of VAT. The new tax, petroleum consumption tax was introduced. With the new tax a proportional tax rate was introduced instead of specific rates. The new rates are between 25% and 85% for these products and applied at one stage.

In the model, excise duties and other indirect business taxes are treated as ad valorem taxes paid on purchases of producer goods.

3.4 Comparison of the Turkish Tax System to that in the European Union countries

3.4.1. Tax Burden

Table 3.4 gives a cross-country comparison of the total tax revenue as percentage of GDP in the EU member countries and Turkey between 1981 and 1990.

Table 3.4: Total Tax Revenue as a Percentage of GDP in the EU and in Turkey[13]

Country	1981	1985	1986	1987	1988	1989	1990
EU	36.6	39.1	39.5	39.7	39.4	38.5	40.6
Belgium	43.5	45.3	44.4	44.4	43.1	41.9	42.8
Denmark	35.7	40.1	42.2	41.6	41.4	40.5	39.3
France	40.3	41.7	40.9	41.3	40.8	40.5	40.8
Germany	29.3	30.4	29.7	29.6	28.8	29.5	29.1
Greece	29.2	35.2	36.9	37.8	36.0	32.6	n.a.
Ireland	37.5	41.5	41.6	41.5	41.6	37.6	38.2
Italy	30.5	33.6	36.3	35.9	36.6	37.9	38.8
Luxembourg	50.8	50.9	49.1	48.1	48.6	48.6	51.4
Netherlands	50.7	51.9	52.1	52.1	51.2	48.4	48.2
Portugal	32.0	33.5	35.1	34.2	33.8	36.1	n.a.
Spain	24.1	27.2	28.8	30.2	30.1	31.7	n.a.
UK	35.8	37.6	36.5	39.5	36.0	35.7	37.2
Turkey	21.3	17.5	17.9	17.9	17.4	18.6	19.4

n.a. = Not available

Source: IMF, Government Finance Statistics Yearbook 1992.

As can be seen from the table, the ratio of total tax revenue to GDP in the EU increased from 36.6% to 40.6% in the 1980s, while it decreased from 21.3% to 19.4% in Turkey. In 1989, five EU countries collected between 40% and 48% of GDP in the form of tax revenue. In the other members of the EU the ratio varied from 30% to 40%. In the 1980s the tax ratio appeared to be levelling off in the high tax rates countries. The figures show that the tax ratios of the member countries moved closer to the EU average.

Recent members, namely Greece, Portugal and Spain are less industrialised than most other states and exhibit relatively low ratios. For example, the tax ratio was 32 % for Portugal, 24% for Spain and 29% Greece in 1981. However, as the table indicates, the rate of increase in the recent members was greater than in the majority of the Union members in the 1980s. Turkey, preparing for membership, has the lowest ratio of total tax revenue to GDP, at around 19% in 1990 as shown in Table 3.4. This ratio is much lower (around half) than EU average and than the lowest ratio in the Union. The

[13] As we take the Turkish tax rates in 1990 into account, the comparison is made only until this date.

overall tax burden increased considerably in the recently joined member states to a level approximately in line with the averages for EU. In Turkey, on the other hand, the tax burden decreased from 21% to 18% in the late 1980s as mentioned. However, there was a slight increase in 1990. One of the most important reasons why Turkey has not reached a tax level of 20 % in GDP is that the agricultural sector still constitutes a significant part of GDP. As the economy is heavily dependent on the agricultural sector and the taxation of that sector is very low, the level of taxation has not been as high as the industrialised European Countries. In addition avoidance and evasion from taxes are at a very high level in Turkey.[14] Although tax legislation is very tough in the letter in terms of enforcement, severity in tax legislation is unmatched by outcomes, which remain by far inferior to those of most other countries which are able to obtain a higher revenue with less severe and less cumbersome tax rules. Thus, tax evasion and avoidance has resulted in a low level of ex post taxation in Turkey. Also, as a result of political preferences, exceptions and exemption have been tremendous in the country. As a result, the level of taxation shows that Turkey is strikingly out of line with the members of the Union.

3.4.2. The Structure of Taxation

Although the structure of taxes and their proportion in total tax revenue varies between the countries, an overwhelmingly large proportion of total tax revenue in the Union and in Turkey comes from the following five main categories of tax:

- Taxes on personal income and capital gains;
- Taxes on corporate income and capital gains;
- Social security contributions;
- Taxes on general consumption, e.g. VAT, and;
- Taxes on specific goods (usually in the form of excise duties).

Table 3.5 gives tax revenues by type of tax as percentage of total taxes.

[14] Therefore, there is lower government expenditure in Turkey than in the EU, and also there is a large budget deficit.

Table 3.5: EU and Turkey: Comparison of Major Tax Revenues as Percentage of Total Tax Revenue (1990).

Country	Personal Income Tax[a]	Corporate Income Tax	Social Security Contributions	Taxes on Goods and Services	Taxes on Specific goods	Other Taxes[b] and Nontax Revenue	Total
EU	22.5	6.5	29.2	18.9	12.1	10.8	100
Belgium	28.8	5.9	35.3	16.5	6.8	6.7	100
Denmark	30.4	3.3	3.8	25.4	15.1	22.0	100
France	11.5	5.6	43.7	20.0	8.1	11.1	100
Germany	13.1	3.3	53.4	13.7	10.1	6.4	100
Greece[c]	12.7	4.8	31.9	16.6	10.9	23.1	100
Ireland	31.1	5.2	14.4	20.1	17.4	11.8	100
Italy	29.6	6.48	28.7	15.2	10.8	9.2	100
Luxembourg	22.1	10.3	24.6	13.5	15.6	13.9	100
Netherlands[d]	24.7	6.8	35.8	14.8	6.2	11.7	100
Portugal[c]	14.2	7.0	25.4	18.7	17.5	17.2	100
Spain	23.1	8.8	36.7	15.5	7.0	8.9	100
UK	28.0	10.8	16.2	16.3	12.5	16.2	100
Turkey	33.9	8.4	10.1	22.5	8.9	16.2	100

(a): Including capital gains

(b): Including taxes on payroll and work force, taxes on property, taxes on international trade and transactions.

(c):1989

(d):1991

Source: IMF(1991 and 1992), Government Finance Statistics Yearbook.

The table shows, the wide range of importance of major tax revenues in the tax systems of EU countries and of Turkey. As can be seen these major taxes account for nearly 90 % of total tax revenue in the EU members on average. One might say that there is still very wide divergence in the tax structures of the EU countries in spite of efforts on approximation of fiscal systems in some areas. As far as personal income tax is concerned, the percentage of total tax revenue varies from 11.5% in France to 31% in Ireland. The role of personal income tax in total tax revenue is significant in the majority of the member countries. In this context, the percentage of income tax

accounted for the largest share of all taxes in Turkey. As can be seen from Table 3.5, the Turkish tax system largely depends on personal income tax. The percentage of the tax in the total tax revenue is much higher than any other EU members and is thus well above the EU average. With regard to corporate income tax, the percentage varies from 3.3 % to more than 10 % among the member countries. In general, this tax has the lowest percentage in the total tax revenues of the member countries. Turkey has a relatively high percentage compared to EU countries with regard to corporate income tax. As can be seen, the percentage of the tax is well above the EU average. Regarding social security contributions, it can be said that almost all of the member countries receive a significant amount of their tax revenues from that source. This tax has the largest share in total tax revenues in the majority of member countries. However, social security payments are not very important in the Turkish tax system.

The role of indirect taxes, mainly general consumption tax (VAT) and taxes on specific goods and services (excises), has been significant in total tax revenue in EU countries as well as Turkey. This is because there has been a switch to VAT from income tax in many countries in recent years. As can be seen from the Table, these taxes generate a considerable amount of revenue in the member countries. On average, the EU countries receive more than 19% from VAT and 12% from excise duties. In this context, Turkey receives a high amount, around the EU average, of tax revenue from VAT. As the table indicates, the larger amount of indirect tax revenue comes from VAT in the Union countries and in Turkey. Although a high amount of revenue comes from VAT (above the EU average), the receipts from excises are low compared to EU.

3.4.3. Comparison of VAT Rates and Structures

VAT is a tax on final consumption that is collected at every stage of production and distribution on the value that each firm adds to its inputs as mentioned earlier. The rate or rates at which VAT is applied is a crucial consideration of the tax. The VAT rates in effect in EU countries are shown in Table 2.1 chapter 2. Also Turkish VAT rates and structure are explained briefly in this chapter. As mentioned in chapter 2, although the VAT system is similar in the European Union, there are considerable

differences between member states in detail. A glance at Table 2.1 in Chapter 2 shows that VAT rates differ considerably between member states despite the progress in the area of indirect tax harmonisation. The rates applied to goods and services are different between the member states. Although some member countries apply three rates, namely, standard, increased and reduced, the situation differs between countries. For instance, Denmark applies a single rate of 22% to all goods and services. On the other hand, the UK has a standard rate of 17.5% and a zero rate for some basic needs. Other countries, such as Germany, Ireland, Luxembourg, apply standard and reduced rates only. The proposal is that EU members should not make any moves that would exacerbate their rate differentials and, if possible should move towards a common number of rates and towards the same rates. What this means, in practice, is that countries using more than two rates should reduce their rates to two rates -standard and reduced- and those using one standard rate will be allowed to increase that number to two. According to the European Commission's proposals, EU countries should abolish the increased rate and zero rate applications as a part of approximation progress. The Commission has chosen to propose a two rate system, in spite of accepting that a single rate system is the simplest and most efficient structure, so as not to cause disruption to the majority of the member countries, which already operate multirate systems. As far as the reduced rates are concerned the Commission has taken the existing spread of rates into account. Moreover, some countries, like Ireland, Portugal and the UK have some domestic zero-rates on some basic needs. Therefore, the Commission has proposed a range for the reduced rate between 4% and 9% and a range for the standard rate between 14% and 20%. As mentioned earlier, the destination principle is applied in the Union with regard to VAT, despite the fact that the aim is to apply the origin principle eventually.

In this context, the Turkish VAT system is similar to those of the member countries of the Union. However, there are some differences in the rates and structure. As mentioned earlier, the Turkish VAT system employs multiple rates as are applied in most of the member countries. According to 1990 figures, Turkey applied a standard rate of 10%, a reduced rate of 1% and 5%, and an increased rate of 20%. In this case one might say that the standard rate is lower than the member countries. Also the increased rate is lower than those countries which apply it. Moreover, the reduced rate

is different from those in member countries. Although VAT rates have been changed in Turkey since 1990 in the direction of VAT harmonisation in the Union, as mentioned, the 1990 figures are taken into consideration for the purpose of the study.

3.4.4. Comparison of Excise Duties.

As shown in Table 3.5, the revenues deriving from the excise duties vary from country to country. Some countries, such as Denmark, Greece, Ireland, Luxembourg and the UK, receive a high amount of tax revenue from excises. In spite of the pattern of widely divergent excise tax systems, comprising on important proportion of total tax revenue in some states, the Commission has put forward ambitious proposals for completely harmonising excise taxes within the Union (see Commission of the European Communities 87c, 87d, 87e, and 87f).[15] The changes, if implemented, would involve all states converging towards the arithmetic mean of current rates leaving the mid-European countries about where they are, the southern states much more heavily taxed, and the northern states rather more lightly taxed. However, the proposed rates would almost certainly fail to be acceptable to the member countries. If the proposals remain as in the latest case, there would be substantial effect on the pattern of consumption and government revenues in certain member states, to the point at which many governments will simply find them unpalatable. For instance, cigarette prices in Greece would double, while some countries such as Denmark and Ireland would suffer a revenue loss.

With regard to excise taxes, Turkey applies a high tax rate on certain products (as shown earlier). Although Turkey has made some progress towards harmonising VAT rates with the Union, this is not the case in the excise duties. As can be seen from Table 3.5, the revenue from excises is lower than majority of EU countries. Although high *ad valorem* as well as specific taxes are imposed on alcoholic drinks, tobacco products and petroleum products, the prices of those products are much lower in relative terms than in any of EU countries. If Turkey applied the proposed rates, the prices of most of those products would appear to be more than doubled.

3.5. The Possible Effects of VAT harmonisation on the Turkish Indirect Tax System

The progress in the field of VAT harmonisation has affected the structure of the Turkish VAT system significantly. The changes in the Turkish tax system have continued, depending upon applications in the Union with regard to harmonisation. The changes in the field of VAT in Turkey are partly due to progress in the area of fiscal harmonisation in the Union. One might say that the application of VAT has resulted in more simplicity in the Turkish tax system. As mentioned earlier, with the application of VAT, the other indirect taxes were abolished and one of the most important effects of application of VAT on the Turkish tax system is that the share of indirect taxes in the tax burden has increased. The shift from direct taxes to indirect taxes tends to have some negative effects especially in developing countries like Turkey. Although application of VAT seems to have been an important tool in decreasing tax evasion in Turkey, and thus has increased government revenue, the increase in indirect tax revenue has created some important problems with regard to fairness in the Turkish tax system. With its negative and positive effects, the application of VAT has been an important step towards harmonisation of Turkish tax system with the EU. The Turkish tax system has some similarities with the EU at some points, as far as VAT is concerned. Most important among the similarities are:

- Taxes are levied on a wide range of goods and services;
- For the distributional objectives multi rates have been applied in Turkey like majority of the EU countries;
- Subtractive method (sometimes referred to as the credit method or invoice method) is used in Turkey the same as the Union;
- Like the EU, exports are tax free and imports are subject to the tax;
- The tax is imposed on the value added that each firm creates. This means that the tax on inputs is deducted from the tax on sales.

Some of the European countries still have to approximate their tax rates towards the Commission's proposal with regard to VAT. In this context, Turkey has made some

[15] In this study, as mentioned before, we only concentrate on VAT harmonisation.

progress towards tax harmonisation even before her membership. Turkish VAT rates have been changed in the direction of the fiscal harmonisation since introduction of the tax. However, the rates that are applied currently are different from the Commission's proposal. In the light of the Commission's proposals Turkey should adjust her tax system to the EU before her membership. In this case, Turkey should abolish the increased rate of VAT. Also, the super reduced rate, 1%, for some goods will have to be increased to at least 4 %. In spite of the fact that the standard rate has recently been increased to the minimum level of Commission's proposal, 15%, the rates applied in 1990 will be taken into consideration. The changes in VAT rates will inevitably tend to have effects on the Turkish economy, as well as affecting the tax system. The economic effects of the tax changes in the direction of VAT will be explored in the following chapters through the application of a CGE model for Turkey.

To summarise, Turkey has adjusting her VAT system moving towards that adopted by the Union with regard to the fiscal harmonisation even before her membership. This has affected the Turkish tax system as a whole. For example the application of VAT changed the Turkish indirect tax system. Since the introduction of VAT, the rates and structure of the tax have been changed so that Turkey would not have difficulties once her membership is realised. However, in the case of membership, more radical changes would have to be made in the tax system, as far as fiscal harmonisation is concerned.

3.6. Conclusion

This chapter has sought to give a brief review of major Turkish taxes and their treatment in the model. Also the recent Turkish tax structure has been compared to those in the EU. As can be seen from the composition of major taxes, the differences between member states and Turkey are great. Although the Turkish tax system very much depends on personal income tax, the share of indirect taxes in the total tax revenue is also significant. Despite the fact that Turkey has already made some progress in the direction VAT harmonisation in the Union, some differences still exist. Regarding this, some changes have been made towards VAT harmonisation

since its introduction. However, as the tax structure in 1990 is taken into consideration, the economic effects of changes in VAT rates towards harmonisation with the EU will be captured through the application of the CGE model by taking 1990 as a base year. As the model is a simulation, we assume that Turkey has applied VAT harmonisation policy with the EU even though her membership has not yet been realised.

CHAPTER 4

COMPUTABLE GENERAL EQUILIBRIUM (CGE) MODELS: A LITERATURE SURVEY WITH TAXATION

4.1. Introduction

Over the last three decades or so, computable general equilibrium (CGE) or applied general equilibrium models have become a widespread tool of policy analysts in both developing and developed countries. CGE models have been used to address a range of policy issues such as choice of development strategy, income distribution, trade policy, structural adjustments to external shocks, tax policy and so on in many countries. CGE modelling attempts to simulate numerically the general equilibrium structure of an economy. When analysing tax policy questions or other economy-wide issues, CGE analysis allows all feedback effects to be taken into account, quite detailed features of the tax system to be captured, and major policy changes to be considered.

One might say that the history of developments in general equilibrium modelling started with the Walras' formulation of general equilibrium. However, it was not until the 1950s that Arrow and Debreu (1954) proved the existence of Walrasian general equilibrium. Thus, after the Arrow-Debreu proof it was possible to convert the Walrasian general equilibrium structure from an abstract mathematical apparatus into a realistic and applicable model of actual economies. The idea of using these models is to evaluate policy choices by specifying production and demand functions and defining equilibrium conditions and incorporating data reflective of real economies.

There is a well established body of literature focusing on tax policy evaluation using dissagregated CGE models. It was the pathbreaking work of Harberger (1962 and 1966), who used a highly aggregated analytical model to focus on the taxation of capital income, that introduced the CGE modelling in the field of taxation. Then

Shoven and Whalley (1972) introduced the first (fully) dissagregated CGE tax model, and most ensuing empirical general equilibrium work for tax policy evaluation followed in the tradition of such contributions and shared the same generic characteristics.[1]

CGE tax models have been used to analyse such policy initiatives as integrating personal income and corporate taxes, the introduction of value-added taxes, housing subsidies and so on. As mentioned in chapter 2, there appear to be few studies related to VAT harmonisation in the EU in spite of its importance.

This chapter aims at presenting a summary of fundamentals of CGE modelling, which is the methodology employed in this study, with emphasis on its application to tax policy issues, and a literature survey related to taxation. In the next section we give some general remarks on the structure and relevance of CGE modelling. First, we summarise the principles of CGE methodology, such as the basic structure of a general equilibrium model, some of the key issues of model design, and so on with emphasis on its application to tax policy issues. We also give the advantages and limitations of CGE modelling in this section. Then we overview CGE tax models in greater detail. As this study is related to VAT harmonisation in the EU, we give an overview of related studies separately in this section. The final section gives some conclusions.

4.2. Computable General Equilibrium Modelling

One might say that applying general equilibrium analysis to policy issues basically requires an understanding of general equilibrium theory. It can be said that a general model of an economy is one in which there are markets for each of N commodities and consistent optimisation occurs as a part of equilibrium. Consumers maximise utility, resulting in the demand-side specification of the model and producers

[1]These models have been surveyed in a number of studies. See, for example, Shoven and Whalley (1984, 1990), Bandara (1991).

maximise profits resulting in the production-side specification.[2] Market prices are such that the required equilibrium conditions are satisfied, i.e., demand equals supply for all commodities and factors, and in the constant-returns-to-scale perfectly competitive case no activity does any better than break even (zero profit condition).

Partial equilibrium analysis can be used to analyse policy issues arising from a shock whose effects are limited to particular industry or rather where the impact on other industries can be considered small enough to be ignored. However, when large pervasive policy changes, such as increases in VAT rates, are considered it becomes painfully inadequate to apply partial equilibrium analysis. Thus, the well-known shortcomings and limitations of partial equilibrium analysis have given rise to computable general equilibrium modelling becoming a widespread and increasingly recognised tool amongst economists. Consequently, with the development of CGE models general equilibrium theory has become an operational tool in empirical economic analysis.

4.2.1. The Computable General Equilibrium Framework

General equilibrium analysis explicitly deals with the interrelationships among different markets and different sectors of the economy. Computable general equilibrium analysis involves using a numerically specified general-equilibrium model for policy evaluation. CGE models include several industries, households, goods and factors as well as international trade flows. General equilibrium modelling is firmly rooted in the explicitly specified framework of microeconomic theory such that the decisions of decentralised agents are based on optimising behaviour and basic parameters and technology.

General equilibrium models possess four important ingredients (Shoven, 1983, p.395). There has to be a specification of (1) the endowments of consumers (2) their demand functions (3) the production technology, and (4) the conditions of equilibrium. In general consumers might have endowments of any or all of the commodities in the

[2] On the consumption side, households supply factors and demand for goods and services. On the supply side, firms produce goods by using factors of production.

economy. In practice, generally, consumers are assumed to be endowed only with two factors of production, namely, capital and labour. The preferences of consumers are specified, implying the market demand functions for each commodity. Commodity demands are non-negative, continuous and homogenous of degree zero in prices meaning that only relative prices matter. Market demands for commodities are the sum of each consumer's demands. Walras's law, which states that the value of demands must equal the value of market endowments at any set of prices, regardless of whether they are equilibrium prices must be satisfied, that is;

$$\sum_{i=1}^{N} p_i \xi(p) = \sum_{i=1}^{N} p_i w_i \tag{4.1}$$

where p_i is the price of commodity i, p is the vector of prices, $\xi(p)$ the market demand functions, N is the number of commodities (including factors), and w_i is the total endowment of commodity i.

or the value of market excess demands must equal zero at all prices, that is;

$$\sum_{i=1}^{N} p_i(\xi_i(p) - w_i) = 0 \tag{4.2}$$

Walras's law is a crucial check on any equilibrium system. If it is not satisfied, this means that there is a misspecification, because the model of the economy in question violates the sum of individual budget constraints.

On the production side of a general equilibrium model, technology is usually described either by a set of constant returns to scale activities or by production functions showing non increasing-returns to scale. The activity analysis is advantageous such that the conditions for equilibrium are straightforward when production is modelled in this way. However, production functions are more convenient to use in applied studies.

With regard to the activity analysis approach, each activity is described by coefficients a_{ij} which denotes the use of good i in activity j when the activity is operated at unit intensity. If there are J activities, the coefficients can be arranged in a (NxJ) non-square matrix A, where a_{ij} elements are negative for inputs and positive for outputs:

$$A = \begin{bmatrix} -1 & 0 & a_{1,N+1} & a_{1,j} \\ 0 & 0 & . & . \\ . & . & . & . \\ 0 & -1 & a_{N,N+1} & a_{N,j} \end{bmatrix} \tag{4.3}$$

The first N columns of this matrix are disposal activities, which allow for costless disposal of each commodity. Joint products are possible which means an activity might have more than one output. However, it is impossible to produce infinite amounts of any good, as the resource availability is fixed in any economy.

In technical terms this assumptions means that:

$$\sum_{j=1}^{N} a_{ij}X_j + W_i \geq 0 \text{ for all } i \text{ in a bounded set.} \tag{4.4}$$

where a_{ij} is the use of good i per unit of activity j, and X_j the level of activity in sector j. Thus, $a_{ij}X_j$ measures the total use of good I in sector j. Also, it is assumed that activities are not reversible. This means that it is not possible to produce inputs from outputs. Moreover, it is assumed there is a linear homogeneity meaning that the vector of outputs obtained by operating the j^{th} activity at any non-negative level X_j is the vector $a_{ij}X_j$.

In the light of these assumptions, equilibrium in the activity analysis model is given by a non-negative equilibrium vector of market prices (P_i^*) and activity levels X^* such that:

1. Demand equal supplies for all commodities,

$$\xi_i(p^*) = w_i + \sum_{j=1}^{J} a_{ij}X_j \quad \text{for all } i = 1,....,N \tag{4.5}$$

2. No production activity makes positive profits, with those in use breaking even,

$$\sum_{i=1}^{N} a_{ij}P^* \leq 0 \ (= 0 \text{ if } X^*j \rangle 0) \quad \text{for all } j=1,.....,J. \tag{4.6}$$

4.2.2. Issues in Designing a General Equilibrium Model

The fundamental issues in CGE model design are the following (see also Figure 4.1);

- specification of theoretical model;
- specification of functional forms;
- choice of parameter values;
- approaches to evaluating the impacts of policy regimes;

As shown in Figure 4.1, the natural starting point in any CGE analysis is , of course, to formulate an appropriate economic model. In applied studies many models are similar in that they are static, and have two factors of production, namely, labour and capital, and a limited number of commodities, with interindustry transactions being modelled through input-output coefficient matrices.

An important issue in CGE model design is the choice of functional forms. The specification of functional forms must be consistent with the basic model assumptions, and the maximising responses of agents must be algebraically simple enough to make repeated solution in the sequence of calculations involved in equilibrium computations feasible. This, in a way, explains why the functional forms of the type used are so often restricted to the family of convenient forms of Cobb-Douglas or Constant Elasticity of Substitution (CES) functions. Another important issue in specification of CGE models is the treatment of external sector. With respect to this, the Armington assumption that treats similar products produced in different

countries as imperfect substitutes is commonly used when modelling the external sector in CGE models.[3]

One needs to decide the level of aggregation alongside with model selection and specification of functional forms. This involves a choice between the theoretical attractions of working more disaggregated data, and the computational complexities of so doing. In practice, modellers choose the appropriate aggregation level by taking the evaluation of the policy changes under scrutiny, the availability of data, and the availability of appropriate computer hardware and software into consideration.

In order to determine results of policy simulations generated by any applied model, knowing parameter values for the functional forms is essential. These parameter values are generated either "exogenously" or through "calibration". Calibration involves fitting the model to a benchmark equilibrium data set.[4] Therefore, the calibration of the model relies heavily on the prior construction of a benchmark data set for the applied model being studied. Four main sets of equilibrium conditions must be satisfied by most of the constructed benchmark equilibrium data sets (see Shoven and Whalley, 1992, p.107):

1. demands are equal to supplies for all commodities;
2. no positive profit is made in any industries;
3. demands of all domestic agents, including the government, demands satisfy their budget constraints; and
4. the external sector is in balance.

However, all of these conditions are not necessarily satisfied in intermediate transactions accounts (input-output data) and other data sources. Therefore, various adjustments are necessary to blocks of data which are available separately, but are not arranged in the form of micro-consistent basis.[5] Note that it is not always possible to

[3] This Assumption is explained in the following chapter in more details.
[4] The detail of calibration procedure is given in Chapter 6.
[5] See chapter 6 for more details about adjustments for consistency.

determine all parameter values 'endogenously' by calibration. Therefore, certain key parameters, mainly elasticities, are determined exogenously.[6]

Given the parameterised model one can evaluate the effects of policy changes. Policy conclusions are reached by comparing the counter-factual and benchmark equilibria after changing some policy parameters such as tax rates. In addition to counterfactual policy analysis, the CGE models are also used to investigate other counterfactuals, for instance, changes in endowments or changes in preferences. In order to make normative assessments of policy changes, we need to measure economic welfare. The Hicksian compensating (CV) or equivalent variations (EV) measures are the most commonly used measures in applied general equilibrium models.[7]

The commonly used procedures in both constructing and using applied CGE taxation models are summarised in figure 4.1 which is adapted from Shoven and Whalley (1992, p.104)

[6] With regard to Cobb-Douglas functions, a single price and quantity observations is sufficient to determine the parameter of the functions uniquely. On the other hand, the exogenous elasticity values are selected on the basis of a literature survey for CES functions in most cases.

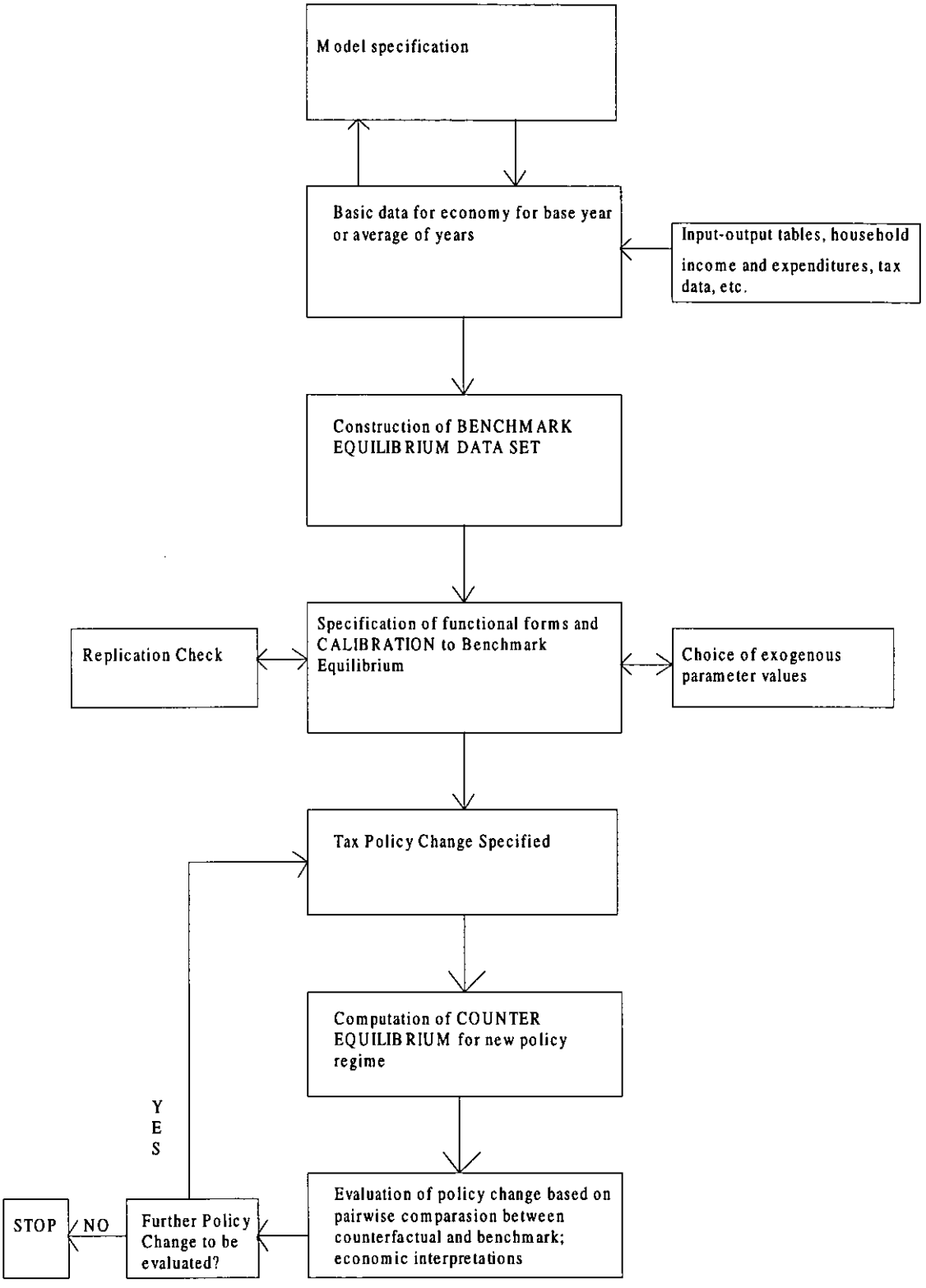

Figure 4.1: Flow chart outlining calibration procedures and model use in typical applied general equilibrium tax model.

[7] The former starts from the new equilibrium and asks how much income is required to compensate consumers so that they will be in their original utility level, whereas the latter starts from the original equilibrium and measures the change in income required to reach the new utility level.

4.2.3. Evaluation of the General Equilibrium Methodology

As mentioned, there has been a well established and rapid growing body of literature focusing on tax policy evaluation and other policy issues using disaggregated CGE models in recent years. The popularity of CGE is not surprising, given that this approach has several advantages over more macro-oriented aggregated models or analytical partial equilibrium analysis. Certainly, one of the most important advantages of general equilibrium methodology lies in its microeconomic foundation. Hence, the behaviour of all economic agents such as consumers, producers, and government is specified in a typical CGE model. Moreover, unlike many alternatives, the CGE methodology allows the study of differential impacts across sectors of production and across consumer groups, as considerable dissagregation of commodities and consuming groups is possible in CGE models, specially in static ones. This permits incidence analysis to focus on the size distribution of personal income, rather than solely on factor incomes. Also it allows a more general representation of tax distortions, one which treats alternative agents, factors, and commodities differently. In addition, this methodology allows a consideration of the interactions between different sectors, and agents, therefore, the policy evaluation is not biased by ceteris paribus assumptions. Furthermore, in a more technical vein, the CGE methodology uses flexible computational numerical techniques. Analytical tools often become intractable for disaggregated models. Another important advantage of computable general equilibrium models is the possibility of deriving better measures of welfare changes associated with new policy through the use of indicators such as compensating and equivalent variation. Finally, the CGE modeller does not have to be confined to small changes in parameters. This is a crucial point, as large changes in policy parameters are often contemplated in most tax reform proposals.

On the other hand, as with any form of economic analysis, CGE models have limitations. The most frequently mentioned limitation is the lack of empirical validation of CGE models in the sense that usually there is not any measure of the degree to which the model fits the data or tracks the historical facts. Also, the economic richness of the model does not allow for the simultaneous estimation of all parameters. Hence, many of the parameters in the benchmark data sets are based on

the modellers' judgement or are point estimates from secondary sources. This is especially common with regard to elasticity values. Due to the assumption of general equilibrium, which is seldom observed in all markets simultaneously, the result of the model do not pretend to forecast reality, but rather to indicate long term tendencies , around which the economy will fluctuate. Modellers should be extremely careful when choosing the types of functional forms as well as parameters in order to overcome this problem. Only parameter values which correspond to a certain consensus should be used, and therefore, the types of functional forms employed are normally simple and non controversial, (for instance, Cobb-Douglas and CES functions).[8] Moreover, they adopt many simplifying neo-classical assumptions such as perfectly competitive markets and constant returns to scale. Lastly, money or monetary assets are not included in most CGE models. Hence, the models have been used to investigate resource allocation issues, but not financial or monetary policy issues. Specifically, it would be impossible to discuss problems related to inflation in the context of existing CGE models. One could defend by arguing that CGE models are concerned with relative prices and are only concerned with real variables. However, some economists do not find that wholly convincing.

Despite its limitations, the general equilibrium approach offers a useful unifying framework to analyse a wide range of economic policy issues in a large number of developed and developing countries. This approach represents an advance over other methods by offering a unifying framework that can highlight channels of interdependence that a partial equilibrium analysis would not cover. The core of the general equilibrium approach is that "everything depends upon everything else". Interdependencies and feedbacks among policy instruments as well as between sectors have an important effect on results, but in practice are difficult to model in anything other than a general equilibrium framework. Thus, general equilibrium models have become extremely useful in the case of economy-wide policy issues The main idea underlying general equilibrium analysis of tax policy is that, in order to evaluate the effects of changing in major tax, important economy-wide effects must be taken into

[8] If the substitution elasticities are equal to one, then the CES functions become Cobb-Douglas functions.

account. Hence, CGE models have already made a great contribution to the policy debate on tax issues and more contributions seem likely in the years ahead.

4.3. Overview of General Equilibrium Tax Policy Analysis

The incidence and allocation effects of changes in tax policies have long been a principal concern of both policy makers and economist in the area of public finance. Three different approaches can be distinguished in the study of the impacts of tax changes. The first approach is 'partial equilibrium' which allows for highly disaggregated analysis at the cost of not considering market transactions. The second approach is 'macroeconomic' and allows for market interactions in the context of aggregated models. The third approach, as an alternative, is 'general equilibrium' which allows for both disaggregated analysis and full consideration of market interactions. Economists have long ago recognised that in order to analyse the effects of changing a major tax, important economy-wide effects must be taken into consideration, and thus constructed models based on the well known Arrow-Debreu (general equilibrium) model to provide quantitative measurement of the general equilibrium impacts of taxes.

The CGE models all derive in one way or another from the path breaking work of Harberger (1962 and 1966) in the United States on corporate and capital income taxes. Harberger's approach represents a great advance over partial equilibrium models. His work has helped to increase the popularity of general equilibrium models among public finance economists. However, his analyses have their own shortcomings. The Harberger approach enabled the general effects of taxes to be quantified in the structure of a series of differential equations with two sectors, two factors, and two goods. Unfortunately, his model quickly becomes intractable in dealing with more than two sectors or two factors. Moreover, this marginal analysis approach is not appropriate for considering large policy changes. The 1962 Harberger general equilibrium model is based on standard neo-classical assumptions (see Harberger 1962). He assumes that the supplies of capital and labour are fixed in the aggregate, that capital and labour are perfectly mobile among industries and that there is perfect competition in factor and product markets. Production takes place under constant

returns to scale. There are two sectors namely, corporate and non-corporate based on whether they are heavily or lightly taxed. Each sector produces a single homogeneous output. He assumes a closed economy (no foreign trade). Lastly, the model considers the effects of a distorting tax in one of the sectors, using estimates of substitution elasticities of production and consumption functions which are based on econometric literature. Harberger generates estimates of the incidence of particular taxes. The solution technique of the model involves total differentiation so that, technically speaking, the model is appropriate only for small changes in the tax code. One might say that the most famous findings from his work is that the corporate tax is likely to be borne by all capital owners regardless of whether their capital is used in incorporated enterprises.

The work of Scarf (1967) provided a reliable algorithm for computing equilibrium prices. The algorithm used simplicial subdivision techniques and can be shown to be the computational analogue of the fixed point theorems previously used to prove the existence of equilibrium.

With a computational technique that could solve much more disaggregated versions of the Harberger model, Shoven and Whalley (1972, 1973) were the first to investigate the medium-run effects of tax policy changes within the CGE framework. Their work is regarded as a great contribution to the area and most of the CGE models for evaluation of tax policy changes in developed countries have followed this tradition (the Yale tradition). The authors have usually focused on measures of efficiency and distributional impacts of tax reform proposals.

Hence, there has been a well established body of literature focusing on tax policy evaluation using dissagregated CGE models followed in the tradition of such contributions and shared the same generic characteristics. Most of the models are static and investigate the medium-run effects such as efficiency, allocation, income distribution, and so on. Mainly, the CGE tax models consider the impacts of tax changes, tax distortions, structural characteristics of a particular system, and welfare effects. However, it is beyond the scope this chapter to survey all of the general

equilibrium tax models. Instead we have restricted our literature survey to some selected tax models, especially, with regard to the first part of literature survey.

The literature survey on CGE tax models is divided into two categories. Firstly, we overview some of the more prominent models in the area of taxation, reflecting a variety of approaches in the field of taxation. Then we focus on CGE tax models of VAT harmonisation.

4.3.1. Overview of the Selected Tax Models

In order to understand the general equilibrium approach to tax policy modelling, it would be useful to delve more deeply into the individual key models to see, for instance, how they have been constructed, what issues have been analysed, and what the main findings have been.

Most of the models that we examine could be said to be static and to be in the "Yale tradition". Taxes are all treated in ad valorem-equivalent form in all the models surveyed. Also, government budget is assumed to be balanced in equilibrium in most of the models.[9] The main characteristics of selected computable general equilibrium tax models, the data used in these models, and some of the more significant features of their results are presented in Table 1. The table includes the following models; Ballard, Fullerton, Shoven, and Whalley (1985), Ballard and Shoven (1987), Baum (1991), Denny *et al* (1995), Gottfried and Wiegard (1991), Hamilton and Whalley (1989), Kehoe *et al* (1988), Kehoe and Serra-Puche (1983), Keller (1980), Pigott and Whalley (1985), Shoven and Whalley (1972), Whalley (1975). [10]

[9] The exceptions are Kehoe and Puche (1983) and Kehoe *et al* (1988), because they allow the government to run a deficit budget as explained later on this chapter.

[10] There are a number of studies dealing with VAT issues in CGE models. As the study is about VAT harmonisation, we select a few key studies such as Ballard and Shoven (1987), Gottfried and Wiegard (1991), Kehoe *et-al* (1988) related to the VAT issues from the existing literature in order to show the modelling of VAT in great detail.

Table 4.1: - Computable General Equilibrium Tax Models : A Summary of Main Features and Results of the Models.

		Demand Side		*Production Side*	
Author(s)	Country	Demand functions	Number of Consumers	Production functions	Number of Producers
1)Ballard, Fullerton, Shoven, and Whalley (1985)	United States	CES/Cobb-Douglas	12 consumer income groups	CES/Cobb-Douglas	19 producer goods, and 19 consumer goods
2)Ballard and Shoven (1987)	United States	CES	12 consumer income groups	CES	19 producer goods, and 19 consumer goods
3)Baum (1991)	United States	CES	10 Household types	CES	16 industries, and 16 consumer goods
4)Denny *et al* (1995)	Ireland	CES	1 Consumer	CES	11 producer goods, 10 consumer goods
5) Gottfried and Wiegard (1991)	Germany	CES	1 representative household	Cobb-Douglas	15 producer goods industries
6)Hamilton and Whalley (1989)	Canada	CES	42 household groups	CES	44 industries, and 23 consumer goods
7)Kehoe *et al* (1988)	Spain	Cobb-Douglas	8 household groups	Cobb-Douglas	12 producer goods, and 9 consumer goods
8) Kehoe and Serra-Puche (1983)	Mexico	Cobb-Douglas	10 household groups	CES	14 producer goods, and 15 consumer goods
9) Keller (1980)	Holland	CES	2 household groups	CES	4 industries
10) Pigott and Whalley (1985)	United Kingdom	CES	100 household groups	CES	33 industries
11)Shoven and Whalley (1972)	US	Cobb-Douglas	2 household groups	CES	2 industries
12) Whalley (1975)	UK	CES	7 household groups	CES	9 industries

Table 4. 1: Continued

Base Year	*Main data base and values of key parameters*	*Taxes incorporated in the model*	*Policy issues*	*Results*
1) 1973	Production data derived from national accounts; Input-output (I-O) tables and demand data from consumer expenditure survey taxation statistics. Production elasticities of substitution between capital and labour from the literature review	All existing us taxes including corporate, income, social security and sales and property taxes	Integration analysis: four alternative plans for corporate and personal income tax integration. Consumption tax alternatives: change in tax treatment of saving	Total integration of personal income taxes yield gains as well as consumption tax alternatives.
2)1973	Production data derived from national accounts; Input-output (I-O) tables and demand data from consumer expenditure survey taxation statistics. Production elasticities of substitution between capital and labour from the literature review	All existing us taxes including corporate, income, social security and sales and property taxes	Examination of the efficiency properties of introduction of a VAT in the United States, particularly, the efficiency and equity trade-off offered by a VAT	Consumption base VAT is advantageous to the other alternatives with regard to efficiency; the lowest income groups are worse off under the new policy regime
3) 1987	Production data from input-output tables; national accounts; demand data from family expenditure surveys, and tax data from different government agencies and input-output tables; elasticities of substitution from literature review	All major taxes including personal income tax, factor taxes, import duties, and indirect taxes	Investigating a base broadening policy in sales tax coverage by setting the sales tax rate on services equal to tax the sale tax rate on consumer durables	This policy produces a potential pareto improvement and its differential incidence is progressive; the policy increases the wage and reduces the returns on capital
4) 1985	A SAM data base; substitution elasticities from literature for most of the sectors; for the rest of the sectors the elasticites are estimated.	All major Irish taxes including production taxes, consumption taxes, and income taxes	Examination of the impacts of moving to a more uniform tax structure	In general, moving to more uniform tax structures would give rise to an increase in employment.
5) 1984	Input-output tables provides the basic data set;	VAT, production taxes, and taxes on the use of capital services	examining the difference between exemptions and zero rating under a consumption based VAT	the efficiency effects of tax changes turned out to be rather small

Table 4.1: Continued.

Base Year	*Main data base and values of key parameters*	*Taxes incorporated in the model*	*Policy issues*	*Results*
6) 1980	Production data from national accounts, and input-output data; the family expenditure survey provides data for the demand side; tax data from different sources such as Statistics Canada; and elasticity values from literature survey	All major components of the Canadian tax system are represented; they include the federal sales tax, provincial sales tax, excise taxes, personal income taxes, factor taxes	Analyses of possible changes to the Canadian indirect tax system	replacing either the federal or provincial sales tax with a broad based sales tax generates small, yet significant welfare gain
7) 1980	SAM based data	All major Spanish taxes including taxes on production, import taxes, taxes on consumer income, sales taxes	to explore the effects of tax reforms such as the introduction of VAT as a result of Spanish entry into EU	Introduction of VAT makes consumers worse off by 2-3 % on average with the high income groups experiencing greater reductions than the lower income groups
8) 1977	I-O Table updated for 1977 using 1970 I-O Table. Assumed production parameters for demand side were based on various surveys. Tax rates derived from government budget data.	All existing Mexican taxes, including sales taxes, income taxes, tariffs and export taxes.	Investigation of the impact of 1980 tax reform which introduced VAT.	Resource allocation moved in favour of agricultural goods and foodstuffs. Also, the results reveal that rich and poor income groups get more benefit than middle class.;
9) 1973	Production data from I-O Tables, demand data from households expenditure surveys. Elasticities of substitution in production from literature survey and best guess.	Taxes on consumer goods and services, on capital goods, imports, labour, capital and corporate income and lump-sum taxes.	changes in marginal tax rates in various production and consumption sectors.	Efficiency effects of taxes generally small. Only small amount of shifting.
10) 1973	Elasticities of substitution in demand and production from the literature survey. Production data from I-O table, demand data from family expenditure survey.	All major UK taxes and subsidies.	Housing subsidies, VAT, overall effects of each tax.	The tax/subsidy system yields 6-9 % of NNP per year subsidies to local authority housing area are significant source of welfare loss

Table 4. 1: Continued.

Base Year	*Main data base and values of key parameters*	*Taxes incorporated in the model*	*Policy issues*	*Results*
11) 1953-9 (average)	Production data from literature source, various specification in elasticities of substitution in production.	Taxes on income from capital.	Imposition of removal of existing taxes on income from capital under various model parameter specifications.	In 6 of the cases analysed, capital bears more than the full burden of surtax; in the remaining cases labour bears the burden.
12)1968-70 (average)	Production and demand data from national accounts, elasticities of substitution in demand and production functions from best guess and literature survey.	All major UK taxes.	Analysis of 1973 UK tax reform	The welfare gain from the reform found to be small. Replacement of purchase tax and selective employment tax appears to generate welfare losses, while changes made to income tax system might yield gains.

The first applications using a full computational general equilibrium procedure were by Shoven and Whalley and addressed policy issues in the area of taxation. Shoven and Whalley (1972), for the first time, employed a full general equilibrium approach to evaluate the effects of differential taxation of income from capital in the United states. In this study, they used an artificial commodity to incorporate the tax distortions, which effectively limits the applicability of the analysis to one tax at a time. Afterwards, Shoven and Whalley (1973) developed a procedure to deal with several simultaneous tax distortions without using artificial commodities. Whalley (1975) used this method of simultaneously incorporating several tax distortions to investigate the impact of 1973 tax changes in the United Kingdom. The model includes several industrial sectors and several household groups. This work was further developed by Pigott and Whalley (1985) into 33 commodities and industries and 100 households. This model was used to evaluate the structural characteristics of the United Kingdom's tax/subsidy system.

Keller (1980) uses a Harberger structure for a tax model of Holland. However, his model is different from the Shoven-Whalley study, because he uses a local linearisation procedure to solve for the tax change equilibria. On the demand side, four groups of agents are included. Along with low income/unskilled labour and high income/skilled labour groups, government and foreign sectors are specified separately

in the model. Keller's incidence analysis focuses on distributional effects between these two first groups. Bovenberg (1987) constructed a general equilibrium model to evaluate alternative instruments of indirect taxation in middle-income countries. His model heavily relies on Keller (1980), but he extends Keller's work by adding dynamic features into his model. The data used are for Thailand as an illustration. This work examines the effects of alternative instruments on revenue, efficiency, equity, and international competitiveness. The model contains 8 household sectors, 13 production sectors and 25 goods and factors. His conclusion is that the interaction between taxes and the distortion caused by various policies can be important for revenue and efficiency.

A general equilibrium model called MEGAMEX was developed for the Mexican economy following the Shoven and Whalley tradition. The main aim of this model was to examine the impact of the 1980 Mexican tax reform on income distribution and resource allocation (Kehoe and Serra Puche 1983). In the model, the effects of shifting from indirect turnover taxes to a consumption type value-added tax (VAT) system as introduced in 1981 (after a major tax reform in 1980) were examined. Kehoe and Serra-Puche (1983) used the model to analyse the 1980 fiscal reform in Mexico, incorporating unemployment generated by an exogenously-specified downward rigidity of real wages. They transform demand for consumption goods into demand for production goods through the application of conversion matrix.[11] The model is a static Walrasian general equilibrium model and is solved by using a variant of Scarf's algorithm for computing fixed points. Kehoe *et al* (1988) use a CGE model of the Spanish economy to analyse the impacts of the indirect tax reform using the information contained in the SAM. Their model is static and follows in the tradition of Shoven and Whalley. It differs from standard models of this type in the special treatment that it gives to the foreign sector, labour markets and the government deficit. The authors use a conversion matrix in the same way as Kehoe and Serra-Puche (1983). Ballard and Shoven (1987) examine the efficiency properties of introducing VAT in the United States. Particularly, they compute the efficiency and equity trade-off offered by a VAT, using the applied general equilibrium model of the US economy

[11] This method is commonly used in the studies which focus on indirect taxes especially VAT in the literature. See, for example, Ballard and Shoven (1987), Baum (1991), Kehoe *et al* (1988).

based on Ballard, Fullerton, Shoven, and Whalley (1985).[12] Denny *et al* (1995) develop a CGE model of the Irish economy to examine the impacts of moving to a more uniform tax structure. They use CES functions for both the demand and production sides of the economy. They dissaggregate the production side of the economy into 11 sectors, while there is only one household on the demand side. Hamilton and Whalley (1989) employ a general equilibrium model to analyse various changes in indirect taxes in Canada, specifically the federal and provincial sales taxes. Gottfried and Wiegard (1991) use a static Shoven-Whalley type equilibrium model of the German economy to study the difference between exemptions and zero rating under a consumption based VAT. Baum (1991) uses a general equilibrium model of the US economy to investigate the impacts of including services in the sales tax base.

Most of the CGE models considered so far are specific examples of a class of general competitive equilibrium with taxation considered by Shoven and Whalley (1972, 1973). In this group of models producers are assumed to maximise profits and market demand functions are assumed to exist which are non-negative, continuous and homogeneous of degree zero in prices.

Examples of this type of modelling have been surveyed by Shoven and Whalley (1984, 1992), Fullerton, Henderson and Shoven (1985), and Bandara (1991) in recent years. These models are static in that aggregate supplies of productive factors, especially capital, are taken as fixed. Most of these tax policy models can simultaneously accommodate several taxes. This is crucial in general equilibrium models of taxation, as taxes compound in effect with other taxes even when evaluating changes in only one tax. In these models, the conditions for equilibrium become demand equals supply for each commodity, firms in operation break even after taxes and the government budget is balanced. The mathematical framework of static general equilibrium models allows the inclusion of a large number of commodities, and disaggregated groups of consumers. Therefore, these models can be used to analyse the welfare implications of changes in complex tax system. This is the

[12] Although their model is based on Ballard, Fullerton, Shoven, and Whalley(BFSW) general equilibrium model of the US economy and uses the same data as in BFSW model, we include this model in our survey as well since it deals with VAT issues.

main advantage of recent versions of this type of model. However, the traditional CGE models do not incorporate time and adjustment dynamics.

In some recent works, some of the models have attempted to incorporate dynamics elements into their models. In other words, the modelling of time and the treatment of financial assets have been addressed. Ballard, Fullerton, Shoven, and Whalley (BFSW) (1985) incorporated all major distorting taxes as in earlier work. However, their model differs from the Harberger structured models through the application of dynamic sequencing of single period Harberger type equilibria. The model includes a number of commodities and industries as appear in the static models, yet saving decisions in any period are made by households based on myopic expectations regarding the future rate of return to capital. However, the production side of the model is completely static. Major developments in dynamic computable general equilibrium models have been carried out by Auerbach and Kotlikoff (1987), Goulder and Summers (1989), Perraudin and Pujol (1991).[13]

4.3.1.1. Similarities and Differences Among Models

The general equilibrium model appropriate for any application depends largely upon the tax policy issues being addressed and the type of the economy. However, most applied models that have been used have a similar form. All these models are basically numerical applications of the Walrasian type neo-classical general equilibrium approach. The main equations of the models are derived from the constrained optimisation of neo-classical production and utility functions. Producers choose inputs to minimise costs of a given output subject to non-increasing returns to scale industry production functions. On the other hand, consumers are assumed to choose their purchases to maximise utility functions subject to a budget constraint. Most of the models involve more than two industries in which fully mobile and homogenous labour and capital are used in a profit maximising combination. Also, in most models, there are several household groups defined by their income levels, skills or socio-economic factors. The households are endowed with labour and capital in

[13] Pereia and Shoven (1988) survey the CGE tax model that incorporates at least some dynamics in their structure.

varying amounts. Moreover, the households receive government transfers. There are usually ad valorem taxes on incomes, factors and outputs, and these enter into appropriate production and consumption decisions. Equilibrium is satisfied when demand equals supply for all goods and factors. In most models, generally, other characteristics of the equilibrium are that producers receive no excess profits and that all agents are on their budget constraint. Also, in most models, the authors have assumed that the government budget is in balance and taxes are all treated in ad valorem-equivalent form. In particular, a balanced budget is a necessary assumption in a model in which there are no paper assets, due to the fact that deficits have to be financed by an increase in government securities or by money creation. Most of the models in Table 1, such as those of Pigott and Whalley (1985), Keller (1980), and Kehoe and Serra-Puche (1983), are large general purpose models for different countries. Most of the applications are concerned with a variety of taxes, transfers and subsidies in addition to corporate income tax. As can be seen from the Table, two broad categories of data are required. Firstly, input-output and national accounts data and secondly various elasticity estimates have to be derived from appropriate sources. In addition, the models related to indirect taxes, especially VAT, used conversion matrix to transform consumer goods demand into producer goods demand as mentioned before.

In spite of these similarities, some authors have made different decisions on modelling factor mobility, aggregate factor supplies, budget balance, and foreign sector. For example, Kehoe and Serra-Puche (1983) and Kehoe et al. (1988) allowed the government to run a deficit budget. Also, Kehoe et-al (1988) allow positive excess supply in the labour markets. Moreover, the existing tax models employ different solution techniques. Scarf's simplicial research method, Merrill's grid search algorithm, and Newton type solution strategies are the most commonly used. The models in use vary in the level of disaggregation with the number of production sectors varying from 2 to 33. The functional form used to explain production technology belongs to the well-known families of Cobb-Douglas or constant elasticity of substitution (CES).[14] In some cases, such as Kehoe and Serra-Puche (1983), Shoven and Whalley (1983), the production functions are generalised to all inputs,

whereas in some others, such as Pigott and Whalley (1985), Keller (1980), they are distinguished between levels as nested production functions.[15]

As far as the demand side of the models is concerned, the household sector has been disaggregated into groups ranging from 1 to 100, based on income levels, skills or socio-economic factors. The selection of functional forms for the household behaviour must be consistent with the theoretical approach and it must be analytically tractable. Subject to this constraint, familiar functional forms, namely, Cobb-Douglas and CES functions have been used in CGE applications as shown in Table 1 for the demand side.[16]

Although the majority of the existing CGE tax models have been used to simulate comparative static results of a change in a particular policy or a group of policies, in some of CGE tax models, modellers such as Auerbach and Kotlikoff (1987), BFSW (1985), Bovenberg (1987), Perraudin and Pujol (1991), have attempted to incorporate dynamic features into their models in recent years. The aspects of static general equilibrium models have highlighted their use in studying intersectoral distortions, while the new generation of the dynamic general equilibrium models added the studying of intertemporal distortions. Although in most static general equilibrium models the government budget is assumed to be balanced, allowing government to run deficits that creates crowding-out effects would be considered another area that causes non-optimality of resource allocation. In the Auerbach and Kotlikoff (1987), deficits are financed by an issuance of government bonds. Feltenstein (1981) included money into his model and, therefore, financed a deficit with a mix of creation of money and issuance of bonds. Clearly, a dynamic setting is required for the specification of government budget constraint with deficit, since, at the end, government debt should be repaid to the household sector. The repayment may be by means of an increase in taxes and / or a reduction in spending but not by borrowing again. By taking this into

[14] CES functions encompasses Cobb-Douglas functions.

[15] Nesting is a hierrarchical system whereby production functions, such as CES, are embedded within other production functions up to a specified level. Usually, CES production function is used for factors and Leontief production functions for intermediate inputs in each production sector.

[16] Linear expenditure system (LES), extended linear expenditure system (ELES), and Non linear expenditure have been used in some CGE applications with regard to demand side.

consideration, Auerbache-Kotlikoff (1987) and Perraudin and Pujol (1981) have specified an intertemporal budget constraint.

4.3.1.2. Implementation of Computable General Tax Analysis

The technical aspects of operating CGE models are the paremeterisation procedure, the solution method and the measurement of efficiency and distributional gains.

In order to find parameter values, given that constraints on the size of the models and their integrated structure make it impossible to simultaneously estimate all parameter values using conventional simultaneous equation econometric techniques, as pointed out by Mansur and Whalley (1984), the so-called, 'non-stochastic' calibration method has been used by most modellers. With this approach, only one year's data would be enough to carry out the parameterisation procedure. The main behavioural equations in CGE tax models are production and demand equations. The parameterisation procedure involves selecting substitution elasticities between factors and goods from previous econometric studies. However, there are some problems with this procedure that are often acknowledged by modellers themselves. Firstly, estimates of parameters might well vary from study to study. Generally speaking, there are no clear rules for deciding among many alternatives. Moreover, sometimes, there is a lack of estimates of some parameter. Therefore, some modellers have used estimates for the same parameters for a different country. For instance, Pigott and Whalley (1985) used estimates of saving elasticities for the United States in their study of the United Kingdom. However, they compensated for this problem by trying a wide range of estimates. Given exogenously determined substitution parameters, the remaining parameters are then determined within the model by using the calibration procedure.[17]

Calibration heavily relies on the prior construction of a benchmark data set for the applied model. In general data are collected from available sources for a particular year and are not consistent. Therefore, the data must be adjusted for consistency. In

[17] Calibration procedure and how we calibrate the parameters for the specific model are given in chapter 6 in more details.

this way, data satisfy the strong assumption of the model that they represent an equilibrium for the considered economy for the particular year.

Once the data set is available and the paremeterisation procedure is completed, the next job is to solve the model. There are a variety of solution algorithms that work directly with the various excess demand equations. These algorithms can be divided into four types: i) those based on fixed-point theorems, ii) those based on a tatonnement process, iii) those exploiting information about the derivatives of excess demand functions, iv) and those using the complementary stackness conditions of the model .

Algorithms based on fixed-point theorems were developed by Scarf (1967) and Merill (1972).[18] A major advantage of this approach is that convergence is guaranteed within a finite number of dimensions on the simplex. Feltenstein and Shoven-Whalley type models have utilised this solution method. Algorithms based on a tatonnement process simply adjust the price in each sector in response to the sector's excess demand. The Gauss-Seidal iteration procedure is a special version of a tatonnement process. Among the surveyed models only Auerbach and Kotlikoff have used a Gauss-Seidel method. The third kind of algorithm which deals directly with the set of algebraic excess demand equations is defined by their use of the functions. The Newton type solution method is an example of this third group. The Newton type procedures, which make linear approximation of various kinds, have been used in several applied general equilibrium models, for example, Pigott and Whalley (1985) and Pigott (1988). Rutherford's MILES solver (see Rutherford, 1994) is the example of this fourth group.

The standard procedure of evaluating the possible impacts of policy changes is to compare the counterfactual and benchmark equilibria.[19]

[18] See Shoven and Whalley (1990) for the detailed discussion on these algorithms.

4.3.2. Overview of CGE Models on VAT Harmonisation in the EU

The impact of VAT harmonisation on the EU countries has been one of the most important issues facing economists and policy makers in the recent years. Therefore, there are a considerable number of studies in this area as mentioned in Chapter 2. However, as mentioned before, there appears to be a shortage of literature dealing with the issues of VAT harmonisation in the EU by using CGE modelling. In the literature, there are both one-country and multi-country CGE models in this area. Most of the models used in this area medium-sized, static CGE models in the Shoven-Whalley tradition, but there appear to be two studies that incorporate dynamic issues into CGE models with regard to VAT issues. In this section, we overview the applied general equilibrium models on VAT harmonisation in the EU. As in the previous section, we focus on the static models in this section. Then we briefly overview the dynamic CGE models. Using the same structure as in Table 4.1, we present a summary description of the applied general equilibrium models used to simulate the effects of VAT harmonisation in Table 4.2 as far as the EU is concerned.[20] The following models are included in the table; Fehr *et al* (1993, 1995), Haufler (1993), Wajsman (1995), Whalley (1976).

[19] Counterfactual equilibrium is an artificial solution of the model, which is based on values of endogenous parameters derived from calibration to the benchmark equilibrium data set, given specified changes in on or more policy regime.

[20] We include only the static CGE models in the table, although we provide a brief overview of the dynamic models in this area.

Table 4.2: - Computable General Equilibrium Tax Models focusing on VAT Harmonisation in the EU: A Summary of Main Features of the Models and the Results

		Demand Side		*Production Side*	
Author(s)	Country	Demand functions	Number of Consumers	Production functions	Number of Producers
1) Fehr *et al* (1993, 1995))	Members of the EC excluding Greece	CES	One representative agent for each country	CES	14 producers
2) Haufler (1993)	Germany, Rest of the EU and Rest of the World	CES	One representative consumer for each country	CES	3 producer goods within each country
3) Wajsman (1992)	Denmark	LES demand System (Stone-Geary)	One representative household	Cobb-Douglas	3 producer goods, 9 consumer goods
4) Whalley (1976)	West Germany, France, Holland, Belgium, Italy	CES	One representative consumer for each country	CES	55 domestically produced goods within each country

Table 4. 2: Continued

Base Year	*Main data base and values of key parameters*	*Taxes incorporated in the model*	*Policy issues*	*Results*
1) 1981	On the production side, the inter-industry transactions table in intermediate demand and the final demand table are mainly derived from literature and EUROSTAT for the EU countries, and input-output data provided by the United Nations and MITI* Tax data from the German Ministry of Finance and OECD for ROW	All major taxes including tariffs, production taxes, VAT, and income taxes	To examine the quantitative effects of the transitional system of VAT for intra-EU trade	Welfare changes are dominated by international income effects as a result of exporting and importing activities. Also, domestic and international substitution effects are relatively small
2) 1987	Production and trade data from United Nations statistics, elasticities of substitution from literature	General commodity taxes	Analysing the welfare effects of switching from destination principle to each of the tax principles feasible in the EU	The analysis of alternative tax principles supports the general choice in favour of the restricted origin principle
3) 1984	A SAM data base; the trade elasticities of substitution and export demand elasticities from the literature	All major Danish taxes, including personal income taxes, capital taxes, VAT and other indirect taxes, import tariffs	Analysing the impacts of tax harmonisation, as has been proposed by the European Commission	Harmonising Danish taxes would give rise to substantial reallocation in the Danish economy; domestic absorption and real GDP would increase by 1.5 %-2.5 % . However, the relation between private and Public Consumption would change in favour of Private Consumption.
4)1965	Data from a set of I-O transactions accounts by the Statistical Office of EEC. Substitution elasticities of production function from literature review.	Turnover taxes, excise duties, sales taxes, entertainment taxes, taxes on motor vehicles, income taxes.	Examination of domestic welfare of different tax harmonisation jointly adopted by each of the five countries considered.	Gains and losses are within bounds of a saving or extra requirement of $1^{2/3}$ percent of national resources through harmonisation within the EEC. Harmonisation on a non-distortion tax systems, the domestic gains would appear to be much more substantial than those achievable under any harmonisation on a national system.

*MITI: Ministry of International Trade and Industry, Tokyo.

Fehr *et al* (1993,1995) developed a multi-country static CGE model to examine the quantitative effects of the transitional system of VAT for intra-EC trade between 1993-1997, as recently adopted by the ECOFIN-council. They have employed CES

functions for both production and demand sides of the economy.[21]They identify 14 domestically produced goods within each country. With regard to the consumer side of each country, they assume a representative consumer maximising utility. Their results reveal that welfare changes are dominated by international income effects as a result of tax exporting or importing activities. They also found that the domestic and international substitution effects are relatively small.

Haufler (1993) employs a small-dimensional static CGE model to study VAT harmonisation issues in the European Union. He uses CES functions for both the production and demand sides of the economy. He identifies three producer goods and one representative household for each country. He concludes that the restricted destination principle should be preferred over the restricted origin principle if compensating transfers to high-tax member states are to be avoided in the EU market and if the incentive for the national governments to engage in a process of competitive tax undercutting is to be reduced.

Wajsman (1992) uses a CGE model of Danish economy within a Shoven and Whalley framework to analyse the impacts of indirect tax harmonisation. The model has three producers and one household. He employs Cobb-Douglas production functions and the representative household maximises a Stone-Geary utility function, yielding a Linear Expenditure System (LES). The results indicate that the reduction in the value-added tax in the line of the Commission's proposals would lead to substantial reallocations in the economy. The results indicated that domestic absorption and real GDP would increase by 1.5%-2.5%, and he found out that the relation between private and public consumption would change in favour of private consumption.

Whalley (1976) uses a general equilibrium analysis to examine domestic welfare impacts of some alternative schemes of fiscal harmonisation in the Community. He uses a traditional Walrasian general equilibrium model as modified by Shoven and Whalley (1973) to construct a separate general equilibrium model for each member

[21] The model identifies two regions, the EU and ROW, with the EU being dissagregated into its member states. As each national economy shows the same dimensionality and the same structure of production and consumption decisions, the modellers restrict themselves to the behavioural assumptions and equilibrium conditions of only one typical country.

state. The considered member states were West Germany, France Holland, Belgium and Italy. He used CES functions both for production and demand functions. His results show us that gains and losses are within the bounds of a saving or extra requirement of $1^{2/3}$ % of national resources. If non-distortionary taxation becomes a harmonisation objective, then the domestic gains would appear to be much more substantial than those achievable under any harmonisation on a "national" system. His results also indicate that no country unambiguously prefers all other or no other "national" tax system.

In contrast to the above static models, Perraudin and Pujol (1990) and Frankel, Razin and Symansky (1991) use intertemporal CGE models dealing with VAT harmonisation issues in the EU. Perrraudin and Pujol (1991) have examined the implications of European fiscal harmonisation on the French economy within a general equilibrium framework. Their model is a extension of the overlapping generations simulation model developed by Auerbach and Kotlikoff (1987). They employed CES functions both for household behaviour and behaviour of firms in their model. The counterfactuals involve cuts in VAT and savings taxes as far as fiscal harmonisation is concerned. According to their calculations, cuts in VAT and savings taxes could entail significant long-run welfare losses for French households. They concluded that the harmonisation policy would give rise to welfare losses for both rich and poor equivalent to 1 % of GDP. Frankel, Razin, and Symansky (1991) have developed an intertemporal model to analyse the international and domestic effects of VAT harmonisation with regard to Europe 1992. Their dynamic simulation results reveal that the macroeconomics and welfare implications of VAT harmonisation depend critically on the tax system and the degree of substitution governing temporal and intertemporal allocations of savings, investments and labour. Also their simulations reveal that VAT harmonisation might give rise to internal conflicts of interest within each country and between the countries. In last two studies, the Commission's 1987 proposals have been taken into account by the authors.

4.4. Conclusion

As explained in this Chapter, CGE models have proved a useful tool for the analysis of tax policy issues in recent years. Therefore, a considerable number of studies have been carried out to address an important set of issues such as a value-added tax, corporate and personal income tax, housing subsidies since the early 1970s. In terms of VAT harmonisation, to our knowledge, there seems to be a relative lack of literature.

In this chapter, we have offered some fundamental remarks about CGE modelling, as this is the methodology employed in the study. We have argued that, in spite of its shortcomings, CGE modelling has proved useful in the area of public finance.

Also, we have surveyed several aspects of the CGE models and have found that although the models share some same characteristics, they differ in structure in several areas. Moreover, we have surveyed the CGE models available on VAT harmonisation issues in the EU. As mentioned in the chapter, despite the fact that the models have similar characteristics, they look at different aspects of VAT harmonisation as far as EU is concerned. Each of the models which we have surveyed in the chapter is vastly richer than the 2x2 Harberger model from which they were derived.

CHAPTER 5

THE STRUCTURE OF THE COMPUTABLE GENERAL EQUILIBRIUM TAX-MODEL FOR TURKEY

5.1 Introduction

In this chapter, a computable general equilibrium (CGE) model of the Turkish economy incorporating the major Turkish taxes is constructed to investigate the impacts on the Turkish economy of VAT rates approximation with the EU. The model follows the tradition of applied general equilibrium tax models pioneered by Shoven and Whalley (1972, 1973). The Shoven-Whalley framework has been the source of inspiration for many large-scale CGE models in the area of tax policy issues. The model we present in this study is a one-stage static multi-sector general equilibrium model and incorporates several industries, households, goods and factors. The specification of the Turkey model follows to some extent the standard CGE models currently in use, described in Dervis et al (1982). Although the model is closely related to conventional Shoven-Whalley type general equilibrium tax models, we develop a sophisticated foreign sector in this study.

We begin with a brief overview of previously constructed CGE models of Turkey to capture the basic features of these CGE applications and to explore basically how the specific model differs from them. This is followed by an overview of the model developed in this study. Next, we present a detailed description of our theoretical model. Within this description, we specify the functional forms of production and utility functions and develop in detail the complete set of equations characterising the Turkish CGE model together with the conditions for economic equilibrium in the model. The model implementation issues, such as the construction of a microconsistent data set for the model, which has to meet the consistency requirements of Walrasian equilibrium theory, and calibration are given in the following chapter.

5.2. A Brief Review of the CGE Models for the Turkish Economy

In the last few years a considerable number of CGE models have been used to address policy issues such as income distribution, trade policy, and growth and structural changes with regard to Turkey. Although the CGE applications for different policy analysis depend partly on the focus of the model, most models currently in use have a similar form. For example, most of the CGE applications have been formulated on the basis of the pioneering theoretical and empirical work of Adelman and Robinson (1978), and Dervis et al (1982). The CGE models for Turkey can be thought of as incorporating particular specifications of production and demand behaviour in the well-known Arrow-Debreu general equilibrium framework. Moreover, they incorporate macro variables and mechanisms for achieving balance in the economy. The main characteristics of selected CGE applications for the Turkish economy are presented in Table 5.1. The data used in these models, the policy simulations, and the most significant features of their results are given in Table 5.2.

Table 5.1 A Summary of Main Characteristics of CGE Models for Turkey

		PRODUCTION SIDE		DEMAND SIDE	
Model	*Base year for data*	*Production Functions*	*Disaggregation*	*Demand Functions*	*Disaggregation*
Dervis *et al.* (1982)	1973	Nested CES production functions	19 Sectors	LES demand function (Stone-Geary)	One aggregate household
Grais, Melo, and Urata (1986)	1978	Nested CES production functions	8 Sectors	LES demand function (Stone-Geary)	One aggregate household
Guven (1986)	1973	CES Production functions; fixed-coefficient use of intermediate inputs	11 Sectors	LES demand functions	Five types of households
Harrison, Rutherford, and Tarr (1993)	1985	CES production functions	40 Sectors	Nested CES demand function	One aggregate household
Karlitekin (1988)	1981	CES and Cobb-Douglas production functions	6 Sectors	LES demand functions (Stone-Geary)	3 types of households
Lewis, and Urata (1984)	1978	Nested CES production functions	13 Sectors	LES demand function (Stone-Geary)	One aggregate household
Togan (1983)	1973	Nested CES production functions	6 Sectors	LES demand functions (Stone-Geary)	Three types of households
Yeldan (1989)	1973	Nested Cobb-Douglas production functions;	7 sectors	Derived from Cobb-Douglas Utility Functions	Three types of households
Yeldan (1990)	1978	Nested CES and Cobb-Douglas production functions	7 Sectors	LES demand functions (Stone-Geary)	Three types of households
Yeldan (1992)	1987	Nested CES production functions	4 sectors	Derived from Cobb-Douglas utility functions	Three types of households

Table 5.2: Data Sources, Policy Simulations, and Results of the CGE Models

Model	*Base Year Data and Values of Key Parameters*	*Policy Simulations*	*Policy Conclusions*
Dervis, de Melo, Robinson (1982)	Input-output table for Turkey for production and demand data , elasticities of substitution in production and trade were assumed	Examining 1977 Turkish foreign exchange crisis by setting 50% tariff on imports and giving a 50% subsidy to exports	The impacts of 50% export subsidies are bigger than the impacts of 50% import tariffs. The results reveal that causes of foreign exchange crisis were principally lie in domestic inflation and oil price shock
Grais, Melo, and Urata (1986)	SAM for Turkey, elasticities of substitution in production and trade are taken from literature searches	Estimating the effects of removing quantitative restrictions and reducing tariff protection across the board by 50 % for Turkey in 1978	The results indicate that a removal of quotas on consumer and intermediate goods would have led to large gains in terms of GDP.
Guven (1986)	SAM for Turkey, substitution elasticities for production are taken from literature searches	To evaluate distributional as well as growth consequences of alternative policies, such as trade strategies, wage policies	The results show that although it is difficult to improve the relative overall distribution of income by means of various policy interventions considered, functional distribution of income is quite sensitive to policy changes
Harrison, Rutherford, and Tarr (1993)	Input-output table for Turkey for production and demand, all elasticity values are selected from literature searches	To investigate welfare effects of trade liberalisation options such as removal of trade barriers	Although a policy of harmonising tariffs to the common external tariff of the European Union has virtually has no effect on welfare, uniformity of tariffs and export subsidies would substantially improve Turkey's welfare
Lewis, and Urata (1984)	SAM for Turkey, all elasticities including income and price elasticities various studies. Guess estimates for premium	To explore the causes of the foreign exchange crisis in the late 1970s in Turkey	The results reveal that while the failure of the Turkish authorities to adjust the exchange rate in line with the inflation differential played the largest role in bringing on the foreign exchange crisis, the effect of the oil price increase was substantial as well
Karlitekin (1988)	SAM for Turkey, elasticities of substitution for production and trade from literature survey	To assess the impacts of Turkish entry into the EU on Turkish economy with regard to international trade	The results show that the Turkish industry will not fade away in the case of more liberal trade policies
Togan (1983)	Input-output tables, all elastisticities for production and trade from literature search	To estimate the welfare costs of Common Agricultural Policies (CAP) for developing countries by taking Turkey as the Case	The results reveal that EC agricultural protectionism leads to substantial welfare losses in Turkey and that the welfare costs of CAP significantly depend on the choice of domestic economic policies

Table 5.2: Continued

Model	*Base Year Data and Values of Key Parameters*	*Policy Simulations*	*Policy Conclusions*
Yeldan (1990)	SAM for Turkey and other sources used for elasticities in trade	The impacts of alternative development strategies, such as manufacturing export led industrialisation and agriculture-linked manufacturing industrialisation	The results show that development strategy of industrialisation based on domestic agriculture is the best amongst the alternatives
Yeldan (1990)	SAM for Turkey, elasticities of substitution for production and trade from literature survey	Assessing the optimality of structural adjustment programme in response to 1979/1980 external shocks	The results show that Turkey could well have achieved a better adjustment performance by following a dynamic adjustment policy that is first targeted to the stabilisation of the foreign trade and then switched around to the stabilisation of the growth related variables
Yeldan (1992)	Input-output tables and other government sources, such as the Central Bank; elasticities of substitution for production and trade from literature search	To estimate the effects of recent Turkish financial liberalisation reforms on the economy	The results indicate that there would be strong short run efficiency gains in the financial markets as a result of deregulation of the government's administrative bond financing of its budget deficit and reduction of the liquidity ratio for the commercial banks

Virtually, all CGE models for Turkey are basically numerical applications of the Walrasian type neo-classical general equilibrium approach. As can be seen from Table 5.1, the number of production sectors varies from 4 to 40 in different models. The functional forms employed to explain production technology belong to well known families of Cobb-Douglas or Constant Elasticity of Substitution (CES), and at least labour and capital are identified as factors of production in all the models.[1]

The household sector is disaggregated into types ranging from 1 to 5 based on income levels, skills or socio-economic factors with regard to the demand side of the models. The behaviour of consumers has also been specified using utility specifications which are well-known in applied economics, as in the case of the production side. In this context, Linear Expenditure System (LES) have been used as the functional forms for the household behaviour in most CGE applications in Table 1. In the other models, CES and Cobb-Douglas functional forms have been employed.

[1]In many models Nested CES functions are used as suggested by Table 6.1.

As can be seen from Table 5.2, the majority of these CGE applications are concerned with trade policies, and growth and structural changes. Most of the models utilise a SAM as the data framework, and substitution elasticities for production, demand, and trade are borrowed from literature sources in most cases. In all models, international trade is treated in the same way as in Dervis *et.al* (1982). This means that the so-called Armington (1969) assumption and the 'small country' assumption are used for the treatment of imports.[2] The 'small country' assumption is also used for the treatment of exports. A government sector is included in all models. However, the treatment of taxes are not detailed, as the models do not focus on tax policy issues. Although the government budget is balanced in the benchmark equilibrium, the models do not follow an equal yield tax policy as described by Shoven and Whalley (1977) because of not focusing on tax policy issues. Moreover, income distribution aspects are neglected or treated in a superficial way apart from Guven (1986).

To the best of our knowledge, this study presents the first attempt to construct a CGE tax model of the entire Turkish economy to analyse fiscal policy issues, i.e., the approximation of Turkish VAT rates with the EU. Therefore, we incorporate major Turkish taxes in the specific model used in our study. Also, we convert producer goods into consumer goods as explained later, since we focus on changes in VAT rates with regard to harmonisation in the EU. Moreover, the production and demand side of the model is reasonably dissaggregated to analyse the effects of the policy changes.[3]

5.3. Overview of Basic Structure of the Model

The model constructed in this study is a medium-scale, traditional Walrasian CGE tax model and incorporates the behaviour of four agents, namely, production, households, government, and the foreign sector. It contains a treatment of the entire Turkish tax

[2] These assumptions are explained in detail later in this chapter.

[3] For example, the household sector is disaggregated into six to investigate the possible effects of changes in VAT rates on income distribution and welfare changes with regard to demand side of the model.

system.[4] Table 5.3 shows the classification of production sectors, consumer goods and households in the model.

Table 5.3: Classification of Industries, Consumer Goods, and Households

Producer Goods	Consumer Goods
Agriculture	Food
Mining	Tobacco and Alcohol
Food Processing	Clothing
Textiles	Housing
Light Intermediates	House Furnishing and Appliances
Petroleum	Transportation and Communication
Basic Intermediates	Health and Personal Care
Machinery	Culture, Education, and Entertainment
Electricity, Gas, Water	Other
Construction	
Services	
Household Groups	
Urban-Poor	Rural-Poor
Urban-Middle	Rural-Middle
Urban-Rich	Rural-Rich

As can be seen from Table 5.3, the model includes 11 producer goods, 9 consumer goods, and 6 household types which are classified according to their income size and to their geographical regions.[5] The primary factors of production namely, capital and labour, are used as inputs by industries and owned by households in different proportions. In the model labour is fully mobile, whilst capital is immobile across the sectors. The labour market is assumed to be neo-classical, with full employment and wage rate equalisation across the sectors in the model.

[4] The treatment of existing major Turkish taxes is given in detail in Chapter 3 and also is explained to the some extent later in this chapter.

[5] Apart from construction sector, the goods produced by the other sectors are internationally traded.

Table 5.4: The Main Characteristics of the Turkish CGE Tax Model

Production	Cost-minimising producers using Cobb-Douglas functions for Value-added using the primary factors as inputs and intermediate requirements involve fixed coefficients across intermediates in different sectors
Final Demand	Cobb-Douglas utility function for households, fixed coefficient investment demand by origin, fixed coefficient demand by the government, fixed real government consumption.
Foreign Trade	Imports and domestically produced goods are imperfect substitutes (Armington Assumption), foreign capital is fixed in terms of foreign currency, domestic production is supplied for domestic markets and for export sales according to CET(constant elasticity of transformation) function.[6] Small country assumption for import supplies and foreign export demand
Taxes	All major existing Turkish taxes, such as income tax, VAT, import duties.

The main characteristics of the Turkish CGE tax model are outlined in Table 5.4. As the Table illustrates, each of the 11 cost minimising production sectors produces a single output using inputs of labour, capital, and intermediate goods as far as production side is concerned. In each sector, value added is produced from the primary factors, labour and capital using a Cobb-Douglas production function. Value added, in turn, combines with intermediate inputs from the other production sectors in fixed proportions to produce domestic output. However, the goods that households consume have a different aggregation from those which are produced by the production sectors. Therefore, we convert 11 producer goods into 9 consumer goods using a transition matrix.[7]

On the demand side of the model, the analysis is conducted for 6 types of households with regard to final consumption. Households derive their income from selling their endowments of labour and capital. The households also receive a fixed proportion of

[6] CET is a specification of a production possibility curve (PPC). If a PPC has this property, then a given proportionate change in the relative prices of two commodities leads to a constant proportionate change in the product mix. This is not as commonly used as CES..

[7] The distinction that is made between producer goods and consumer goods is necessary, as it enables us to use national account data on a producer good classification and the 1987 Consumer Expenditure

lump-sum transfer payments from the government. Moreover, they receive transfers from abroad. Each household's demand is derived from a Cobb-Douglas utility function defined over the consumer goods. In the model the level of gross investment is determined by the savings in the economy the latter being the sum of private, public and foreign capital flows, and investment demand by origin[8] is determined according to fixed coefficients.

In the model, the government has several functions. Firstly, it receives revenue from imposing taxes. Secondly, it transfers some of the revenues to the households. Also, it consumes exogenously given amounts of producer goods in fixed proportions and saves the rest of its revenue for investment. As in the most CGE tax models, we assume that the government budget is balanced. This means the government must equate tax revenue minus tranfers to the households, consumption, and savings. In the study we apply equal yield tax analysis following Shoven and Whalley (1977).[9]

With regard to foreign trade, Turkey is modelled as a small country as far as import transactions are concerned.[10] This implies that the country is a price taker and cannot influence the world prices of imports by her transactions. Foreign economic activities includes not only trade flows but also capital inflows[11] such as net remittance inflows, net factor income, and foreign borrowing[12] in order to balance the external sector in the economy. However, both labour and capital are immobile internationally. On the import side, foreign and domestic commodities are assumed to be imperfect substitutes following the Armington assumption (Armington, 1969). In this context, domestically produced and imported goods are combined in a CES function to produce a composite commodity. This implies that domestic consumers will decide

Survey defined for consumer goods. We give detailed information about transformation matrix or sometimes referred as conversion matrix in chapter 6.

[8]This refers to the demand for the output of a particular sector that results from the investment activity or additions to capacity occurring in sector of destination, and is obtained by using a capital coefficient matrix.

[9] This analysis allows an existing tax to be replaced by an alternative tax system that yields equivalent amount of revenue. In this study, we change the income tax rates accordingly in order to follow "equal yield" tax policy as explained later in this chapter..

[10] The small country assumption means that the country cannot affect world prices of the commodities that it imports or exports. See Dervis *et al* (1982, chapter 7) and Dervis and Robinson (1989) for further detailed of the treatment of foreign sector in CGE models

[11] Capital inflows are fixed in terms of foreign currency in the model

between domestically produced goods and imported goods depending on their relative prices. These composite commodities are then demanded in various ways. Firstly, they serve as intermediate inputs for producers. Also, they meet the final government demand for the producer goods. Furthermore, they combine to create the 9 consumer goods demanded by households according to fixed coefficients. They then combine to produce representative capital good, and thus satisfy the total demand for new capital goods given by the aggregate level of investment according to fixed coefficients. On the export side, we assume that exported commodities face a downward sloping demand curve that depends, among other things, on a price elasticity of demand. Also, domestic production is split between exports and domestic market sales according to a constant elasticity of transformation (CET) function.

As far as taxes are concerned, the model includes all major components of the Turkish tax system. Table 5.5 gives a brief summary of the treatment of the major Turkish taxes in the model.[13]

Table 5.5: A Brief Summary of the Model Treatment of Major Turkish Taxes

Tax	Model Treatment
1. VAT	As ad valorem tax on purchases of consumer goods
2. Income tax	As ad valorem tax on households' income
3. Tariffs	As ad valorem tax on imports
4. Excise Duties	As ad valorem tax on output of producer goods
5. Other indirect taxes, such as excise duties, banking and insurance transaction tax, and motor vehicles tax	As ad valorem tax on output of producer goods

As shown in Table 5.5, the tax system of the economy includes VAT, income tax, tariffs, excise duties and other indirects taxes.[14]

[12] Foreign borrowing is net of amortisation and interest payments.

[13] The rates and structures of taxes and further detail of their treatment in the model is given in Chapter 3.

[14] We should emphasise that value-added tax plays a very crucial role in the model, since all of our simulations depend on changes in Turkish VAT rates with regard to the Commission's proposals as mentioned earlier.

All taxes are modelled in an ad valorem context in our model. The consumption tax, VAT, is of the European type.[15] Thus we model VAT as a destination-based tax as final consumption tax on expenditures of consumer goods in Turkey. We impose equal yield tax analysis through an additive adjustment in the income tax rates.[16]

The analysis is carried out for 11 different industries, 6 households, and 9 consumer goods (see Table 5.3). Firms produce goods using the primary factors and intermediate goods as inputs. Intermediate goods demand is represented by an input-output matrix in fixed coefficients. Produced goods are demanded in various ways. First, they meet the intermediate goods demand by firms. Also, they meet the demands for final goods by the households and government, and the exports demands for the external sector. Moreover, they meet the demand for the investment good which is determined by the savings in the economy.

As in most CGE models, the concept of equilibrium in our model is the standard Walrasian form. It is assumed that, in equilibrium, producers maximise profits, consumers maximise utility, government tax revenues equal its expenditures, demand equals supply, the external sector is in balance, and the labour market is cleared. The model was programmed and solved using the GAMS (General Algebraic Modelling System) software developed by Brooke, Kendrick and Meeraus (1988).

5.4. Production Sector and Labour Market

It is assumed that each of the 11 production sectors produces a single output using constant returns to scale technology. In each sector, intermediate inputs and value added are combined by a fixed coefficient technology to generate the output. Thus, the domestic output is described by a two-level nested production structure. At the top level, a Leontief nest contains intermediate inputs and value added. At the bottom level, the value added is produced by a Cobb-Douglas nest using labour and capital

[15] The underlying characteristics of European VATs are the destination basis, different rates structure, and also the so-called credit (invoice) method is applied to calculate the tax liability. The further detail of European type VAT is given in Chapter 2, and also the main characteristics of Turkish VAT is given in Chapter 3.

stock.[17] Capital stock is sector specific and is fixed in the short run, whereas labour is fully mobile between the sectors. The labour market is neo-classical with full employment and wage rate equalisation among the sectors. To be more precise, the production function on the first level of the industry can be written as the following type:

$$X_i(L_i, K_i, V_{ji}) = \min\left\{ \frac{1}{a_{oi}} VA_i(K_i, L_i), \frac{V_{1i}}{a_{1i}}, \ldots, \frac{V_{ji}}{a_{ji}}, \right\} \tag{5.1}$$

where X_i is output of Sector i (i=1, 2, 3, ...11 sectors), a_{oi} is the value-added requirement per unit of sectoral output, $VA_i(.,.)$ is value added, K_i is fixed-sectoral capital stock, L_i is labour, V_{ji} is the physical quantity of intermediate input from sector j to sector i (j=1,2,3, ...11 sectors), and a_{ji} is the fixed input-output coefficients.

Value added in each sector is produced according to a Cobb-Douglas production function using the two primary factors:[18]

$$VA_i = \overline{A}_i L_i^{\alpha_i} K_i^{1-\alpha_i} \qquad i=1,2,3, \ldots. 11. \tag{5.2}$$

where $\overline{A}_i$ is the productivity parameter in production of sector i , α_i is the share parameter of labour.

It is assumed that intermediate demand V_i for each sector follows a Leontief fixed coefficient technology of the following form:

$$V_i = \sum_j a_{ij} X_j \quad i=1,2,3, ..11. \text{ and } j=1,2,3, \ldots,11. \tag{5.3}$$

[16] In this case we reduce income tax rates applied to all households' income. Thus these tax changes are regressive. Equal yield tax analysis is explained in the following chapter in more detail.

[17] It is also possible to employ CES production functions with the elasticity of substitution between the primary factors of production estimated separately. However, for the sake of simplicity Cobb-Douglas production functions are used in this study.

[18] As the top level production function is Leontief, equation (5.2) yields the demands for value added aggregate and for the aggregate producer goods in each sector. Therefore, the equation basically refers to the cost of the value added aggregate and intermediate inputs. However, we derive the value added

As value added is combined in fixed proportions with intermediate input to produce domestic output, the price of value added can be determined from the price of final output in each sector. Thus the price of value added (PN_i) can be written as:

$$PNi = PD_i(1 - td_i) - \sum P_j a_{ji} \quad i=1,2,3, ...11., \text{ and } j=1,2,3, ..., 11. \tag{5.4}$$

where PD_i is domestic price of domestic sale of output in sector i, td_i is production tax rates,[19] and P_j is the composite price of the j'th good.[20]

After defining the price of value added, the demand for labour can be determined. A profit maximising firm under perfect competition employs labour until the marginal product of labour is equal to the wage:

$$L_i = X_i \frac{PN_i}{w_i} \alpha_i \qquad i=1, 2, 3, ..., 11. \tag{5.5}$$

where w is the average wage rate, and α_i is that proportion of that average wage earned by workers in sector i. The equation (5.5) defines the labour demand. Thus, the dependence of domestic supply on prices and wages is established using the equation (5.2), (5.4), and (5.5).

The labour market clears when total labour demand LD, equals to the labour supply, LS:

$$LD = LS \tag{5.6}$$

where

$$LD = \sum L_i \qquad i=1,2,3, ...,11. \tag{5.6.1}$$

through describing the value added prices as in equation (5.4), and intermediate demand through equation 5.3.

[19] Production taxes are net of subsidies.

As mentioned earlier, because the "labelling" of households demand for goods is different from the "labelling" of the goods supplied by the production sectors, it is necessary to convert households" demand for producer goods into demand for consumer goods. Thus, consumer goods, C_k (k=1,2,3, ..9) are produced from producer goods, Q_i (i=1,2,3, ..., 11) through the use of a fixed-coefficients *transformation matrix*[21]. Each coefficient of the transformation matrix, c_{ik}, gives the amount of producer goods i required to obtain one unit of consumer good k. For instance, a unit of the consumer good 'food-stuff' includes parts of the outputs of three industries, namely, agriculture, food-production, and services.

As a result of perfect competition, and particular freedom of entry and exit industries make zero profits after making payment for the primary factors of production, intermediate inputs, and taxes. Also, we apply zero-profit conditions to production of consumer goods. Hence, the cost covering consumer good price PC_k is defined as:

$$PC_k = \sum_i c_{ik} P_i \qquad k=1,2,3, .., 9. \text{ and } i=1,2,3,....,11. \qquad (5.7)$$

However, when households buy the consumer goods, they have to pay additional ad valorem tax as consumption tax (VAT). The consumption tax is modelled on the purchase of each good at rates τ_v. Thus, the price paid by the consumers for good k (including VAT) is given by:

$$PT_k = PC_k(1+\tau_{vk}) \qquad k=1,2,3, .., 9. \qquad (5.8)$$

where PT_k is the price of consumer good k (inclusive VAT) and τ_{vk} is the VAT rate on good k.

[20] The information about how we obtain P_j is given later in the chapter

[21] Also, sometimes referred as the conversion matrix.

5.5. Household Sector

The model contains six representative households which are classified according to their geographical regions and to their income size.[22] The six household groups are divided into 3 income groups, namely, poor, middle, and rich, within both the urban and the rural sectors. Each household receives income from selling its endowments of labour and capital in factor markets. Also the households receive exogenous transfer payments from government in addition to exogenous factor income remittances from abroad. Thus, the income Y_h for household group h can be written as:

$$Y_h = \mu_{1h}LAB + \mu_{2h}CAP + \mu_{3h}REMIT + \mu_{4h}TRAN \qquad h=1,2,3,..,6. \qquad (5.9)$$

where *LAB*, *CAP*, *REMIT*, *TRAN* are labour income, capital income, transfers from abroad and government transfers, and $\mu_{1h}, \mu_{2h}, \mu_{3h}, \mu_{4h}$ are the shares of labour income, capital income, transfers from abroad, and transfers from the government sector accruing to household group h respectively. The household groups in the economy pay income tax imposed on gross income at source. Also, they save a fixed proportion of their income after paying income tax. The rest of their income is used to purchase the composite commodity goods. Note that the total capital income is net of total depreciation and is given by:.

$$DEPR = \sum_j \varphi_j PK_j K_j \qquad i=1,2,3,....,11. \text{ and } j=1,2,3,....,11. \qquad (5.9.1)$$

and

$$PK_j = \sum_i P_i h_{ij} \qquad i=1,2,3,....,11. \text{ and } j=1,2,3,....,11. \qquad (5.9.1.1)$$

where *DEPR* is the depreciation of fixed capital as a fixed proportion of the capital stock in each sector, φ_i is the depreciation rate, PK_j is the rate of capital rent by

[22] We basically follow the classification reported in Household Income and Consumption Expenditure Survey Results (see SIS 1990).

sector i, and h_{ij} is the fraction of capital good i in sector j's capital stock (as explained in section 5.8).

We assume that the households maximise a Cobb-Douglas utility function giving rise to demand for composite goods[23]. Thus the utility function of the household group h has the form:

$$U_h = \prod_{k=1}^{9} (C_k^h)^{\mu_k^h} \qquad k= 1,2, .., 9. \text{ and } h=1,2,..,.6. \tag{5.10}$$

The parameters μ_k^h satisfy the properties that $\mu_k^h \geq 0$, and $\sum_{i=1}^{9} \mu_k^h = 1$. The households' demand over consumer goods can be derived by maximising equation (5.10) subject to the budget constraint:

$$\sum_k PC_k(1+\tau_{vk})C_k^h = YD_h \qquad k= 1,2, .., 9.\text{and } h=1,2,.., 6. \tag{5.11}$$

Hence, demand for individual consumer goods is obtained from equation (5.10), which is subject to equation (11) as:

$$C_k^h = \mu_k^h \frac{YD_h}{PT_k} \qquad k=1,2,3...,9. \text{ and } h=1,2,3,...,6. \tag{5.12}$$

where C_k^h is consumption of good k by household h. The μ_k^h weighting parameters are the Cobb-Douglas expenditure shares and YD_h is the income available for allocation among the 9 consumer goods. The income available for consumption, YD_h, can be written as:

$$YD_h = \left[Y_h(1-\sigma_h)(1-t_{ih})\right] \qquad h=1,2, .., 6. \tag{5.12.1}$$

[23] The CGE model does not model the trade-off between leisure and labour because of lack of data on this trade-off for different household groups. Therefore, there is no substitution between consumption and labour in the household's utility function.

where σ_h is the fixed proportion saving rate of household group h, and t_{ih} is income tax paid by household h. Hence the household savings $HSAV$, which is translated directly into demand for investment goods takes the form:

$$HSAV_h = \left[\sigma_h Y_h (1 - t_{ih})\right] \qquad h=1,2,..,6. \qquad (5.12.2)$$

5.6. Foreign Sector

In applied general equilibrium models, the foreign sector is treated in a variety of ways with regard to the different assumptions made about export demand and import supply behaviour.[24] The specification of the foreign sector in this model is similar to that used in many other CGE models of developing countries. We model Turkey as a small country as far as trade is concerned. In its treatment of foreign trade, the model adopts the commonly used Armington assumption with regard to imports and a downward-sloping export demand curve with constant elasticity with regard to exports. Also, on the export side, we employ a Constant Elasticity of Transformation (CET) function to distinguish between export sales and domestic sales from domestic output. The foreign sector must be balanced as a part of the characterisation of equilibrium. This means that the value of imports plus the net imbalance on the capital account equals the value of exports and factor incomes from abroad, and implies that Turkey is always on the budget constraint as far as her international transactions are concerned.

5.6.1. Import Demand

In the model, we depart from the neo-classical hypothesis of perfect substitutability of tradables and the law of one price as far as imports are concerned. Instead, as mentioned earlier, we adopt the Armington assumption which states that imported and domestic goods are imperfect substitutes for any traded good. Therefore, we assume that, in each sector, foreign and domestic goods are combined to form a composite commodity using a CES aggregation function with a given elasticity of substitution .

[24] See, for example, Whalley and Yeung (1984) and de Melo and Robinson (1989) for more details.

Thus the aggregation is given as:

$$Q_i = \beta_i \left[\delta M_i^{-\rho_i} + (1-\delta) D^{-\rho_i}\right]^{-1/\rho_i} \qquad i=1,2,3,.....11. \qquad (5.13)$$

where Q_i, M_i, and D_i are composite, imported, and domestically produced commodities respectively, while β_i, δ_i, and ρ_i are parameters. It can be said that M_i and D_i are like inputs "producing" the aggregate output. Equation (5.13) implies that the demands for imports and domestically produced commodities become derived demands, in just the same way as the demand for factor inputs is a derived demand in a conventional production model. Thus, the consumers choose a mix of M_i and D_i according to their relative prices.

Given the specified prices for the domestic and imported goods, the problem facing the user or buyer is mathematically equivalent to that facing a firm seeking to produce a specified amount of output at minimum cost.

Thus minimising the cost of obtaining a "unit of utility",

$$P_i \cdot Qi = PD_i \cdot D_i + PM_i \cdot M_i \qquad i=1,2,3,.....,11. \qquad (5.14)$$

where PD_i and PM_i are the domestic and imported goods prices respectively, while P_i is the "composite commodity" price.

subject to equation (13) yields the demand for imports of good i as:

$$M_i = \left(\frac{\delta_i}{1-\delta_i}\right)^{\sigma_i} \cdot \left(\frac{PD_i}{PM_i}\right) \cdot Q_i \qquad i=1,2,3,....,11. \qquad (5.15)$$

where σ_i, the elasticity of substitution between imported and domestic goods, is given by $\sigma_i = \frac{1}{1+\rho_i}$, while δ_i is the share parameter in the CES trade aggregation function. The specification of equation (5.15) has three specific cases; first, if the substitution

elasticities $\sigma_i = 1$, the equation reduces to a Cobb-Douglas specification , and the value shares of imports remain constant; second if $\sigma_i = \infty$, the responsiveness of $\frac{M_i}{D_i}$ to small changes in $\frac{PD_i}{PM_i}$ will become so great that $\frac{PD_i}{PM_i}$ will never change much from its base value and thus we approximate the case where $PD_i = PM_i$; third, if $\sigma_i = 0$ there will be no substitution between imported and domestically produced goods. One should note that equation (5.15) allows for a richer set of responses, and as σ gets larger, the sensitivity of $\frac{M_i}{D_i}$ to changes in $\frac{PD_i}{PM_i}$ increases. PD_i is no longer equal to PM_i as a result of this specification; rather it is determined endogenously in the model. On the other hand, the variable PM_i is fixed exogenously as the price-taker assumption of classical trade theory is retained, and is related to the world price in dollars.

Thus the price of imports measured in Turkish Lira (TL) is given by:

$$PM_i = PW_i(1+\tau m_i)ER \qquad i=1,2,3,....,11. \qquad (5.16)$$

where τm_i is the tariff rate on imports, PW_i is the world price in dollars ER is the exchange rate between American dollar ($) and Turkish Lira, and is a fixed parameter in the model.[25]

Finally, given the import demand function, the price of composite good P_i then can be written as:

$$P_i = \left[\delta_i^{\sigma_i} PM_i^{1-\sigma_i} + (1-\delta i)^{\sigma_i} PD_i^{1-\sigma_i}\right]^{1/1-\sigma_i} \qquad i=1,2,3,....,11. \qquad (5.17)$$

5.6.2. Export Demand

It is assumed in classical theory that a small country faces a perfectly elastic demand for its exports. However, this assumption may no longer be appropriate on the export side, once product differentiation is introduced. The assumption of product differentiation naturally gives rise to less than infinitely elastic demand functions for a country's exports. With differentiated products, while a small country may not be able to influence the world market prices with its exports, such a country may face a decreasing market share as its domestic prices rise. Accordingly, we assume a downward-sloping demand curves with constant elasticity for exports.

Thus, the export demand functions have the following form:

$$E_i = E_0\left(\frac{\pi_i}{PE_i}\right)^{\varepsilon_i} \qquad i=1,2,3,...,11. \qquad (5.18)$$

where E_i is the export demand for sector i's output, π_i is a weighted average of world prices for good i, E_0 is a constant , ε_i is the elasticity of export demand, and PE_i is the price of exports and is defined as:

$$PE_i = \frac{PWE_i * ER}{1+\tau e_i} \qquad i=1,2,3,...11. \qquad (5.19)$$

where PWE_i is the dollar price of exports and τe_i is the export tax.

Also, export supply may show a strong response to changes in domestic prices. When there is an increase in domestic prices, producers are induced to increase supply and domestic consumers to reduce their demand. Thus, there will be an increase in exports as a result of the difference between supply and domestic demand. In reality, however, exports might not increase that fast, as the domestically consumed and exported goods in the same sector may be quite different. For instance, "intermediate goods" contains both traded and non-traded goods. Moreover, there might be a difference in the quality

[25] ER is American Dollar per TL.

of exported goods vis-à-vis goods for domestic consumption in the same sector. Therefore, we employ a CET function between domestically consumed XS_i and exported (E_i) goods of the following form:

$$X_i = \lambda_i\left[\gamma_i E i_i^{\theta_i} + (1-\gamma_i) XSi\right]^{1/\theta_i} \qquad i=1,2,3,....,11. \tag{5.20}$$

where λ_i and γ_i are constants, and the elasticity of transformation ϕ_i is given by $\frac{1}{1-\theta_i}$. Maximising the revenue from a given output we obtain:

$$PX_i \cdot X_i = PD_i \cdot XS_i + PE_i \cdot E_i \qquad i=1,2,3,.....11. \tag{5.21}$$

where PX_i is the average output price. Subject to equation (5.20) yields the following allocation of domestic supply between sales and exports:

$$\frac{E_i}{XSi} = \left(\frac{PE_i}{PD_i}\right)^{\phi}\left(\frac{1-\gamma_i}{\gamma_i}\right)^{\phi} \qquad i=1,2,3,.....11. \tag{5.22}$$

where $XS_i = X_i - E_i$ and ϕ_i is the elasticity of transformation. One should note that this gives rise to the export price PE_i diverging from the domestic price PD_i as in equation (5.19).

5.7. Government Sector

The government enters the model through its revenue, expenditure and savings. It gathers revenue from various taxes and tariffs so as to finance its expenditures. The expenditure activity of the government is split into two components. Real government expenditure on producer goods follows fixed sectoral shares on each commodity. We model the government as if it were a single consumer. Also, the government transfers exogenously given lump-sum amounts to the household sector. The difference between government revenue and government expenditure is considered as government savings and these savings are transformed to finance a part of the total

investment in the economy. We impose a balanced budget constraint for the government sector, as is common in most CGE models. Thus, when performing the simulations, we ensure equal yield tax analysis by reducing income tax rates accordingly in order to avoid budgetary imbalances consequent on changes in VAT rates.

5.7.1. The Government Sector Revenues

The government obtains its revenue from income tax, value-added tax, output taxes such as the petroleum consumption tax, banking and insurance transaction taxes, and tariffs. The tax rates used in the model are the effective average tax rates computed from the information supplied by the underlying Social Accounting Matrix and any other government sources. We assume, given lack of information, that any tax evasion is neutral across economic agents and sectors.

Each household group h with an income Y_h faces an income tax rate τ_h. Hence, the income tax revenue R_i is:

$$R_i = \sum_{h=1}^{6} \tau p_h Y_h \qquad h=1,2,3...,6. \qquad (5.23)$$

The total tax revenue collected from ad valorem value-added tax on consumer goods R_V is given by:

$$R_V = \sum_{k=1}^{9} \tau v_k PC_k C_k \qquad k=1,2,3,..,9. \qquad (5.24)$$

and the government revenue from ad valorem output taxes can be written as:

$$R_O = \sum_{i=1}^{11} \tau o_i PX_i \cdot X_i \qquad i=1,2,3,....,11. \qquad (5.25)$$

Also, the government receives revenue from ad valorem taxes on imports.[26] If we denote tariff rates levied on imported goods by τ_{Mi} then the revenue from taxing imports is:[27]

$$R_M = \sum_{i=1}^{11} \tau_{Mi} PWM_i M_i \qquad i=1,2,3,....,11. \qquad (5.26)$$

Accordingly, the government's total revenue R from all types of taxes is:

$$R = R_I + R_V + R_O + R_M \qquad (5.29)$$

5.7.2. The Government Sector Expenditures

The expenditure side of the government sector covers both transfers and real expenditures. The lump-sum transfer payments are made to the representative households. The level of government expenditures to the households is exogenously determined in the model. However, the households receive different types of income transfer from the government, as mentioned earlier. Thus, the total transfer payments Tr to the households from the government are:

$$Tr = \sum_{h=1}^{6} \mu_{4h} \overline{TRAN} \qquad h=1,2,3,..,6. \qquad (5.30)$$

where $\overline{TRAN}$ is the exogenously given amount of transfer payments .

It is assumed that the government keeps its real level of expenditure on each producer good fixed. Thus, government demand for producer good i is:

$$G = \omega_i \overline{G} \qquad i=1,2,3,...,11. \qquad (5.31)$$

[26] It is assumed that no taxes are imposed on exports.

[27] The final demand for imported goods is implicitly reflected in the conversion matrix.

where ω is the sectoral share parameters of the government consumption demand for producer goods, and $\overline{G}$ is the total government spending on producer goods and is fixed.

Thus, the government savings, $GOVSAV$, as a part of total investment in the economy are:

$$GOVSAV = R - Tr - \sum_{i=1}^{11} G_i P_i \qquad i=1,2,3,...11. \qquad (5.32)$$

5.7.3. The Government Budget Constraint

The model requires that the government budget always be in balance. This can be expressed as:

$$R = Tr + GOVSAV + \sum_{i=1}^{11} P_i G_i \qquad i=1,2,3,....11. \qquad (5.33)$$

As can be seen from equation (5.33), the right-hand side of the government budget summarises total government outlays. It includes, in addition to total transfers, expenditures on producer goods. The difference between government revenue and expenditures is government savings, as given in equation (5.32). The government uses savings to balance its budget. The government savings are used to finance a part of the total investment in the economy as mentioned before. On the left-hand side of the budget constraint we have government revenue generated by taxes, as explained.

5.8. Investment and Savings

In spite of the fact that our model is static, we must account for the investment and savings that take place during the period for the analysis of the study. In the model, we assume that capital stocks are fixed when we do our comparative static experiments. Hence, investment does not add to the current capital stock, but for the accounting

purposes we need to specify the size and composition of investment demand.[28] The level of investment is determined by the available supply of savings in the economy. The latter is the sum of private, public, and foreign savings plus depreciation.

Thus, the total level of savings can be written as:

$$SAVINGS = \sum HSAV + GOVSAV + DEPR + \overline{FSAV} * ER \qquad (5.34)$$

where $\overline{FSAV}$ is the exogenously given level of foreign savings that is interpreted as the trade deficit. The level of foreign savings is given by:

$$\overline{FSAV} = \sum_i PW_i M_i - \frac{PDiEi}{ER(1+\tau e_i)} - REMIT \qquad i=1,2,3...,9. \qquad (5.35)$$

This can be seen as an additional equation that specifies the trade deficit that is equal to the level of foreign savings.[29]

After determining the level of savings and thus the level of investment from equation (5.12), we must specify how the composition of investment is determined. Firstly, it is assumed that the total of investment funds is distributed among different sectors by exogenously specified shares. The sectoral investment function is Cobb-Douglas, without any nesting, so that investment demand by sector of destination, in which additions to the capital stock actually occur, will be a fixed proportion of total savings in the economy.

Hence the investment demand by sector of destination DKi can be written as:

[28] We do not distinguish between allocation of public and private investment in the model. Rather we allocate the pool of total investment (fixed and inventory) according to a single set of sectoral investment.

[29] In some Dervis, de Melo and Robinson type of the models, either the level of foreign savings (F) or the exchange rate (ER) is endogenously given variable. Also these type models contain an equation which fixes both the aggregate price level. In our model, both F and ER are fixed, but we allow the price level to adjust endogenously.

$$DK_i = \frac{\beta_i * (SAVINGS - \sum_i DST_i * P_i)}{PK_i} \qquad i=1,2,3,...,11 \qquad (5.36)$$

where βi is shares of investment by sector of destination, PK_i is the rate of capital rent, and DST_i is the changes in stocks (inventory investment) and given by the following equation:

$$DST_i = \theta_i * X_i \qquad i=1,2,3,....11. \qquad (5.37)$$

where θ_i is the fixed share of inventory investment by sectors in gross sectoral output.

Investment by sector of destination is then transformed into investment by source of sector through the capital composition matrix.[30]

Hence the demand for investment by the sector of origin Z_i can be obtained as:

$$Z_i = \sum_j h_{ij} DK_j \qquad i=1,2,3,....,11. \text{ , and } j=1,2,3,.....11. \qquad (5.38)$$

where h_{ij} is capital composition coefficients.

5.9. Equilibrium Solutions for the Model

The concept of the model outlined so far conforms closely to a standard Walrasian model, with the exception of sector-specific capital stocks. In the model, it is required that the following six conditions are satisfied, given a set of tax rates.

1. The demand for the output of each sector equals its supply;
2. Producers maximise profits given the production technology;
3. Households maximise utility subject to their budget constraints;

[30] Investment by source of sector is also referred as investment by sector of origin. Investment by sector of origin refers to the demand for the output of a particular sector that results from the investment activity or additions to the capacity accruing in a sector of destination, and is obtained by using a capital coefficient matrix.

4. Total government revenues are equal to total government spending;
5. Labour market clears, i.e., the demand for labour is equal to its supply;
6. The external sector is in balance, i.e., foreign exchange receipts are equal to foreign exchange payments.

In the model, product market equilibrium requires that sectoral supply is equal to sectoral domestic demand, or that excess demand for domestic goods is zero. Hence, the product market equilibrium for each sector is defined by:

$$Qi-(V_i+C_i+G_i+DST_i+Z_i)=0 \qquad i=1,2,3,...,11. \tag{5.39}$$

where Ci is the private demand for producer good i. However, as explained earlier, we convert household demand for consumer goods into demand for production goods by using a fixed-coefficients "conversion matrix". Hence, the private demand for production goods is given:

$$C_i=\sum_k c_{ik}C_k \qquad i=1,2,3,....,11. \text{ and } k=1,2,3,....,9. \tag{5.39.1}$$

We should note that we assume all export demand is for the domestically produced good rather than for the composite commodity with regard to equation (39).

The labour market clears when there is no excess demand for labour.
Hence,

$$\sum_i LD_i-LS=0 \qquad i=1,2,3,....,11. \tag{5.40}$$

and the government budget constraint condition is :

$$R-G-Tr-GOVSAV=0 \tag{5.41}$$

finally, the balance of payments condition is:

$$\sum_{i=1}^{11} PMi \cdot Mi - \sum_{i=1}^{11} PWEi \cdot Ei - \overline{F} - \overline{REMIT} = 0 \qquad \text{i=1,2,3,...,11.} \qquad (5.42)$$

The closure rule is one where households' marginal propensities to save are fixed. This rule is the savings-driven closure described by Dervis *et.al* (1982).[31]

5.10. Conclusion

This chapter has examined the specification of the model that we have developed for the Turkish economy for the purpose of the study. The model will be used to evaluate the alterations in Turkish VAT rates with regard to Commission's original fiscal harmonisation proposals. The implementation issues and the results are described in the following chapters. As this chapter explains, the model used in this study is disaggregated by identifying 11 production sectors, 6 types of households, 9 consumer goods and two primary factors of production. The major Turkish taxes are also included. Cobb-Douglas production functions have been employed with regard to the production side of the economy, and Cobb-Douglas utility functions have been utilised for the household sectors. After describing the main features of the model in this chapter, we are able to carry out the simulations which are for the purpose of the study which are described later.

[31] There are other closure rules such as "Keynesian" closure where the full employment condition is dropped, "Johansen" Closure where the consumption function is dropped, and "Kaldorian" closure where the marginal productivity condition is dropped. For further details see Lewis (1992).

CHAPTER 6

MODEL IMPLEMENTATION ISSUES

6.1. Introduction

The CGE model described in chapter 5 forms the basis for all the simulation results presented in this study. Implementing the model described in chapter 5 involves the same approach as used in all CGE models, i.e., calibration to a benchmark data set, followed by counterfactual equilibrium analysis. In order to construct a benchmark data set for the Turkish economy, we need data on inter industry transactions, value added, final demand, capital income flows, government revenue and expenditures. The benchmark data set is constructed from several sources, such as input-output transactions tables, national income accounts, household income and consumption expenditure surveys, and taxation statistics. However, these data collected from different official sources are not often mutually consistent - for instance household income from employment is not the same as the payments to labour by the sectors. Therefore, a number of adjustments are required to produce consistency based on the procedure described in St-Hilaire and Whalley (1983 and 1987). Further difficulties arise in constructing a consistent data set besides the adjustments to the blocks of data. For example data do not exist in a convenient form of payments of taxes on use of factor by industry which enables us to calculate the effective factor tax rates.

With respect to taxes, we use some data directly available from the published sources, such as the Turkish Ministry of Finance and Customs (TMOFC) (1991) and OECD (1995), while some have to be constructed using the best information we are able to obtain - for example we use an unpublished document of the TMOFC which shows dissaggregation of VAT by type of commodities to calculate the VAT rates. Hence, the final result is a benchmark equilibrium data set which assumes that the economy is characterised by a situation of Walrasian equilibrium. In this context, the base year's data has to satisfy the equilibrium conditions of the model, namely, demands equal

supplies for all products, all industries make zero profits, all agents' demands satisfy their budget constraints, and external sector transactions are in balance. The implementation of the model is based upon a Social Accounting Matrix (SAM) for Turkey for the year 1990.[1] Thus, parameter values for equations are calculated from benchmark data using the equilibrium conditions for the model, and the model is solved for competitive equilibria under the various policy changes to be considered. Data are structured for a single and particular year, the choosen year being 1990, and parameter values are obtained from these data in a way that is explained later in this chapter. However, the SAM does not provide sufficient information to determine all quantity and price variables of the model. In this case, some parameter values, such as the trade elasticities of substitution in imports, and export demand elasticities are from the existing literature. This is a procedure adopted in a wide range of CGE models. The values of all taken elasticities are represented in Table A.5 in Appendix 5.[2]

It is useful to present the accounts explicitly in the form of a SAM, given that there is an accounting system corresponding to every economic model. The major usefulness of the SAM is due to the fact that any multi-agent, multi-sector CGE model requires the computation of a statistically consistent data set, at least for the base year. The SAM provides a consistent picture of the circular flows of a market economy in one set of accounts. Once constructed the equilibrium data set can be used to generate parameter values for the equations used in the model (calibration).

The GAMS software package programme developed by Brooke, Kendrick, and Meearaus (1988) is used to calibrate and solve the model. As mentioned above, the base SAM is used to define the model and calibrate most of the model parameters. Note that the numbers in the SAM are values, i.e., they are mostly payments of the form price times quantity.[3] We assume that all prices are unity the convention as originally adopted by Harberger (1959, 1962) when calibrating the model. Thus, we

[1]SAMs have been widely used in economic literature to provide a framework for collating, reconciling, and presenting a detailed quantitative picture of an economy in the past years. (see, for example), Dervis, de Melo, and Robinson (1982), Grais, de Melo and Urata (1986), Kehoe, Manresa, Noyola, Polo, Sancho-Serra, Puche (1980), Keuning and De Reuijter (1988), Pyatt and Round (1977).

[2] In this study, the international trade elasticity values used are based on Lewis and Urata (1983).

[3] However, certain payments, for instance government transfers do not have associated prices or quantities.

can interpret the payments as quantities, where appropriate, and the model can then be calibrated. Once the benchmark data set is constructed, GAMS generates the equations of the model, performs error checking.[4] Then we are able to perform the experiments for the purpose of the study.

The remainder of this chapter is as follows. We start by describing the construction of the SAM for the Turkish economy for the year 1990 in section 6.2. Following that we discuss the data sources and consistency adjustments in constructing the benchmark equilibrium data set. We then focus on paremeterisation issues in section 6.5. Next, we give a brief discussion of the equal-tax-yield-equilibrium concept. The last section is the conclusions from the chapter.

6.2. Construction of the SAM for the Turkish Economy

Compiling the transactions of the Turkish economy has been achieved by means of a statistical data base device called a SAM. A SAM is an accounting framework in matrix form which encapsulates aggregate structural interrelationships amongst the various agents in an economy. It is a simple and efficient way of representing the fundamental law of the economics that for every income there is a corresponding outlay or expenditure. The SAM accounts provide the underlying data framework for CGE models with an income and expenditure account for each actor in the model.

Mainly, a SAM has two principal aims. The first is concerned with the organisation of information relating to the economic and social structure of a country in a particular year. Since a SAM presents a static image which can reveal much about the country's economic structure, it makes maximum use of the available information which may be dispersed or fragmentary. The second aim is to provide a data base for the creation of plausible models. Therefore, one might use a SAM as an organising framework, presenting in one unified set of accounts a picture of the "circular flow" of a market economy. A SAM provides information which describes the structure of an economy

[4] The complete GAMS listing of the Turkish CGE model and the calibration results are presented in Appendix 6 and 7.

and is well suited to be a basis for CGE models. Hence, the SAM has been used as the framework for a consistent data set in this study.

In constructing a SAM, the most important things to be noted are that it is a square matrix and that all corresponding row and column totals are equal; that is the defining characteristic of a SAM is that each column and column indicates a separate account in which expenditures and receipts must balance.

Table 6.1 presents an aggregated SAM in schematic form for a national economy in which elements of the matrix are labelled according to the type of transaction they represent.

Table 6.1: An Aggregated SAM in a Schematic Form

		EXPENDITURES							
RECEIPTS		Production Activities	Commodi-ties	Factors	Households	Government	Capital	ROW	Total
1	Production Activities		domestic sales					exports	total sales
2	Commodities	intermedi-ate inputs			household consumption	government consumption	invest-ment		aggregate demand
3	Factors	factor payments							total factor income
4	Households			factor income		transfers		foreign remittances	household income
5	Government	indirect taxes	import taxes	factor taxes	direct taxes				government revenue
6	Capital				savings	savings		foreign savings	total savings
7	ROW		imports						imports
	Totals	Total Costs	aggregate supply	total factor income	household expenditures	government expenditures	total invest-ment	foreign exchange receipts	

As can be seen from the Table, the matrix is square and illustrates the characteristics of all SAMs that corresponding rows and columns are labelled identically. The basic structure of the Table recognises 7 types of accounts and totals. Firstly, a set of accounts for production from 1 to 3, namely, production activities, commodities, and

factors of production. Secondly there are both current and capital accounts for institutions (number 5-6). Finally the table shows a distinction between the home economy (accounts 1 to 6) and the rest of the world, ROW for short (account 7). Thus, the SAM in schematic form shows us where each account derives its receipt from and how the income is distributed to the other accounts.

The SAM constructed for 1990 provides a framework for reconciling the input-output table and national income and other necessary data for Turkey.[5] The input-output table for 1990 contains the most detailed information on separate industries and products available in the present national accounting system and provides the starting point for the SAM. We expand the input-output data to incorporate demands and incomes of domestic household groups from the other sources consistent with the production side accounts and explicitly incorporate an external sector balance condition which is not present in the input-output data.

As our ultimate purpose is general equilibrium tax policy analysis, we incorporate substantially more detail on taxes than exists in the input-output table or the income and expenditure accounts. The SAM is constructed for the year 1990 and has 42 accounts. As can be seen, the structure of the Turkish SAM follows in general the general structure of the SAM in a schematic form in Table 6.1 in general. However, unlike conventional SAMs, we distinguish between goods and services produced (11 producer goods) and goods and services consumed (9 consumer goods) in this study, since the classification of consumption goods is quite different from that of production goods as mentioned before. Households' demands are defined over the class of goods that are present in the household consumption expenditure surveys while sectoral production technologies are defined taking the input-output classification into account. As the data are only available in this format, we need to construct a (11x9) transformation matrix so as to reconcile both sources of information and be able to define agents' characteristics in the underlying general equilibrium model. This transformation matrix permits us to convert the vector of households' consumption demands into final private consumption.

[5] The aggregated SAM for Turkey is presented in Table 5.3 in Appendix 5. However, the disaggregated SAM is available from the author if requested.

We separate indirect taxes between indirect taxes on production and indirect taxes on consumption (VAT). The former is paid by the production sectors while the latter is paid by the households when consuming consumer goods.[6] It should be evident from the table that this SAM for Turkey, like all consistent ones, has the same number of rows and columns, respectively representing receipts and expenditures associated with each type of account.

As noted earlier, the SAM satisfies the rule that all receipts must be matched by corresponding expenditures. Production, as the centre of economic activity, is the most important element in the Turkish SAM as with all SAMs. In the production account activities and commodities are separated in order to allow greater flexibility in the determination of relative prices, as well as industrial structure. The separation of the activity and commodity account is crucial in a modelling framework, as activities are assumed to consist of producers who are behaviourally distinct in the models. The separation is in recognition of the fact that there is no one-to-one correspondence between the output of a commodity and the output of an industry producing that commodity as its principal output; it is not usual for the output of an industry to fall completely within one commodity group, while conversely the total output of a commodity group may be drawn from several industries. In the SAM, industries sell their output to the commodity accounts in the proportions in which they make the different groups. Then, the commodity account distributes their outputs to industrial uses as intermediate purchases and to final users as final demands. The "commodity" account mainly corresponds to the domestic market for all products with the supplies coming from producers and imports. Note that exports are not included in the "commodity" accounts but are sold directly to the ROW by producers.

The "activities" accounts (1 to 11) in the Turkish SAM represent the producing sectors in the input-output accounts. For example, the inter industry flows in the input-output

[6] We follow the system of National Accounts (SNA) in constructing the SAM. Under SNA, it is possible to show indirect taxes according to the agent on whom they are imposed. The SNA makes it obvious that the VAT is imposed on consumer goods and paid by households. For further detail, see Pireddu and Dufournaud (1993 and 1995), Roberts and Zolkiewski (1993).

table have been aggregated into 11 sectors in the SAM.[7] As a result of the basic conceptualisation that activities purchase raw materials and rent factor services in order to produce commodities, producers pay out the total income from sales of their output to commodity market to intermediate input suppliers as material costs to factors of production as factor costs and to the government as indirect taxes. They derive their receipts from sales of their output to commodity markets, from subsidies from the government, and from the rest of the world as a result of exporting commodities. The "activities" account consists of the sectors as defined in Table 6.2 and the matrix of intermediate flows (use matrix, sometimes called the absorption matrix) appears in rows 12-22 and columns 12-22. In other words, the use matrix records the commodity inputs to an industrial production process.

The "commodity" account (12-22) corresponds to the domestic product market, buying domestic goods from activities and imports from the rest of the world, and selling the goods to all domestic purchasers. This account is net of output tax and indirect taxes, i.e., value-added tax and specific excise duties. In the SAM entries 1 to 11 of rows and 12 to 22 of columns provide the mapping from activities to commodities and are sometimes called the make matrix. This matrix is the matrix of production outputs by commodity groups. The matrix is dominated by the elements on the diagonal, because these represent the principal product output of each industry, which by definition is important. The accounts from 23 to 32 present the transformation matrix.[8] The factors account 32 and 33 shows payments for factors of production-labour and capital- (rows 32 and 33) and the pre-tax distribution of factor income to the households in rural and urban areas (columns 32 and 33). The factor accounts, thus, act as transfer accounts, channelling wages and profit income from all activities to households.

Along with production, the "institutions" (households and government) are represented by accounts 34 to 40 in the complete Turkish SAM. They are the major economic actors in the system whose behaviour provides much of the focus of the

[7] In order to avoid the risk of getting lost in too many details, the 64 sectors of the input-output table (1990) have been aggregated into 11 sectors.
[8] The transformation matrix coefficients is presented in Table A.1 in Appendix 5.

model we will develop. In the accounts shown in Table 2, "enterprises" do not appear as a separate institution, since they are not treated as behaviourally distinct from producers. "Households" and "government" accounts are treated separately, corresponding to their very different behavioural specification both in theory and in the model we shall present later. Six types of households, disaggregated according to their income size and to their geographical regions (3 rural and 3 urban households) are presented in the Turkish SAM in the accounts 34 to 39. The households receive factor income from firms as labour income and capital income. In addition, they receive factor income from abroad. Also, they receive transfer payments from the government. Households pay direct taxes, i.e., income taxes, and then divide their disposable income between consumption and savings. Government (account 40) receives import duties from the commodity accounts indirect taxes from production activities, direct taxes from the households and allocates it in column 40 to production activities as subsidies, expenditure on commodities, and saves the remaining income.

The "capital" account row and column 41 can be seen as funds for investment, since it collects all savings, domestic and foreign, and spends them on investment goods in the column.

Finally, the last account (42) to consider is the rest of the world (ROW). It shows the relationship between the home country and rest of the world. In the Turkish SAM, the account is set up to reflect the sources of foreign exchange (column 42) and its disposition (row 42). In this respect, foreign exchange receipts from exports and foreign borrowing are allocated to producers and households. The home country uses these receipts to buy imports or they are kept by government as increased reserves. The treatment of trade in the SAM should be consistent with the approach we shall develop in our model in this study, describing how we open the core model behaviourally to include imports and exports.

The SAM briefly described above has been estimated as the accounting framework and the source of parameters for the general equilibrium model of Turkish economy. One can say that the construction of a SAM will reflect the features that are given by the assumptions of the model selected for the particular economy and circumstances.

In this particular case, all the equations related to the model will be exhausted within the SAM in order to consist a general equilibrium model. In other words, in order to calibrate parameter values for the model, we have to fit the model to the benchmark data set. However, the data set provided by the SAM is not sufficient to solve for the model parameters. For example, the exogenously given substitution elasticities in trade are also required to calibrate the parameters. Values for such elasticises need to be borrowed from other sources. Then, we will be able to use the numerical model to examine policy issues through simulation exercises. For example, an increase in VAT rates will affect the Turkish economy. The CGE model can be used to resolve the model to identify a new counter-factual equilibrium by specifying new values for the policy instruments separately. Therefore, we can analyse the effects of policy change regarding Turkish VAT on the economy by comparing the counter-factual and benchmark equilibrium as far as tax harmonisation in the EU is concerned.

6.3. The Benchmark Equilibrium Data Set

Calibration depends upon the prior construction of the benchmark equilibrium data set. Data requirements for a single and representative year are extensive for a CGE model. These include capital stock and its financial structure by industry, labour usage by industry, input-output data, household expenditure and endowment data, and tax data. The benchmark data set that we outline has been constructed for Turkey for 1990, and separate details contained in input-output transactions tables, national accounts, household income and expenditure survey, taxation statistics, foreign trade statistics, and other unpublished sources from government agencies.[9] Since the data set for this model is so comprehensive, the sources are necessarily divergent. Hence, adjustments are made to ensure that each part of data is consistent with the rest so that we can use all of these data together. For example, all data on industry are taken to be fixed, while data on household incomes and expenditures are correspondingly

[9] Complete GAMS listing of the Turkish model in Appendix 6 presents the base year data set used in the model including the input-output coefficients matrix, the capital coefficients matrix, the structure of output, final demand, value-added, labour and capital, and various trade, tax and production data and parameters.

adjusted by using the RAS method.[10] Then we are able to obtain the consistent data set that involves the assumption of an "observable equilibrium" in which the equilibrium conditions that explained in the previous chapter are met.

6.3.1. Production Data

The information available in the National Accounts is primarily macroeconomic and refers to value-added. Thus, one needs an input-output table to obtain data on surplus of industries and their intermediate demands with regard to production side. We have specified the production side of the economy using the input-output matrix of Turkey for 1990.

The 1990 input-output table published by the State Institute of Statistics (SIS) in 1994 distinguishes 64 industries in the production side of the economy and reports 1990 inter industry transactions in millions of Turkish Lira (TL) at producer prices. We aggregated these sectors into 11 sectors and 11 corresponding commodity categories and converted the values to billions of TL.[11] Table 2 displays the aggregation scheme that relates the sectoral classification of the model to the 1990 SIS input-output Table classification.

[10] The term RAS derives from the Row and Column Sum method. This is a method of using an initial guess of a matrix in which given row and column constraints must be met so that we can have a consistent matrix. This procedure is used to resolve inconsistencies between portions of our data set which are linked through marginal conditions. See Bacharach (1971), Hilaire and Whalley (1983 and 1987) for further details.

[11] As explained earlier, the description of this commodity and industry classification appears in the Turkish SAM in Table A.5 in Appendix 5.

Table 6.2. The Sectoral Aggregation

CGE Model's 11 Sectors	Key to Sectors in SIS 1990 Input Output Table
Agriculture	1-4, 20
Mining	5, 7-10
Food Processing	11-19
Textiles	21-24
Light Intermediates	25-28, 34-35
Petroleum	6, 32-33
Basic Intermediates	28-31, 36-40
Machinery	41-49
Electricity, Gas, Water	50-51
Construction	52-53
Services	54-56

After aggregating the SIS 1990 input-output Table as in Table 6.2, the intermediate demands are derived from the inter industry transactions of the input-output Table for the 11 production sectors. The input-output coefficients matrix for the intermediate demands among the productive sectors are computed directly from the base SAM, and are presented in Table A.2 in Appendix 5.

We used employment and capital stock data as presented in Table A.4 Appendix 5 in addition to the data contained in the SAM. The labour use by the industries for the base year were obtained from Statistical Yearbook of Turkey (SIS, 1992). Data on capital stocks of industries are obtained from State Planing Organisation (SPO), as the input-output table does not provide data for these. Since the latest figures for capital stocks are for 1988, we estimated the capital stocks data for the base year on the basis of a moving average of sectoral, incremental capital output ratios. We calculated economic depreciation rates from the data on capital consumption by the industries given by the SIS input-output Table.

Value added contains net payments to the primary factors of production plus factor taxes on production. We use the SIS input-output Table to obtain figures for gross capital and labour income by industry.

6.3.2. Data on Demand

The demand side of the economy is represented by six groups of domestic households differentiated according to their income size and geographical place (urban-rural), by the government, and by a foreign sector that represents the ROW.

The data related to household-demand side of the economy were obtained from household income and consumption expenditures survey results of Turkey for 1987 (SIS, 1990). The information in these surveys has been aggregated in order to have 6 different household groups, divided into 3 different income brackets in rural and urban areas.[12] The demand parameters (C_{kh}) were obtained from the shares of expenditure good k by household group h, and adjusted in order to have market demands equal to the final private consumption column in the input-output matrix.[13] The survey results contain a wide variety of consumer goods categories. We used a detailed description of these categories so as to place them as accurately as possible into our classification of nine consumer goods. However, as mentioned before, household expenditures on the nine consumer goods which are reported in the survey results are different from that of private expenditures on the eleven producer goods. In other words, the demand parameters are given for the consumer goods and not for the sectors which means households do not demand agricultural products as such, yet goods that use its output-for instance, bread. Therefore, we were led to construct a conversion matrix Z linking the two classifications to accommodate the different expenditure category classifications in these data.[14] There are 9 final consumption goods (k) and 11 sectors of production (i). Thus, each coefficient (Z_{ki}) in the conversion matrix Z gives the amount of particular producer goods needed to produce one unit of consumer good. For instance, when consumer acquire bread, they implicitly demand the outputs from production sectors such as agriculture, food-

[12] Urban households are defined as those living in a settlements of 20.001 or more and rural households are defined as those living in a settlements of 20.000 or less. We subdivide each group into 3 different groups, namely, poor, middle, and rich, according to their income. In this context, we consider the first 40% as being poor, the next 40% as being middle, and the rest as being rich households by taking their income brackets into account.

[13] The demand parameters are given in Table A.2 in Appendix 5.

[14] We have deducted VAT on consumption from the aggregate values for the nine consumer goods and then transform the net figures into households' demand for the productive sectors when constructing the Conversion matrix.

products, and service sector which includes trade. Hence, we use the Z matrix to convert expenditures on the nine consumer goods into expenditures on eleven producer goods as mentioned previously in the previous chapter (see Table A.1 in Appendix 5). The VAT rates on consumer goods are the weighted average of effective tax rates by using the unpublished information from the TMOFC and the VAT legislation. We have carefully aggregated the actual tax rates so as to match our aggregation. We assume neutrality of tax evasion within the sector or aggregated good as far as VAT is concerned.

We used the information in the survey results to allocate the private income by household groups. Considerable care was devoted to the allocation of the various income sources (e.g. transfers, imputed rent, interest and dividend, self-employment income, wage and salaries) by income range for the urban and rural households using the information in the survey results. However, we needed to adjust initial endowments of the household groups to match value-added in the activity input-output matrix. Table 6.3 shows the data on endowments of capital and labour held by the various households.

Table 6.3: Average Capital and Labour Income by Household Groups (in 1990 billion TL)

Household Groups	*Capital*	*Labour*
Urban-Poor	114802	207029
Urban-Middle	433142	315631
Urban-Rich	857068	262508
Rural-Poor	121912	105924
Rural-Middle	412077	147052
Rural-Rich	694080	32880

The disposable income of the household groups was estimated by deducting income tax and savings from their gross income. We derived the effective average income tax rates by household type from the data on income taxes paid by households and household disposable income that we calculated. It was assumed that evasion is neutral across the households and is independent of the income source.

The data for the final purchases by the government was derived from the 1990 input-output table. Also the final demand data related to the foreign sector was taken from the input output table. The tariff rates were computed simply by finding rates that yield the actual tax revenues as the input-output table provides the import duties paid by the sectors.

The model simplifies certain aspects of modelling issues as in most CGE models. Firstly, the government is not allowed to have an unbalanced budget. Also, despite the fact that capital flows are allowed, we assume a balanced foreign trade in the base year.

6.4. Parameterisation Methods

The model needs to be calibrated before the effects of altering VAT base can be simulated. Calibrating the model involves specifying values for certain parameters in the model. The calibration procedure which is similar to that used in other applied general equilibrium models (see Mansur and Whalley, 1984) uses the micro-consistent data set and exogenous elasticty values such as elasticity values in trade to solve the parameter values for the functions used in the model.[15] This procedure makes the crucial assumption that the economy is in equilibrium in the base year. The procedure requires one additional assumption: That all data are given in value terms, i.e. they are products of prices and quantities. On the other hand, general equilibrium theory requires the separation of prices and quantities. The common procedure in applied general equilibrium models is to adopt appropriate unit conventions on quantities allowing one to transform data in value terms into information on quantities. The most convenient assumption is to choose physical factor quantities such as to earn 1 Turkish Lira (TL) net of all taxes and subsidies in the benchmark equilibrium. Quantities of commodities are implicitly defined in a similar way by assuming prices of goods net of indirect taxes and tariffs to be 1 TL in the base year.[16]

[15] With regard to exogenous elasticty values, Lewis and Urata (1983) provide information on trade elasticty values as mentioned before. (See Appendix A.5)
[16] We use domestic prices as numeraire in the solution of the model.

Consequently, the vector of factor and producer prices is one in the benchmark equilibrium. The first task in applying general equilibrium analysis is to select a set of parameter values such that with no change in tax policies the model equilibrium is the same as that represented by the benchmark data set. In other words, the model must yield an equilibrium solution with values matching those of the benchmark data set.[17] Especially, the levels of inputs in each sector, the level of factor incomes, and the magnitudes of various tax payments have to be identical to those of benchmark data set. After fully specifying the model and incorporating a policy change, the model can be solved for a new equilibrium. Evaluations of the impacts of approximating the Turkish VAT rates with the EU follow from pairwise comparisons between simulated (or new) equilibria and the benchmark equilibrium to which the model is calibrated.[18]

Hence, two types of equilibria must be distinguished when using the model. The first one is 'observed' or 'benchmark' equilibrium which is derived from data and to which the model is calibrated and which thus do not need to be computed. The second one is 'new or' 'counterfactual' equilibrium that is computed as a model solution under changes in policy.

Having described the calibration procedure, we illustrate the calibration method to derive the values for the parameters. Consider the Cobb-Douglas production functions in equation (6.2), reproduced here:

$$X_i = \overline{A}_i L_i^{\alpha} \overline{K}_i^{1-\alpha} \qquad i=1,2,3,.....,11. \qquad (6.1)$$

The corresponding first-order conditions for profit maximisation are given by:

$$w_i \cdot L_i = \alpha_i \cdot PN_i \cdot X_i \qquad i=1,2,3,.....,11. \qquad (6.2)$$

[17] This is called the 'replication requirement' in calibration.
[18] The original equilibrium represents a benchmark for the comparative static analysis of the tax change in the study.

The benchmark data contains information on the value of X_i, L_i, $\overline{K}_i$, w_i, and PN_i. Hence, this information is sufficient to derive α_i from the following equation:

$$\alpha_i = \frac{w_i L_i}{PN_i X_i} \qquad i=1,2,3,.....,11. \qquad (6.3)$$

Having derived α_i from equation (6.3), $\overline{A}_i$ which is the productivity parameter in production of sector i can now readily computed as:

$$\overline{A}_i = \frac{X_i}{L_i^{\alpha i} K_i^{1-\alpha i}} \qquad i=1,2,3,.....,11. \qquad (6.4)$$

We follow parallel procedures to derive the parameter values for the Armington functions and CET functions in the model.[19]

Since the utility functions for the households over the consumer goods are Cobb-Douglas type, we merely take each household's adjusted expenditure on each of the nine consumer goods and divide by the household's total expenditure on all nine goods. The resulting share parameter values are represented in Table A.2 in Appendix 5. We use a similar procedure to calculate the input-output coefficients and present them in Table A.2 in Appendix 5.

Having completed the calibration procedure, a full model is available and can be used for the tax policy analysis. Thus, we can specify the tax policy change in the line of VAT harmonisation in the EU and compute the counterfactual equilibrium for the new policy regime. Then the policy appraisal proceeds on the basis of paired comparisons of the counterfactual and benchmark equilibrium data. We give the analysis of the simulation results by comparing both equilibria in chapter 7.

6.5. Equal Yield Equilibrium

In CGE tax models it is conventional to use an equal-tax-yield equilibrium concept through which we are able to undertake "differential" analysis. This analysis allows an existing tax to be replaced by an alternative tax system which raises equivalent revenue. Thus, we can maintain the size of government when the effects of an existing tax are evaluated. In other words, the tax policy change should be revenue-neutral. This is crucial in applied general equilibrium tax analysis, because a change in the size of government may well contaminate model findings. Since we are interested in the effects of changes in the structure rather than the level of taxes, we wish to be able to interpret our results without worrying about changes in the pattern of total demands which are caused by changes in the amount of government spending.

All of the simulations in the following chapter involve increases in the government revenue. In this case, to avoid the budgetary imbalances consequent on the changes in the VAT rates, we ensure revenue neutrality by altering the income tax rates accordingly.[20] Hence, we keep the total tax revenue intact when we carry out our simulations.

6.6. Conclusion

In his chapter, we have presented the methodology and a summary of the benchmark data set we constructed for Turkey for 1990 to use in counterfactual general equilibrium analysis of the changes in the Turkish VAT rates with regard to harmonisation in the EU. In this context, we have constructed a SAM for the Turkish economy for the base year. This chapter describes the data related to production and demand side of the economy. Also, the chapter has identified the sources of the benchmark data set used in the study and has explained the necessary adjustment for consistency. Since the constructed data set represents a state of Walrasian general equilibrium for Turkey for the base year, it can be used for calibration of the

[19] The elasticty values for Armington and CET functions are given in Appendix 5 in Table A.5.
[20] As mentioned before, we reduce income tax rates applied to all households' income in the same proportion. Thus these changes in income tax rates are regressive.

parameters of an underlying general equilibrium model. We also have described equal-tax-yield equilibrium concept in tax policy analysis and explained how we obtain this equilibrium in our model.

CHAPTER 7

THE ANALYSIS OF SIMULATION RESULTS

7.1. Introduction

In this chapter we analyse the impact of the approximation of Turkish VAT rates to the level of Commission's original VAT harmonisation proposals on the Turkish economy using the CGE tax model of Turkish economy described in chapter 5. The underlying assumption is that Turkey is going to become a full member in the near future. This may not be politically feasible under current circumstances as explained in chapter 1. However, the very fact that the model results are simulations rather than forecasts makes the approach useful in finding the likely direction that the Turkish tax system is going to pursue and how would this affect the Turkish economy in the future, since sooner or later the integration will be realised.

We perform our simulations by applying three particular scenarios to the CGE model of Turkey as far as harmonisation in the EU is concerned.[1] Note that the scenarios consider the consequences of the original proposals and do not take into account the recent temporary agreement on minimum rates which explained in chapter 2.

Assessing the impacts of VAT harmonisation with the EU on the Turkish economy involves examination of changes between equilibria. Hence, we first determine the base case solution ("benchmark equilibrium") for the model using the data set and methodology explained in chapter 6. The model is next solved for counterfactual equilibria corresponding to different VAT reform options as far as the Commission's proposals are concerned. Using summary statistics, the simulation results are compared to the original benchmark equilibrium. Thus, we can obtain the variations in consumer purchases of commodities, industry production levels, household income levels and relative prices. We then try to analyse the results of changes in the Turkish

[1] We explain these scenarios later in this chapter.

economy. The main focus of the analysis will be on relative prices, resource analysis, income distribution, welfare analysis, although other economic effects will also be analysed.[2]

In order to run the simulations, certain assumptions are made about the model. These were explained in chapter 5. For example, a balanced government budget is assumed. Also, the capital stock is fixed in each sector when we conduct our experiments.

The remainder of the chapter is organised as follows. We begin by explaining the simulations conducted in this study. Next we give the effects of changes in Turkish VAT on production side of the economy. Then we concentrate on how these changes would affect the consumption in the economy. Following that we focus on the effects of the changes on income distribution and welfare of the households. Afterwards, we give the effects of the changes on aggregate variables such as GNP and investment. Some concluding comments are given in the final section.

7.2. Simulations

As mentioned in Chapter 3, statutory VAT rates in Turkey are 10 percent for the standard rate, 1 and 5 percent for the reduced rate, and 20 percent for the higher rate in 1990. In addition the tax system has special provisions and exemptions for such groups as small farmers and fisherman, small enterprises and goods and services for cultural, educational, recreational, scientific, social and military objectives and some other complications eroding the tax base. Obviously, VAT with exemption no longer corresponds to pure consumption taxes.

Table 7.1 shows averaged statutory and effective VAT rates for our commodity classification in this study. Averaging is inevitable because in aggregating to 9 consumption sectors we have to lump together consumer goods subject to different tax rates and different tax bases. To obtain statutory VAT rates for the consumer goods, we took the product mix within each consumption demand sector to calculate a

[2] Changing the VAT rates will have effects on trade as well as we modelled Turkey as a small open economy. However, in this study we will focus on the other economic issues as mentioned.

weighted average of the VAT rates using the relative expenditure on each of these product mixes as weights.[3] In contrast, effective VAT rates are obtained from the information contained in the Turkish SAM.

Table 7.1: Statutory and Effective VAT Rates (%)

Consumption Demand Sectors	*Statutory Tax Rates (Averaged)*	*Effective VAT rates (Averaged)*
Foodstuff	2.4	1.8
Tobacco and Alcohol	10.0	7.5
Clothing	10.3	7.8
Housing	10.0	7.5
House Furnishing and App.	10.3	7.8
Transport and Comm.	10.0	7.5
Health and Personal Care	10.3	7.8
Culture, Education and Entertainment.	3.7	2.8
Other	9.7	6.8

Thus, as can be seen from Table 7.1, the weighted average effective tax rates on final consumption are lower than their statutory counterparts because of exemptions and evasion as indicated before. Hence, we conduct the above experiments taking the effective and the Statutory VAT rates into consideration in order to see the impact of different scenarios in more detail as far as VAT approximation is concerned. As the table indicates, the VAT rates on all consumer goods have to be increased in all simulations as far as the VAT harmonisation in the EU is concerned. In each case, changes relative to the 1990 equilibrium are examined. The 1990 equilibrium is represented by an equilibrium price vector of unity, where parameters and units of measurement are chosen for consistency with national accounts data.

The VAT rates corresponding to the 9 consumer goods have been computed as weighted averages of individual rates levied on commodities included in each composite good. As shown in Table 7.1, the VAT rates differ substantially among commodities and are much lower than the Commission's proposals. This leads us to assume that the approximation of VAT rates with the EU would have an appreciable

[3] For instance, if 25 % of expenditure on food sector was accounted for by goods to which 1 % VAT is applied, the relative weight will be 0.25 and so on.

effect on the relative prices of consumption goods in particular and on resource allocation in general.

To analyse the effects of changes in the Turkish VAT rates as far as European Commission's proposals are concerned, we consider three main scenarios. In each scenario we conduct a different tax policy change in order to bring the VAT rates in 1990 into agreement with the rates proposed by the European Commission.[4] These scenarios are presented in Table 7.2.

Table 7.2: The Existing VAT Rates and the Necessary Changes in Each Scenario (%)

Structure	*Existing Rates*	*Scenario 1*	*Scenario 2*	*Scenario 3*
Super Reduced	1	4	6.5	9
Reduced	5	4	6.5	9
Standard	10	14	17	20
Higher	20	14	17	20

As shown in Table 7.2, the first scenario corresponds to an approximation of the Turkish VAT in 1990 to the lower limit of the ranges proposed by the Commission. In this case, the existing super-reduced (1%) and reduced rate (5%) of the 1990 Turkish tax system are combined into one rate of 4%, while the standard rate (10%) is increased to 14%. The higher rate (20%) is abandoned and the standard rate of 14% is applied to these goods and services. In the second scenario, the super-reduced and reduced rates are combined into one rate of 6.5%, whilst the standard rate is increased to 17%. The higher rate falls to the new standard rate of 17% (see chapter 2 about central cases). In this scenario we allow a 2.5 percentage point variation for the reduced rates and a 3 percent point variation for the standard rate around the central cases. In the third scenario, we alter the tax rates according to the upper limit of the Commission's proposals (9% and 20% respectively) and the higher rate falls to the standard rate of 20%. Hence, three different equilibria have been calculated as far as VAT approximation is concerned.

[4] As mentioned in Chapter 2, European Commission recommended a two rate system of VAT with a standard rate applied to most of the products and a reduced rate applied to certain basic products such as food, water, books and newspapers. The Commissions original proposals suggested that the standard rate lies between 14 % to 20 % and the reduced rate within the range of 4 % and 9 %.

As the above scenarios suggest the approximation of Turkish VAT to the EU would require Turkey to make quite extensive changes in its VAT system. The scenarios require an increase in the VAT rates applied to goods and services in all of the experiments as shown in Table 7.3. In this direction, the VAT rates on food and culture, education and entertainment sectors increased to the level of Commission's proposals for the reduced rates, and the VAT on all other goods is increased to the standard rate of the proposals, while higher rates are abolished.

Table 7.3 shows the required increases in the VAT rates applied to goods and services in the three scenarios when the statutory rates in 1990 are taken into account as far as VAT approximation is concerned.

Table 7.3: The Increase in the VAT Rates in the Three Scenarios (%)

Consumption Demand Sectors	*Scenario 1*	*Scenario 2*	*Scenario 3*
Foodstuff	67	171	275
Tobacco and Alcohol	40	70	100
Clothing	36	65	94
Housing	40	70	100
House Furnishing and Appliances	36	65	94
Transport and Communication	40	70	100
Health and Personal Care	36	65	94
Culture, Education and Entertainment.	8	75	143
Other	44	75	106

As shown in the table, the VAT approximation requires an increase in all consumer goods in all cases. As an example, we consider the following scenario in the first case: In order take the existing Turkish VAT rates in 1990 to the lower level of the Commission's original proposals, the average statutory VAT on food is increased by 67% (from 2.4% to 4%), the VAT on culture education and entertainment increased by 8% (from 3.7% to 4%), while the VAT on all other consumer goods (between 10% and 10.3%) increased by between 36% and 44%[5] (see also Table 7.1 and 7.2). Hence, we apply these policy changes that are presented in Table 7.3 to the nine consumption

[5] The VAT on luxury goods are abolished and the standard rate applied to those goods. Therefore, these increases are averages that conceal some cuts on particular goods.

goods when performing the simulations in this study by taking the Commission's proposal into consideration.

In performing simulations, the general procedure is as follows. Starting with our 1990 data set, which is interpreted as the result of an equilibrium allocation (benchmark equilibrium), we consider a VAT policy change and compute the alternative equilibrium associated with a specific reform proposal with regard to harmonisation (counterfactual equilibrium). Thus, the evaluation of different policy changes then proceeds on the basis of comparisons between the counterfactual and benchmark equilibrium. However, we do not change the behavioural parameters between base-case sequence and revised-case sequence. Otherwise, we would not be able to isolate the effects of the policy changes in the tax rates.

The path of real government spending is held the same as in the base case. When performing the simulations, we impose equal yield tax analysis through a proportionate change in the income tax following Goulder, Shoven, and Whalley (1983) and also Frenkel, Razin, and Symansky (1990). Thus, income tax collections fall through an income tax reduction applied to all household personal income tax rates. As a result, these tax changes are regressive. Moreover, the results, detailed in the following sections, rest on the assumption that the capital stock in each sector is held constant throughout our simulation exercises. Therefore, the results show the medium-term effects of the changes on the Turkish economy.

The results of our simulations are presented in the tables, and are analysed in economic terms in the following sections in this chapter. In each of these tables three cases are considered, each involving different changes in the Turkish VAT rates as far as tax harmonisation in the EU is concerned. The main focus of our simulations is the effect of approximation of Turkish VAT rates to the Commission's original proposals on relative prices, resource allocation and income distribution, welfare effects amongst the Turkish urban and rural households.

7.3. The Analysis of Simulation Results in the Production Sectors

As explained above three experiments have been conducted to approximate the EC Commission's tax harmonisation proposals as far as VAT is concerned. We conduct these experiments by altering the Turkish VAT rates as in cases 1, 2, and 3.

The effects of VAT approximation on production sectors are summarised in tables 7.4 and 7.5. Three alternative scenarios are considered as mentioned before. Cases 1, 2, and 3, report the results of these three scenarios respectively.

Table 7.4 reports the results of changes in producer goods prices in each case, relative to the benchmark equilibrium, caused by the tax policy changes .

Table 7.4: Simulation Results for Producer Goods Prices (Benchmark =1)

Production Sectors	*Case 1*	*Case 2*	*Case 3*
Agriculture	1.005	1.006	1.006
Mining	1.001	1.001	1.002
Food Processing	1.002	1.001	1.000
Textiles	0.999	0.998	0.997
Light intermediates	1.002	1.002	1.002
Petroleum	0.997	0.996	0.996
Basic intermediates	0.999	1.000	1.001
Machinery	1.000	1.000	1.000
Electricity, Gas and Water	0.955	0.948	0.941
Construction	1.010	1.019	1.027
Services	1.001	1.001	1.000

As can be seen from the table, the results indicate that the approximation of Turkish VAT rates to the level of the Commission's original proposals alters relative prices in most production sectors. The prices of all producer goods vary only by the changes in the VAT tax rates after taking the different scenarios into consideration. We should mention that the new prices in Table 7.4 show the percentage change with respect to original equilibrium, as all prices in the original equilibrium were equal to one.

Notice that although the price changes are different in all sectors, overall the pattern of changes is similar for most sectors. As can be seen from Table 7.5, the reforms lead to a general price increase in many sectors, namely, agriculture, mining, light intermediates, construction and services (expect for case 3). As expected, the largest increase amongst the production sectors is in the construction sector in all cases (between 1.0% and 2.7%), because there is no consumer demand for the production of this sector. This means it does not contribute to the make up of any final consumer goods, and thus does not face VAT on final consumption expenditure. Therefore, this sector becomes fairly sensitive to increase in VAT rates. The agriculture sector has the second largest price increase in all cases (between 0.5% and 0.6%) as shown in Table 7.4. This is explained by the fact that the agricultural sector faces no VAT as there are many exemptions in this sector. The food processing sector has an increase of 0.2% in the first case. Then the pattern of prices fall slightly in the second and third cases (0.1% and no change respectively) as the VAT increases more in these cases. Hence, the prices of foodstuff to which the food processing sector contributes substantially on the consumption side are much higher in the last two cases than in case one. The price increase of foodstuff decreases the demand for the foodstuff, and thus the increased price of this consumer goods translates into lower increase in price in the food processing sector in cases 2 and three.

Notice, however, that price changes in the mining, basic intermediates and services sectors are relatively small. Notice, too, that the relative prices of machinery sector remain unchanged and also the price increases remains fairly constant in the light intermediates sector (0.02%) in all cases. This is because a considerable amount of the output of these last five sectors is used as an intermediate input by the other sectors, not just in consumption demand.

On the other hand, the reforms give rise to a relative price decline in three sectors, namely, textiles, petroleum and electricity, gas and water in all cases. The largest price drop is in the electricity, gas and water sector in all cases (between 4.5% and 5.9%). This is because this sector faces a rather high VAT in the benchmark data. In other words the amount of VAT paid by this sector is much higher than the rest of the production sectors. As a result, not surprisingly, increase in VAT rates leads to fall in

prices in this production sector. The prices in petroleum sector decreased by between 0.3% and 0.4%, while they went down by between 0.1% and 0.3% in textiles sector in all cases. This is explained by the fact that the amount of VAT paid by these two sectors is also relatively high.

Table 7.5 presents the simulation results for the quantity changes in the production sectors when applying different policy changes to the Turkish VAT system with regard to the Commission's proposals.

Table 7.5: Simulation Results for Quantity Changes in Production Sectors (% Change from Benchmark Equilibrium)

Production Sectors	*Case 1*	*Case 2*	*Case 3*
Agriculture	+0.20	+0.18	+0.12
Mining	-0.07	-0.05	-0.05
Food Processing	-0.03	-0.08	-0.13
Textiles	-0.28	-0.36	-0.43
Light intermediates	+0.10	+0.11	+0.12
Petrol	-0.02	-0.02	-0.02
Basic intermediates	-0.03	-0.01	+0.01
Machinery	-0.13	-0.11	-0.09
Electricity and Gas	-0.05	-0.07	-0.08
Construction	+0.20	+0.43	+0.66
Services	-0.10	-0.12	-0.14

As can be seen from Table 7.5, the tax policy changes considered in each of the three cases changes the level of production in the economy. The results suggest that the output of most of the production sectors fall with respect to the base case despite the fact that there is a producer price increase in some of the sectors.[6] Notice that, although the quantitative effects are different the overall pattern of changes is similar as far as production sectors are concerned.

As can be seen from Table 7.5, the activity levels the of agriculture, light intermediate, and construction sectors increase in all cases as a result of tax policy changes with

regard to harmonisation. Not surprisingly, in general, the largest increases in activity levels take place in construction sector (between 0.20% and 0.66%) in all cases due to increase in prices in this sector. The quantity changes show the same pattern as the relative prices in this sector. This is because the intermediate and consumption demand are absent in this sector. Also, there is an increase in the investment after changes in the tax rates. As a result, this sector does not contribute to any of the consumer goods on the demand side, and thus does not face VAT as mentioned before. Therefore, the highest increase in the tax rates gives rise to largest increase (0.66%) in output as shown in the table in case 3. The activity level of production in light intermediates sector went up by between 0.10% and 0.12% in the similar direction to the relative prices in this sector as shown in Table 7.5. This explained by the fact that this sector faces relatively low VAT. Notice that the pattern of increase in the activity levels of this sector does not change significantly in case 2 and 3. This is because its output is used as an intermediate input by many other sectors as mentioned before. Also, the activity level of the agriculture sector increased by 0.24% in the first case. However, the price increase is lower in cases 2 and 3 (0.18% and 0.12% respectively) in this sector in comparison to case 1 as shown in Table 7.5 despite the price increases in the last two cases. This is explained largely by the fact that the demand for foodstuff to which agricultural products have a high contribution has the similar pattern (see foodstuff in Tables 7.6 and 7.7). Thus, the decreased demand for foodstuff products on the consumption side translates into decreased output in the agricultural sector.

The rest of the sectors have a declining activity level. The falls in the activity levels are largely explained by the demand side of the economy. The price increases in consumption reduce the amounts demanded by households and thus result in lower production in most of the sectors as shown in Table 7.5.

However, the largest decrease in the level of output is in the textiles sector (between -0.28% and -0.43%). The drop in the output of this sector is sensitive to tax policy

[6] Normally, we would expect the output to increase in the production sectors as the producer prices increase. However, as it is explained later in this chapter, we should take the demand side of the economy into account as well.

changes despite the fact that the prices do not change significantly in this sector (see also Table 7.4). This is because the amount of VAT paid by this sector is relatively high as mentioned before. The second largest decrease is in the services sector in general (between -0.10% and -0.14%). This is because the services sector contributes to the make up of all consumer goods on the consumption side as far as conversion matrix is concerned. As there is a general decline on the demand side of the economy, the output of the services sector fall as well. It is interesting to notice that although the relative prices in the machinery sector does not change, the activity level of this sector decreases in all three scenarios as shown in Table 7.5. This because this sector face relatively high VAT. Also, as can be seen from the Table, the decrease in the food processing sector is bigger in cases two and three (-0.08% and -0.13% respectively) than case one (-0.03%). This is because this sector also contributes considerably to the foodstuff sector on the consumption side. Since the demand for foodstuff falls in cases two and three compared to case one on the consumption side (see also Table 7.7), the output of the food processing sector decreases. The tax policy changes result in a fall in the activity levels of petroleum sector (-0.02% in all cases) and electricity, gas and water sector (between -0.05% and -0.08) in all three scenarios as shown in Table 7.5. As shown in the table, the drop in the activity levels of petroleum sector remains the same regardless of tax policy changes. Also the pattern of decrease in the activity levels of electricity, gas and water sector does not change significantly after the tax policy changes. This is because these two sectors also make up substantial amount of intermediate consumption by many other sectors.

7.4. The Analysis of Simulation Results in the Consumption Sectors

With regard consumption side, we expect that our simulations would give rise to an increase of consumption prices in general as every case in the simulations involves a very high increase in the Turkish VAT rates as mentioned before. However, we expect the impact of changes on prices of the consumer goods would be fairly variable depending on the VAT rates that the consumer goods face. Hence, naturally the changes in the consumption prices would change the quantity of consumer goods demanded by the households. The changes in quantities would depend upon mainly

the changes in prices and household income after the simulations. The impact of our simulations on consumption sectors is summarised in tables 7.6 and 7.7.

Table 7.6 presents the percentage changes in consumer goods prices in all scenarios, relative to benchmark equilibrium, caused by the increases in VAT rates with regard to harmonisation.

Table 7.6: Simulation Results for Consumer Good Prices (% Change from Benchmark Equilibrium)

Consumption Demand Sectors	*Case 1*	*Case 2*	*Case 3*
Foodstuff	+1.6	+3.4	+5.3
Tobacco and Alcohol	+3.0	+5.0	+6.9
Clothing	+2.7	+4.6	+6.7
Housing	+2.7	+4.7	+6.8
House Furnishing and Appliances	+2.6	+4.7	+6.8
Transport and Communication	+2.9	+4.6	+6.7
Health and Personal Care	+2.5	+4.5	+6.0
Culture, Education and Entertainment	+0.3	+2.1	+4.0
Other	+3.0	+4.9	+6.8

As can be seen from Table 7.6, as expected the results suggest that the VAT approximation with the EU leads to a considerable changes in consumption prices in all cases in all sectors. The results show us that the prices of all consumer goods vary by the changes in the VAT rates under the different scenarios as far as VAT approximation is concerned. Notice that although the price effects are different, the overall pattern of price changes is similar for most of the sector in all cases. This because the VAT increase in some consumer goods are similar as well.

As expected, in general, the relative prices of all consumer goods increase in all cases as a result of the tax increase. Hence, not surprisingly, the results suggest that the price distortions are mostly reflected on the consumption side of the economy as shown in Table 7.6. As one would expect, in general, the consumption prices in case three become substantially higher relative to cases one and two, since the increase in VAT rates are also higher in the latter case.

Referred to Table 7.6, the results shows that the consumer prices increase by between 0.3% and 3.0% in the first scenario, and between 2.1% and 5.0% in the second scenario, while they went up by between 4.0% and 6.9% in the third scenario. As expected, prices went up substantially in case 3, because in this scenario the increase in VAT rates is the highest.

The lowest price increase occurs for the culture, education, and entertainment sector in all cases (between 0.3% and 4.0%), because this sector carries the reduced VAT rates. The foodstuff sector has the second lowest increase in all cases (between 1.6% and 5.3%), as this sector carries the reduced VAT rates as well. However, the increase in the foodstuff sector is substantially higher than the culture, education and entertainment sector. This is because the statutory VAT rates are lower in the former. As a result, the increase in VAT rates would be higher to put it the same level as the lower band of the Commission's proposals for the reduced rates as far as VAT approximation is concerned.

The increases in the other consumption sectors are similar. This is because they face the similar increases in the standard VAT rates, as far as the Commission's proposals are concerned. However, in general, the last (other) sector in Table 7.6 has slightly higher increase than rest of the sector that carry the standard rate, because the increase in VAT rates in this sector is higher in relative to the other sectors.

Table 7.7 shows the percentage quantity changes in consumer goods caused by the tax policy changes with regard to the benchmark equilibrium.

Table 7.7: Simulation Results for Quantity Changes in Consumption Sectors (% Change from Benchmark Equilibrium)

Consumption Demand Sectors	*Case 1*	*Case 2*	*Case 3*
Foodstuff	+0.49	+0.44	+0.38
Tobacco and Alcohol	-0.88	-1.06	-1.25
Clothing	-0.43	-0.60	-0.76
Housing	-0.42	-0.49	-0.56
House Furnishing and Appliances	-0.42	-0.61	-0.79
Transport and Communication	-0.53	-0.56	-0.59
Health and Personal Care	-0.29	-0.46	-0.63
Culture, Education and Entertainment	+1.91	+2.00	+2.06
Other	-0.78	-0.83	-0.88

As can be seen from the table, the increase in consumer prices, in turn, gave rise to fall quantity in most of the consumer goods after the policy changes. This means the quantity changes in consumption sectors are associated with changes in the prices of consumer goods.[7] The effects of tax policy changes are as expected for most sectors, although quantity changes are in the same direction as prices for the foodstuff and culture, education and entertainment sectors because of substitution effects (see also table 7.6).

Not surprisingly, output decreases in most consumption sectors except for foodstuff, and culture, education and entertainment sectors as shown in Table 7.7. However, the highest quantity decreases are in the second (tobacco and alcohol) and in the last (other) sectors in all cases (between -0.88% and -1.25 % and between -0.78% and -0.88% respectively). This is because the increase in VAT rates is higher relative to the other sectors that carry standard rates as far as the last (other) sector is concerned. The relatively large decreases in the tobacco and alcohol sector in all cases shows us that this sector is more sensitive to the consumer price increases as a result of the tax increase in relative to the other sectors. The output decreases in the other sectors such as clothing (between -0.43% and -0.76%), housing (between -0.42% and -0.56), and health and personal care (between -0.29% and -0.63%) are in a similar pattern in all

[7] However, note that the consumer demand changes more than does the domestic output. In this context, we should mention the role of imports, as it is the import volume that changes to accommodate the reduction in domestic demand, not the domestic output.

cases with the exception of the transport and communication sector in which the pattern of output decrease (between -0.53% and -0.59) does not change significantly as shown in Table 7.7.

It is interesting to notice that consumption increases in foodstuff (0.38% and 0.49%) and culture, education and entertainment in all cases (between 1.91% and 2.06%). This is because the VAT rates in these two sectors are relatively low, since they face super reduced and reduced rates as mentioned before. Thus, although the increase in the VAT rates are relatively high as far as the Commission's proposals are concerned, the consumption increases in these two sectors due to substitution effects. Notice that the increases in consumption of foodstuff sector is in decreasing pattern in the second and third cases, as the prices are substantially higher in last two cases in relative to case one.

The households lose through lower consumption in most of the sectors. Relatively large decreases in the demand for the tobacco, and alcohol, clothing, house furnishing and appliances, and the other goods (last sector) sectors suggest that households as a whole are worse off in terms of these consumer goods, while they are better off with regard to the food and culture education, and entertainment goods and services.

7.5. The Effects of Simulations on Income Distribution

The impact of the tax policy changes with regard to VAT approximation may be studied by analysing the change in income of each household group. In order to assess the distributional impact in each case relative movements of each group must be examined. In this context, we compare the percentage change of each household's real income to examine who gained or lost after the tax policy changes.

Table 7.8 reports estimates of the impact of the tax policy changes on household incomes both gross and net of income tax, relative to the benchmark equilibrium.

Table 7.8: Simulation Results for the Percentage Changes in Households Incomes (% Change from Benchmark Equilibrium)

Households	*Case 1*	*Case 2*	*Case 3*
A: Gross Household Income (Including Transfers) After the Tax Policy Changes			
Urban-Poor	+0.37	+0.46	+0.55
Urban-Middle	+0.30	+0.41	+0.52
Urban-Rich	+0.24	+0.37	+0.50
Rural-Poor	+0.31	+0.42	+0.52
Rural-Middle	+0.25	+0.38	+0.50
Rural-Rich	+0.17	+0.32	+0.47
B: Disposable Household Income (Including Transfers) After the Tax Policy Changes			
Urban-Poor	+1.99	+3.60	+5.19
Urban-Middle	+2.16	+4.01	+5.85
Urban-Rich	+2.70	+5.12	+7.53
Rural-Poor	+1.72	+3.13	+4.55
Rural-Middle	+1.71	+3.18	+4.66
Rural-Rich	+1.90	+3.66	+5.41

As can be seen from the table, the incomes (both gross and disposable) of all households increase as a result of the tax policy changes in every case. However, it is not surprising to observe that a greater increase is recorded in disposable income of all households due to the reduction in the income tax rates after the policy changes. All households also gain relatively small amount of gross income. This is not surprising in spite of the fact that the prices of consumer goods increase in all cases, because all households benefit by an increase in GNP regarding gross income (see also Table 7.10). In general, the households are better off in cases 2 and 3 than case 1, since the increase in GNP is also higher in these last two cases than case one regarding gross income. Also, as the reduction in income tax is higher in cases two and three than case one, the households are better off in these two cases than in case one as far as disposable income is concerned.

From case one of Table 7.8, we can observe that the urban poor household groups enjoy the greatest percentage increases (0.37% and 0.31% respectively) in their gross incomes among the households. Thus, we might say that increasing the VAT rates to the lower level of Commission's proposals favours poorer households in general

regarding gross income, because the price increases in the consumption sectors on which the poor households spend most of their income are relatively low. Also, we should point out that the percentage increases in household gross incomes favour the urban households in case 1 as shown in Table 7.8, as far as regional classification is concerned. In general, although the gross incomes of all households rise, the income increase may be described as progressive, since the poor household groups experience relatively high percentage increases in their gross incomes regarding case 1. On the other hand, the increase in household incomes after tax is much greater than the gross income as expected in case 1, due to reduction in income tax rates as mentioned before. However, not surprisingly, the income increase (net of income tax) can be described as regressive in general, since the richer households enjoy greater percentage increases in their income after the tax policy changes as shown in Table 7.8. Also, as the urban households pay higher percentage of income tax than rural households, they benefit greater amount increase in their disposable income from reduction in income tax rates after the tax policy changes.

As in case 1, Table 7.8 indicates that the largest percentage gains in gross income go to the urban and rural poor household groups (0.55% and 0.52% respectively) in case 3. We might say that the tax policy changes help the poor household groups more than the other household groups in the third scenario. This is easily explained by the changes in relative prices. In other words, as mentioned earlier, the relatively low increase in food prices has a favourable impact on the poor households, as food is such a major item in their budgets. On the other hand, the urban and rural rich household groups enjoy relatively large increase (7.53% and 5.41% respectively) in their disposable income in case 3. This can be largely explained by the fact that the reduction in income tax rates is relatively high in this case. In other words, the relatively high reduction in income tax rates allows the rich households to benefit more as they pay higher income tax. Thus, the drop of the income tax rates has more positive effects on disposable income of rich households, since they pay the largest amount of their income as income tax. However, the urban households gain considerably larger increases than the rural households in their disposable income, due to the reduction in income tax as mentioned before in case 3. In other words, as the urban households receive the larger share of the national income and thus pay higher

income tax, the reduction in income tax allows the urban households to benefit from greater increases in their disposable income.

Once again, the urban and rural poor households enjoy slightly higher percentage increase (0.46% and the rural rich 0.42%) in their gross income in the second scenario as shown in Table 7.8, because of the reason explained above. The middle income households in both rural and urban areas gain the second highest increase in their gross incomes (0.41% and 0.38% respectively), while the lowest increases go the urban and rural rich households (0.37% and 0.32% respectively). On the other hand, the rich households enjoy greater increase (5.12% urban rich and 3.66% rural rich) in their disposable incomes in case 2, due to the reduction in income tax (as in the other two cases). Thus, we observe that although the disposable income increases for all household groups, the gains from the policy changes for the households may be described as regressive, since the rich household groups both in rural and urban areas enjoy higher income gains in cases 2 and 3 as mentioned above.

Hence, from Table 7.8 it seems to be reasonable to state that the redistributive effects of the tax policy changes with regard to tax harmonisation in the EU are likely to be small in all cases, regarding gross income. Nevertheless the redistributive effects of the tax policy changes are in favour of the low income groups in all cases as explained above. However, large decreases in income tax rates lead to redistributive effects against the low income groups in general with regard to disposable income, because the rich households benefit more from reduction in income tax rates as mentioned before. Regarding regional classification, the redistributive effects of the tax policy changes favour the urban households in all cases as far as households' gross income is concerned. This is because the urban households receive relatively a large amount of GNP. As a result, they benefit more from the increases in GNP in all cases. Also, the redistributive effects of tax policy changes favour the urban households in every case regarding disposable income. This is because the urban households own relatively large amount of income and pay greater amount as income tax. Thus, the reduction in income tax rates allows the urban households to benefit more relative to rural households.

As mentioned, all households are better off in terms of income distribution in all cases. The improvement of income levels is explained by the large decline of the income tax burden as mentioned before. We should mention that households tend to save more rather than consuming in spite of the increase in their income level as consumption goods become more expensive.

7.6. The Welfare Effects of Simulations on Household Groups

Economic welfare gains and losses by household groups or in aggregate are usually measured by compensating and equivalent variations.[8] Table 7.9 shows the percentage changes in welfare measures in terms of both equivalent variation and compensating variation among the household groups.

[8] The equivalent variation is the amount of income which would have to be taken from an individual, at the original (before the policy change) relative prices, to leave him or her at an equivalent level of welfare as the pre-policy-change situation, while the compensating variation measures the amount of income which would be required to compensate an individual, at the post-policy-change relative prices, to leave him or her at the initial level of welfare. It can be said that the main difference between these two concepts is the level of utility at which the cost difference because of the price changes is measured. In this context the CV is concerned with the original utility level and EV with the final utility level (see Greenaway et.al. 1993 ,and Pigott and Fuller 1988).

Table 7.9: Simulation Results for the Percentage changes in Equivalent Variation, and Compensating Variation by Household Groups

Households	*Case 1*	*Case 2*	*Case 3*
A: Percentage Changes in Equivalent Variation (EV) by Household Groups			
Urban-Poor	-0.055	-0.159	-0.261
Urban-Middle	-0.056	-1.140	-0.223
Urban-Rich	+0.257	+0.557	+0.843
Rural-Poor	-0.080	-0.179	-0.275
Rural-Middle	-0.188	-0.369	-0.545
Rural-Rich	-0.112	-0.182	-0.250
B: Percentage Changes in Compensating Variation (CV) by Household Groups			
Urban-Poor	-0.056	-0.166	-0.277
Urban-Middle	-0.058	-0..146	-0.237
Urban-Rich	+0.263	+0.581	+0.897
Rural-Poor	-0.081	-0.186	-0.292
Rural-Middle	-0.192	-0.385	-0.579
Rural-Rich	-0.115	-0.190	-0.265

As can be seen from Table 7.9, the tax policy changes alter the welfare of all households in all three scenarios due to increase in consumer prices. The welfare of the households varies by the changes in VAT rates. However, as the Table shows, the greatest redistribution of welfare occurs in case 3. This is not surprising as the increases in VAT rates are also highest in this case. We should mention that the welfare effects in CV are slightly larger than in EV as shown in the table as expected.

As shown in Table 7.9, the results suggest that the welfare of most of the household sectors fall in all three scenarios. The reduction in welfare is explained by the increases in consumer prices. As we mentioned before, households tend to save more, because the consumption goods become more expensive in relative to investment goods. As the table shows, the welfare losses in cases 2 and 3 are larger than in case 1, because the consumer price increases in the last two cases are also higher relative to case 1 as mentioned before. It is clear that the aggregate welfare losses of Table 7.9 are not shared equally by all households. The results suggest that the largest welfare losses in equivalent and compensating variations go to the rural-middle income

groups (between -0.188% and -0.545% in EV, and -0.192% and -0.579% in CV) in all three cases. This can be partly explained by the increase in the prices of house furnishing, clothing, and tobacco and alcohol, because these consumption goods account for a relatively large share of budgets of the rural-middle income household groups. On the other hand, urban-middle households have the lowest welfare losses in both equivalent variations and compensating variations in general (between -0.056% and -0.223% in EV, and between -0.058% and -0.237% in CV) as shown in Table 7.9. This may be partly explained by the relatively low increase in food prices, since food is such a major item in their budgets.

As can be seen from Table 7.9, only the urban-rich households enjoy welfare gains in EV and CV (between +0.257% and +0.843% in EV, and between +0.263% and +0.897% in CV) in all scenarios. This result is not surprising, because these household groups benefit considerably from the reductions in income tax rates as mentioned before (see also Table 7.8). Also, they tend to own relatively large amount of capital so that they can also benefit from the increase in capital income.

The results also suggest that, in general, all of the rural household groups suffer more from welfare reductions than urban household groups in both EV and CV in all cases, as shown in Table 7.9. This can be explained by the fact that the urban households pay a greater amount of their income as income tax in relative to rural households. Thus, the urban households benefit considerably from the decrease in income tax rates (see also Table 7.8).

7.7. The Effects of Simulations on Macroeconomic Variables

In Table 7.10, we present the percentage changes in selected major aggregate macroeconomic variables, such as gross national product (GNP), investment, and wages, relative to the benchmark equilibrium, caused by the tax policy changes in each case.

Table 7.10: Simulation Results for the Percentage Changes in Selected Macroeconomic Variables

Aggregate Variables	*Case 1*	*Case 2*	*Case 3*
Investment	+0.20	+0.41	+0.45
Gross National Product	+0.26	+0.38	+0.50
Wages	+0.55	+0.73	+0.73
Private Consumption	-0.07	-0.16	-0.18
VAT Tax Revenue	+40.17	+84.48	+115.42

As can be seen from the Table, as expected, the tax policy simulations, in general, give rise to changes in the selected macro economic variables. Note that, in general, the effects of the tax policy changes are smaller in case 1 in relative to case 2 and 3. This means that when we approximate the Turkish tax rates to the upper limit of Commission's proposals, the effects on the economy would be larger relative to the lower level of the Commission's proposals.

As can be seen from Table 7.10, real investment goes up in all cases (between 0.20% and 0.45%) as a result of increases in household savings. Note that investment is sensitive to the tax policy changes, as the increases in household incomes and consumer prices would lead to rise in savings as shown in Table 7.10. Not surprisingly, the GNP rises in all cases (between 0.26% and 0.50%) as shown in the table due to increase in investment. Also, the wage increases in all cases (between 0.55% and 0.73%).

Not surprisingly the total private consumption decreases in all cases (between -0.07% and -0.18%) as a result of increase in prices of consumer goods. Notice that, as expected, the largest decrease is in the third case as the consumer prices are the highest in this scenario. The revenue from VAT increases substantially (between 40.17% and 115.42%) after the tax policy changes. This is not surprising as the approximation of Turkish VAT rates to the EU requires Turkey to make substantial increases in the existing VAT rates in 1990. In this study, we decreased the income tax rates in order to reach equal yield tax equilibria. The government could also use this extra revenue on the expenditure side of the economy, such as transfers to the households in order to improve the income distribution amongst the household groups.

7.8. Conclusion

In this chapter, we have presented our numerical results and tried to analyse them in economic terms. As mentioned in this chapter, we have performed three possible reform options in order to approximate the Turkish VAT rates to the EU.

The results of the VAT simulations indicates that the tax reforms would have significant effects on the Turkish economy, mainly on relative prices, resource allocation, the income distribution and the welfare of households. However, we might say that the main conclusions of our simulation results are that the increases in the VAT rates are reflected mostly by the consumption side of the economy as far as VAT approximation is concerned. In this respect, the tax policy changes would increase the relative prices in most of the consumption sectors and thus decrease the output in most of the sectors. On the other hand, the tax policy changes have relatively small effects on the production side of the economy.

The tax policy changes would increase the incomes (both gross and net of tax) of the household groups in all cases, although the rise in the household incomes may be described as regressive in all cases as explained in the chapter as far as gross disposable income is concerned. However, the tax policy changes improve income distribution slightly regarding gross income in all cases. The redistributive effects of tax policy changes are against rural households in terms of after tax income in all scenarios, because the urban households gain greater as a result of reduction in income tax as mentioned before. Also, in general, the tax policy changes have negative effects on rural households' gross income, since they receive a relatively small amount of GDP. Also, the results indicate that the tax policy changes lead to fall in most of the households welfare in equivalent and compensating variations due to increase in consumer goods prices in all scenarios. However, the largest welfare losses go to the rural-middle income groups in equivalent and compensating variations in all scenarios. On the other hand only the urban-rich households enjoy welfare gains in EV and CV in all scenarios. Moreover, the results indicate that investment increases in every case. Thus, as expected, the GNP also increases as a result of increase in investment as mentioned in the chapter. Furthermore, the tax policy changes give rise

to substantial increases in VAT revenue as far as tax harmonisation in the EU is concerned, while the total private consumption falls in every case as a result of increase in consumer prices.

Our simulation results of the VAT reforms appear to be roughly consistent with estimates in the previous literature (see for example, Wajsman 1992, Kehoe et al. 1988, and Kehoe and Serra-Puche 1983). Thus, we might say that the results appear to be sufficiently convincing that useful policy implications can be deduced from the analysis of the results for Turkey as far as the VAT approximation with the EU is concerned.

CHAPTER 8

SUMMARY AND CONCLUSION

In this study we have developed a static computable general equilibrium (CGE) tax model of the Turkish economy to investigate the impact of VAT approximation with the EU on, especially, relative prices, resource allocation and income distribution. The CGE model identified 11 production sectors, 9 consumption sectors, and 6 types of households which were disaggregated according to income size and geographical region. All major Turkish taxes were included in the model. In line with many studies, for example, Kehoe et al. (1988), Serra-Puche (1984), and Wajsman (1992), Cobb-Douglas production functions were employed on the production side of the economy. Cobb-Douglas utility functions were also utilised on the consumption side. With regard to foreign trade Turkey is modelled as a small country. On the import side, domestically produced and imported goods are assumed to be imperfect substitutes following Armington assumption. Domestic production is split between exports and domestic market sales according to a constant elasticity of transformation (CET) function. In the model, the government has several functions. Firstly, it receives revenue from imposing taxes. Secondly, it transfers some of its revenues to the households. Moreover, it consumes exogenously given amounts of producer goods in fixed proportions and saves the rest of its revenue for investment. Finally, the parameters of the model were calibrated to a 1990 benchmark equilibrium set.

A CGE modelling approach is an appropriate method for analysing the impact of policy changes on the different component sectors of an economy. The use of CGE modelling has been grown rapidly in recent years, probably because of the widespread feeling that it has many advantages over more macro-oriented aggregated models or analytical partial equilibrium analysis. One of most important advantages of CGE modelling lies in its microeconomic foundations, because the behaviour of all economic agents such as consumers, producers, and government is specified in a typical CGE model. In addition, unlike many alternatives, the CGE methodology allows the study of differential impacts across sectors, since considerable

disaggregation of commodities and household groups is possible, specifically in static models. This allows a more general representation of tax distortions, which treats alternative agents, factors and commodities differently. On the other hand, as with any form of economic analysis, CGE analysis has some limitations. For example, the lack of empirical validation of the CGE models in a sense that there is not any measure of the degree to which the model fits the data or tracks the historical facts. In addition, the economic richness of the model does not allow for the simultaneous estimation of all parameters. Therefore, some of the parameters in the benchmark data sets are based on the modellers' judgement or are point estimates from secondary sources. In spite of its limitations, the CGE approach represents an advance over other methods by offering a unifying framework that can highlight channels of interdependence that partial equilibrium analysis would not cover. The core of the CGE approach is that everything depends upon everything else. Thus, interdependencies and feedbacks among the policy instruments as well as sectors have important effects on results, yet in practice are difficult to model in anything other than a general equilibrium framework. The main idea underlying the general equilibrium analysis of tax policy is that in order to evaluate the effects of changes in a major tax, important economy-wide effects must be taken into account. As we have mentioned before, the changes in Turkish VAT rates would have varying effects on the various production and consumption sectors, and on the different household groups of the economy. Thus, only a CGE model would make it possible to capture these effects without ignoring the simultaneous adjustments of the main economic variables. Having these considerations in mind, a CGE approach seemed to be the most appropriate choice for the aim of the study.

The main method of the analysis used is the counterfactual equilibrium approach. This requires the assumption that the Turkish economy is in equilibrium in the presence of the tax policies. Based on this equilibrium assumption, we constructed a social accounting matrix (SAM) for Turkey using data for the year 1990, the latest data available to us. The SAM was constructed from several sources, such as input-output transactions tables, national income accounts, household income and consumption expenditure surveys, and taxation statistics and other unpublished sources from government agencies. The input-output table for 1990 (the latest year available)

contains the most detailed information on separate industries and provided the starting point for the SAM. The input-output data were expanded to incorporate demands and incomes of households from other sources and explicitly incorporate an external sector balance condition which is not present in the input-output data. As the data set for the model is so comprehensive, the sources are necessarily divergent. For example, household income from employment is not the same as the payments to labour by the sectors. Therefore, a number of adjustments were made to ensure that each part of the data is consistent with the rest so that we can use all data together. In order to ensure consistency, for example, all data on industry are taken to be fixed, while data on household incomes and expenditures are correspondingly adjusted by using the Row and Column Sum (RAS) method. Thus, the parameter values for the functions in the model are calculated from the benchmark data set using the equilibrium conditions of the model, such as demand equal supplies for all products, all agent's demands satisfy their budget constraint, and external sector transactions are in balance. We should note, however, that the data set provided by the SAM is not sufficient to solve for the model parameters. Therefore, some parameter values such as the trade elasticities are taken from Lewis and Urata (1983). The GAMS (General Algebraic Modelling System) software package programme developed by Brooke, Kendrick, and Meeraus (1988) is used to calibrate and solve the Turkey CGE model. Then the counterfactual analysis involves the introduction of tax policy changes in Turkey as far as VAT harmonisation in the EU is concerned. This method is in the tradition of comparative static theoretical work. However, our analysis is conducted within an empirically based computable general equilibrium model. In this study, the focus has been on the effects of the tax policy changes on relative prices, resource allocation, and income distribution and welfare changes amongst the households.

Turkey has already introduced VAT as the main turnover tax, but, although she has already made some progress in the direction of VAT harmonisation, some differences remain. The tax changes proposed by the Commission require Turkey to increase most VAT rates, but also, following the Commission's 1987 proposals to abolish higher rates. It is assumed throughout the study that the destination principle is to be retained for the foreseeable future. Therefore, rather than considering the introduction

of a radically new tax structure, the thesis has mainly focused on the adjustments of the tax rates to confirm with EU Commission proposals.

We performed our simulations by applying three alternative scenarios to the CGE model of Turkey. In brief, the first scenario corresponds to an approximation of the Turkish VAT rates in 1990 to the lower limit of the ranges proposed by the Commission. In this first scenario (first case), the existing super-reduced (1%) and reduced rate (5%) of VAT rates are combined into one rate of 4%, while the standard rate (10%) is increased to 14%. The higher rate 20% is abandoned and the standard rate of 14% is applied to these goods and services. In the second scenario (second case), the super reduced and reduced rates are combined into one rate of 6.5%, whilst the standard rate is increased into 17% allowing a 2.5% point variation for the reduced rates and a 3% point variation for the standard rate around the central cases. In the third scenario (third case), we alter the tax rates according to the upper limit of the Commission's proposals (9% reduced rate and 20% standard rate. Thus, three different equilibria were calculated as far as VAT approximation is concerned.

The results of the VAT simulations indicate that the tax reforms would have significant effects on the Turkish economy. With regard to the production side of the economy, the tax policy changes would have small effects on production sectors relative to consumption sectors. In this respect, the tax reforms regarding VAT approximation would lead to a general price increase in many sectors, namely, agriculture, mining, light intermediates, construction, and services. However, as expected the largest price increase amongst these production sectors is in the construction sector in all cases (between 1.0% and 2.7%). This is because there is no consumer demand for the production of this sector. On the other hand, the tax reforms would give rise to a general price decline in three sectors, namely, textiles, petroleum, and electricity, gas and water in all cases. However, the highest price drop is in the electricity, gas and water sector in all cases (between 4.5% and 5.9%), because the amount of VAT paid by this sector is relatively high. As a consequence of this, increases in VAT rates would give rise to reductions in prices in this production sector. The results also suggest that the activity levels of three sectors (agriculture, light intermediates, and construction) increase, while the output decreases in the rest

of the sectors in all cases. As expected, the largest increases in activity levels take place in construction sector (between 0.20% and 0.66%), because the intermediate and consumption demand are absent in this sector. The drop in the activity levels of the rest of the sectors is largely explained by the consumption side of the economy. This means the consumer prices increases reduce the demand of goods, and thus result in lower production in most of the sectors.

However, as expected, one of the major conclusions of our simulation results is that the increases in the VAT rates are reflected mostly in the consumption side of the economy because the tax is imposed on consumer goods. In this respect, the tax policy changes would lead to increases in consumption prices in all sectors and thus decrease the output in most of the sectors in all scenarios considered. However, in general, the prices of consumer goods in case 3 are substantially higher relative to cases 1 and 2 as expected, since the increase in VAT rates are also higher in case 3. The results indicate that the consumer prices increase by between 0.3% and 3.0% in the first case, and between 2.1% and 5.0% in the second case, while they went up by between 4.0% and 6.9% in the third case. The foodstuff and culture, education, and entertainment sectors have relatively low increase (between 1.6% and 5.3%, and 0.3% and 4.0% respectively) in all cases, since these two sectors carry the super-reduced and reduced rates. As a result of increases in the prices of consumer goods, output decreases in most of the consumption sectors (between -0.29% and -0.88% in the first case, between -0.46%, -0.83% in the second case, and between -0.56 and -0.88 in the third case). On the other hand, output increases in foodstuff (between 0.38% and 0.49%), and culture education and entertainment (between 1.91% and 2.06%) in all cases, because these two sectors face relatively low VAT rates as mentioned before. Thus, the households lose through lower consumption in most of the sectors.

As far as income distribution is concerned, although the incomes (both gross and disposable) of all households increase in all cases, our analysis suggest that, in general, the households are better off in cases 2 and 3. However, as expected, the larger gain is recorded in disposable income of all households because of the reduction in the income tax rates after the tax policy changes. In percentage terms, the poor households (both urban and rural) enjoy greatest increase (between 0.37% and

0.55% and 0.31% and 0.52% respectively) in their gross income in all cases. Thus, we might say that the income distribution improves as a result of tax policy changes regarding gross income. However, we should point out that the difference in percentage changes in household gross incomes is relatively small in all cases. On the other hand, although all households enjoy larger increases in their real incomes, large decreases in income tax rates and increases in relative prices of consumer goods lead to considerable redistributive effects against low income groups in all cases with regard to disposable income. As far as regional classification is concerned, the redistributive effects of the tax policy changes favour the urban households in every case regarding disposable income, since the urban households own relatively larger amount of national income and pay greater amount as income tax. Hence, the reduction in income tax rates allows the urban households to benefit more in relative to rural households. Also, the redistributive effects of the tax reforms favour the urban households slightly in all cases as far as gross income is concerned. This is because the urban households receive a relatively large amount of GNP. Hence, they benefit more from increases in real GNP in all cases.

Our analysis also indicates that the tax policy changes would have a negative overall impact on welfare of household groups due to increase in consumer prices. The largest welfare losses in equivalent variation (EV) and compensating variation (CV) go to the rural-middle income groups (between -0.188% and -0.545% in EV, and -0.192% and -0.579% in CV) in all scenarios. This may be partly explained by the increases in the relative prices of house furnishing, clothing, tobacco and alcohol, since these consumption goods account for a relatively large share of budgets of the rural-middle income household groups. On the other hand, the lowest welfare losses in EV and CV (between -0.056% and -0.223% in EV and between -0.058% and -0.237% in CV) go to the urban-poor household groups in all cases in general due to low increase in food prices which account for a major item in their budgets. Only the urban-rich households enjoy welfare gains in EV and CV (between +0.257% and +0.843% in EV, and between +0.263% and +0.897% in CV) in all scenarios. This is not surprising, since these household groups benefit considerably from the reductions in income tax rates. The results also suggest that all of the rural households suffer more from welfare losses than the urban households in both EV and CV in all scenarios,

because the urban households pay greater amount of their income as income tax in relative to rural households. As a result, the urban households benefit relatively considerable amount from the decrease in income tax rates.

We have also analysed the effects of the tax policy changes on selected macro economic variables such as GNP, investment, and total private consumption. The results suggest that investment rises in all cases (between 0.20 % and 0.45%) due to increase in household savings. The GNP also increases (between 0.26% and 0.50%) as a result of increase in investment, while the total private consumption falls (between -0.07% and -0.18%) due to increase in consumer prices in all cases. On the other hand, as expected the VAT revenue increases after the tax policy changes regarding VAT harmonisation in the Union. Not surprisingly, the highest increase is in the third case (115.42%) where we increase the VAT rates to the upper level of the Commission's 1987 proposals. Income tax rates were decreased to ensure revenue neutrality. In effect this means the government budget is always in balance. Alternatively, one could have increased government expenditure in line with increased VAT revenue to ensure a balanced budget. For example, the government could use this extra income to improve the income distribution through transfer payments rather than decreasing the income tax rates (which is regressive).

However, the model used in this study has a few potential shortcomings. Firstly, the model is within a purely static framework. Therefore, needless to say, the static nature of the model advises us to be cautious in the analysis of the results. Especially, when analysing the macro phenomena, such as investment or savings, which have a clear dynamic and intertemporal dimension, it is difficult to draw strong conclusions. For example, the model tells us that investment will increase after tax policy changes. As a result, one could argue that a high rate of investment could induce a higher growth rate and this would give rise to higher real income levels over time. Also, we would like to analyse the optimal design of transfers and receipts by taking into account the changing composition of the population. The natural framework to analyse this type of question requires a dynamic intertemporal model. However, constructing a dynamic general equilibrium model is beyond the scope of this study, as we are only interested in the medium term effects of the tax policy changes regarding tax harmonisation in

the Union. Moreover, the functional forms used in the model could be replaced by more flexible ones such as constant elasticity of substitution (CES) functions. Furthermore, a model with a hierarchy of labour types, and with the possibility of unemployment would undoubtedly be more attractive. Similarly the aggregation of all factors of production apart from labour into one capital good is another weakness of the model. However, some of these issues such as disaggregation of factors of production are closely related to the lack of data.

In spite of its shortcomings, the model produces results that are both interesting and plausible. It provides us with a flexible policy tool that is sensitive to market interdependencies and general equilibrium feedback. Our simulation results of the VAT reforms appear to be roughly consistent with the previous literature estimates (see for example, Wajsman 1992, Kehoe et al. 1988, and Kehoe and Serra-Puche 1983). Thus, we might say that the results appear to be sufficiently convincing that useful policy implications can be deduced from the analysis of the results.

Our discussion in this study indicates that one of the most important products of the general equilibrium modelling exercise is that it explores the important area of future research. There are many other important issues associated with tax harmonisation in the Union which can be addressed by using the model or extending it accordingly. For example, while the present model considers the retention of destination principle, one could also take the origin principle into consideration. Also we modelled the excise duties as output taxes, as the main concern of this study is VAT. One could easily model the excise duties as consumption taxes in order to see the effects of indirect tax harmonisation in general. Furthermore, one could dissagregate the labour into labour types to study the effects of the tax policy changes on employment. This is only a partial list of the issues along which research have not been carried out. Thus, many more exciting areas of research can be explored.

APPENDIXES

APPENDIX 1

A: VAT Exemptions in Turkey

1. The leasing of immovable property which except for the immovable included in the business assets is exempt from VAT;

2. The delivery of immovable property by the corporations (excluding corporations engaged in immovable property trade) is exempt from VAT;

3. The deliveries of residences of less than 150 square metres in area and deliveries to house building co-operative societies by building contractors are exempt from VAT until 31 December 1997.

4. Transfer of a business in the form of a sole proprietorship by the reason of death to the legal beneficiaries is exempt from VAT with the condition that the beneficiaries carry on the same business at the book values of all assets liabilities unchanged;

5. Transactions carried out by banks and insurance companies that fall within the scope of banking and insurance transactions tax are exempt from VAT;

6. Deliveries of unprocessed gold, foreign exchange, money, stocks and bonds, tax and duty stamps, vehicle tax stamps, official stamps and papers exempt from VAT;

7. Deliveries by the public institutions where banknote, coins and official stamps are exempt from VAT;

8. The following goods and services delivered by national and local public institutions, universities, political parties, trade unions, non-profit organisations, agricultural co-operative societies, social security institutions and other officially qualifying organisations, in performance of their regular activities are exempt from VAT :

a) Goods and services delivered at hospitals, clinics, dispensaries, human blood and organ banks, public parks, monuments, botanical and zoological gardens, veterinarian bacteriological, serological and similar laboratories, school dormitories, orphanages and homes for the aged;

b) Goods and services delivered at theatres, concert halls, libraries, sports facilities, reading rooms and conference halls;

c) Goods and services deliveries for the purpose of promoting and encouraging scientific, artistic, and agricultural activities;

d) All kinds of deliveries without any compensation to the above organisations;

9. Supply of water for agricultural purposes and land improvement services rendered by public institutions, agricultural co-operative societies and farmers unions are exempt from VAT;

10. Deliveries of military factories, shipyards and workshops, in accordance with their statutory objectives, are exempt from VAT;

11. Goods and services delivered to the small traders who engaged in agricultural activities including forestry and fishing are exempt from VAT;

12. All kinds of deliveries by the small traders are exempt from VAT;

13. Importation of certain goods that are exempt from customs duties according to the Customs Law are exempt from VAT as well. These included:

a) Samples and models of products that are of no commercial value;

b) All kinds of military equipment for the army;

c) Publications to be distributed free of charge for advertisement purpose;

d) Goods required for official or personal use by diplomatic or consular officials and their families within certain restrictions subject to the condition of reciprocity;

e) Personal luggage of passengers;

f) Goods imported for the personal use of the president or the presidential residence;

g) Households articles of individuals moving back to Turkey after having been resident abroad for at least two year;

h) Articles intended for display at exhibitions or fairs;

i) Goods donated for social, cultural and health purposes.

Source: Kocahanoglu (1991), Tax Acts.

B: Zero VAT Rating in Turkey

Value Added Tax is zero rated on the following goods and services:

1. Exported goods and services;

2. Deliveries of sea air and railway transportation to be employed for business purposes and deliveries related to their maintenance and repair;

3. Services supplied at harbours and airports for vessels and aircraft;

4. Deliveries to persons engaged in petroleum explorations activities within the scope of Petroleum Law;

5. International transportation and deliveries of goods and services;

6. Deliveries to embassies, consulates and diplomatic and consular agents subject to the condition of reciprocity;

7. Deliveries to international institutions and foreign agents connected with such institutions, to the extent that the exemption is granted by an international agreement;

Source: Kocahanoglu (1991), Tax Acts.

APPENDIX 2

LIST NO : 1 (Deliveries Subject to 1 percent tax rate)

1. Dried figs, grapes and apricots, hazel-nut, pistachio nut, walnut;
2. Raw cotton;
3. Natural nuts, with shells; pistachios, not cracked and dried; pine nut with shells derived from pine cones;
4. Saps and extracts of liquorice ; anise, bay leaves, thyme, apricot stones, plum stones, nuts (shelled but not processed) and some other raw vegetable materials of a kind;
5. Seeds of sunflower, sesame, poppy and hemp;
6. Wheat flour and bread, raw wheat, barley, corn, oats, lentil rye, maize, unhusked rice, soyabean, bean dried, small reddish bean, chickpea and beet;
7. Natural goat and sheep skin;
8. Vetches;
9. Deliveries or lease of goods subject to financial leasing by the financial lessors;
10. Animals for butchery (except poultry and fish) and their meat (except the meat products of a kind manufactured with a contribution material).

Source: Kocahanoglu (1991), Tax Acts.

APPENDIX 3

LIST NO : 2 (Deliveries Subject to 5 percent tax rate)

1. Poultry, fish and their meat (except the meat products of a kind manufactured with a contribution material);
2. Milk and yoghurt (not concentrated or sweetened); white cheese, olive, dried tea and egg:
3. Beet sugar in solid form (caster, cube, granulated sugar);
4. Animal feed (used in producing meat, and milk, fish, egg and honey) and fish flour, meat and bone flour, blood flour;
5. Bulgur, semolina, macaroni, rice in the husk and rice;
6. Vegetable margarine and oil for human consumption, butter and raw oil used in the production of olive, sunflower oil, cotton-seed oil and cooking oil
7. Fresh fruits and vegetables, potatoes, onions and garlic;
8. Deliveries of natural gas;
9. Newspaper, periodicals, books and similar publications (except pornographic publications);
10. Newsprint;
11. Tickets for cinema, theatre, opera and ballet;
12. Deliveries of tachometer for the bus and truck.

Source: Kocahanoglu (1991), Tax Acts.

APPENDIX 4

LIST NO : 3 (Deliveries subject to 20 percent tax rate)

1. Caviar and caviar substitutes;

2. Eau de cologne, lotions, perfumes, lipsticks, deodorants;

3. Raw furskin of foxes, rabbits, martens, caraculs and astrakhans, minks and others;

4. Tanned or dressed rabbit, squirrel, fox, caraculs and astrakhan, mink and other furskin (including furskin assembled in plates, squares, cross and similar forms);

5. Pieces or cuttings of furskin tanned or dressed (not being fabricated);

6. Articles of furskin of a kind commonly used in machinery and dressing or accessory of dressing;

7. Other articles of furskin not used in machinery, and dressing;

8. Artificial furs and articles made thereof;

9. Machine or hand-made, edge-worked or engraved crystal glassware of a kind commonly used for table or kitchen;

11. Crystal Pyrex glassware of a kind commonly used for table or kitchen;

12. Other machine or hand-made crystal glassware of a kind commonly used for table or kitchen;

13. Crystal glassware for toilet, office, indoor decoration or for similar purposes;

14. Unprocessed diamond, including brilliants, (not for industrial uses);

15. Processed or unprocessed, natural or not, pearls but not mounted, set or strung (whether ungraded pearls strung for convenience of transport or not);

16. Crystal chandeliers;

17. Emerald ruby and other precious stones, cleaved (not for industrial uses);

18. Diamonds (including brilliants), emerald, ruby and other precious stones (not for industrial uses)

19. Synthetic or reconstructed stones (not for industry);

20. Dust and powders of synthetic or precious stones;

21. Necklaces, bracelets, or other articles consisting of pearls, simply strung without fasteners or other accessories;

22. Other articles consisting of pearls;

23. Necklaces, bracelets or other articles of precious stones, simply strung without fasteners or other accessories;

24. Necklaces, bracelets or other articles of precious stones, whether strung or not, with fasteners or other accessories;

25. Necklaces, bracelets or other articles of stones, synthetic or incorporated whether strung or not, with or without fasteners or other accessories;

26. Air conditioning machines (comprising a motor driven fan and elements for changing the temperature and humidity of air);

27. Electrical refrigerator used for domestic purposes; deep freezers;

28. Non-electrical water heaters and flash heaters;

29. Cloth-dryers, electrically operated, each of a dry linen capacity not exceeding 6 kg;

30. Dish washing machines, electrically operated, with or without provision for drying;

31. Clothes-washing machines, electrically operated, used for domestic purpose (each of a dry linen capacity not exceeding 6 kg.);

32. Clothes drying machines, electrically operated, used for domestic purposes (except centrifuges);

33. Clothes-washing and clothes-drying machines, non-electrical, used for domestic purposes;

34. Electrical vacuum cleaners, mixers, fruit-juice extractors, food grinders and other electro-mechanical appliances (with self contained electric motor) used for domestic purposes;

35. Electrical water-heaters and flash-heaters;

36. Electro-thermic domestic oven and other electro-thermic domestic appliances;

37. Radio telephonic, radio telegraphic transmission and radio-broadcasting and television transmission and reception apparatus (including receivers incorporating sound recorders or reproducers) and television cameras;

38. Passengers cars (with engines whether have a spark ignition or a compression ignition or not);

39. Sea-going vessels weighing more than 100 kg. and up to 1000 gross tons (for sport and entertainment purposes);

40. Record- players; tape decks, other sound recorders or re-producers;

41. Television image and sound recorders or re-producers (video tape decks or others);

42. Video tapes, recorded or prepared for recording but not recorded (with or without a cassette); and video records.

43. Mobile telephones.

44. TV cameras.

45. Radio with alarm

46. Services of cable TV.

47. The leasing of plane and helicopter.

48. Motor-cycle and motor-bikes

49. All kinds of fire-arms and similar arms including for sports and entertainment purposes.

50. Game machine (betting activities) for entertainment.

Source: Kocahanoglu (1991), Tax Acts

APPENDIX 5

A SUMMARY OF DATA SET FOR THE TURKEY CGE MODEL[1]

Table A.1: Conversion (Z) Matrix Linking Producer and Consumer Good Classifications after Consistency Adjustments

	Consumer Good Classification								
	1	2	3	4	5	6	7	8	9
Producure good Classification	Foodstuff	Tobacco and Alcohol	Clothing	Housing	House-Furnishing	Health	Transfer and Commun.	Culture, Edu. and Entart.	Other
1) Agriculture	0.638246	0.000000	0.000000	0.000000	0.000000	0.043038	0.000000	0.000000	0.062114
2) Mining	0.000000	0.000000	0.000000	0.026651	0.000000	0.000000	0.000000	0.000000	0.000000
3) Food-proccessing	0.237907	0.779245	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.251568
4) Textiles	0.000000	0.000000	0.444667	0.000000	0.086662	0.000000	0.000000	0.000000	0.104756
5) Light-Intermediates	0.000000	0.000000	0.067622	0.041409	0.071066	0.000000	0.000000	0.246651	0.077474
6) Petroleum	0.000000	0.000000	0.000000	0.140177	0.000000	0.000000	0.000000	0.000000	0.000000
7) Basic-intermediates	0.000000	0.000000	0.000000	0.000000	0.207636	0.459450	0.000000	0.000000	0.124919
8) Machinery	0.000000	0.000000	0.000000	0.000000	0.406095	0.000000	0.126555	0.000000	0.122016
9) Electricity-gas-Water	0.000000	0.000000	0.000000	0.039577	0.000000	0.044465	0.000000	0.000000	0.000000
10) Construction	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
11) Services	0.123847	0.220755	0.487711	0.752185	0.228541	0.453047	0.873445	0.753349	0.257153
Total	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

[1] The more detail of data used in this study is presented in GAMS code for the Turkey CGE model.

Table A.2: Household Cobb-Douglas Preference Parameters for the nine Consumer Goods Other Than Savings

		Household Groups					
Consumer Goods		Urb-Poor 1	Urb-Midd 2	Urb-Rich 3	Rur-poor 4	Rur-midd 5	Rur-rich 6
1	Food	.3781	.2944	.1971	.4154	.3690	.3384
2	Tob-alc	.0535	.0418	.0267	.0688	.0517	.0504
3	Clothing	.0932	.1120	.1000	.1179	.1297	.1002
4	Housing	.1739	.2102	.2134	.1173	.0909	.1199
5	House-fur	.1512	.1410	.1528	.0894	.1740	.1721
6	Health	.0316	.0335	.0321	.0350	.0265	.0250
7	Tran-Com	.0648	.0932	.1984	.0791	.0884	.1262
8	Cult-Edu	.0374	.0449	.0504	.0409	.0346	.0333
9	Other	.0163	.0290	.0292	.0362	.0351	.0344

Table A.3: Input-Output Coefficients

	Agricult	Mining	Food Pr	Textiles	Light Inter	Petrol	Basic Int	Machine	El-Gas-W	Construc	Services
	1	2	3	4	5	6	7	8	9	10	11
1 Agriculture	0.170745	0.009561	0.345263	0.076119	0.094964	0.000000	0.000630	0.000652	0.000407	0.000011	0.010799
2 Mining	0.000126	0.002335	0.003702	0.000217	0.000843	0.000133	0.037947	0.001161	0.043401	0.020717	0.001459
3 Food Processing	0.020697	0.000568	0.159143	0.014281	0.000631	0.000000	0.004373	0.000106	0.000174	0.000000	0.012391
4 Textiles	0.001528	0.001038	0.003799	0.312180	0.006401	0.000115	0.001055	0.003004	0.000996	0.000000	0.001447
5 Light Intermediates	0.004517	0.004168	0.016007	0.005989	0.251855	0.001086	0.008305	0.027274	0.003195	0.070952	0.013813
6 Petroleum	0.023753	0.054567	0.013675	0.005814	0.020045	0.402167	0.059098	0.011304	0.088071	0.020172	0.051759
7 Basic Intermediates	0.030212	0.024146	0.018840	0.013359	0.077774	0.009128	0.278175	0.342188	0.005328	0.243869	0.009731
8 Machinery	0.004030	0.029838	0.008035	0.004995	0.008370	0.001455	0.017540	0.268567	0.041571	0.045020	0.022467
9 Electricity, Gas and Water	0.002437	0.037865	0.014749	0.024721	0.046401	0.004919	0.043864	0.016389	0.052484	0.003634	0.006125
10 Construction	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
11 Services	0.075694	0.071221	0.110722	0.203731	0.138954	0.040916	0.129927	0.191031	0.070261	0.148091	0.123913

Table A.4: A Summary of Production Data, 1990 (Billions, TL)

	Intermediate Input	Indirect Taxes	Wages	Profits	Employment (1000 Person)	Capital Stock
Production Sectors						
1 Agriculture	41808.251	-578.938	7443.283	58674.269	9221	77090.8
2 Mining	4562.535	189.224	1968.535	1895.730	223	37818.1
3 Food Processing	13697.223	1350.967	3499.499	7246.272	242	21098.1
4 Textiles	13606.991	684.801	3200.631	9088.037	833	23997.9
5 Light Intermediates	17788.154	424.831	2294.285	5320.174	460	34908.7
6 Petroleum	35471.863	6907.940	420.302	5613.245	21	30534.9
7 Basic Intermediates	51151.690	583.344	5499.832	8608.863	663	46518.9
8 Machinery	20627.730	2121.530	4548.941	8723.035	651	27632.9
9 Electricity, Gas and Water	9103.010	788.754	2433.993	3732.416	11	83593.6
10 Construction	0.000	987.853	13317.919	9956.483	904	130181.6
11 Services	83430.179	7054.008	62475.300	1048117.739	6345	212899.6

Table A.5: Trade Data and Parameters

	Imports	Tariffs	Exports	Elasticity of Substitution	Elasticity of Transformation	Elasticity of Export Demand
Production Sectors						
1 Agriculture	2962.968	712.732	2821.018	1.8	1.8	1.0
2 Mining	1260.866	81.798	505.556	1.4	1.4	1.0
3 Food Processing	3912.944	1419.125	5086.312	1.2	1.2	1.0
4 Textiles	2833.575	138.208	11206.502	1.2	1.2	4.0
5 Light Intermediates	1711.621	656.307	567.725	1.1	1.1	4.0
6 Petroleum	11756.149	1828.510	767.407	0.6	0.6	4.0
7 Basic Intermediates	18866.037	2936.247	5670.666	0.5	0.5	4.0
8 Machinery	21629.678	5622.865	2595.508	0.5	0.5	4.0
9 Electricity, Gas and Water	13.567	1.049	114.501	0.8	0.8	4.0
10 Construction	0.000	0.000	0.000	0.8	0.8	4.0
11 Services	4086.957	0.000	22726.360	0.7	0.7	4.0

Table A.6: SAM for Turkey in Million Turkish Liras, 1990.

			EXPENDITURES								
			Activities	Commod	Labour	Capital	Urban HH	Rural HH	Governm	Capital Ac	ROW	
			1	2	3	4	5	6	7	8	9	Total Rec
R	Activities	1	0	616714104	0	0	0	0	0	0	52061555	668775659
E	Commodities	2	291247626	0	0	0	170740313	91465623	43083466	102608279	0	699145307
C	Labour	3	107102520	0	0	0	0	0	0	0	0	107102520
E	Capital	4	249911199	0	0	0	0	0	0	0	0	249911199
I	Urban Households	5	0	0	21162178	190189944	0	0	0	0	0	211352122
P	Rural Households	6	0	0	85940342	59721255	0	0	0	0	0	145661597
T	Government	7	20514314	13396841	0	0	13582003	7464981	0	0	0	54958139
S	Capital Account	8	0	0	0	0	27029806	46730993	11874673	0	16972807	102608279
	Rest of the Worlds (ROW)	9	0	69034362	0	0	0	0	0	0	0	69034362
	Total Expenditure		668775659	699145307	107102520	249911199	211352122	145661597	54958139	102608279	69034362	

APPENDIX 6

THE GAMS MODE FOR THE TURKEY CGE MODEL

```
$TITLE A GENERAL EQUILIBRIUM MODEL FOR TURKEY (TURCGE, SEQ=81)
$ONTEXT
  THIS GENERAL EQUILIBRIUM MODEL OF TURKEY FOR THE YEAR 1990 IS
  USED TO ANALYSE THE CHANGES IN INDIRECT TAXES WITH REGARD TO TAX
  HARMONISATION IN THE EU. IT FOLLOWS CLOSELY THE STYLE AND TYPE
  OF MODEL PIONEERED BY SHOVEN AND WHALLEY FOR TAX POLICIES .
$OFFTEXT

 SET I        SECTORS    / AGRIC       AGRICULTURE
                           MINING      MINING
                           FOOD-PRO    FOOD PROCESSING
                           TEXTILES    TEXTILES
                           LIGHT-INT   LIGHT INTERMEDIATES
                           PETROL      PETROLEUM
                           BASIC-INT   BASIC INTERMEDIATES
                           MACHIN      MACHINERY
                           ELEC-GAS    ELEC.GAS WATER
                           CONST       CONSTRUCTION
                           SERVI       SERVICES /

      HH HOUSEHOLD TYPE /URB-POOR      URBAN POOR(BOTTOM 40%)
                         URB-MIDDLE    URBAN MIDDLE(MIDDLE 40%)
                         URB-RICH      URBAN RICH(TOP 20%)
                         RUR-POOR      RURAL POOR(BOTTOM 40%)
                         RUR-MIDDLE    RURAL MIDDLE(MIDDLE 40%)
                         RUR-RICH      RURAL RICH (TOP 20%)     /

     C CONSUMER GOODS /FOOD            FOOD
                      TOB-ALCH         TOBACCO AND ALCOHOL
                      CLOTH            CLOTHING
                      HOUS             HOUSING
                      HOUS-FUR         HOUSE FURNISHING AND APPLIANCES
                      TR-COM           TRANSPORTATION AND COMMUNICATION
                      HE-PC            HEALTH AND PERSONAL CARE
                      CU-EDU           CULTURE EDUCATION AND
ENTERTAINMENTS
                      OTH              OTHER /

      F FACTORS      /LAB              LABOUR
                      CAP              CAPITAL/

      IT(I)   TRADED SECTORS
      IN(I)   NONTRADED SECTORS

      ALIAS (I,J),(C,CCD), (F,FF)


PARAMETERS DELTA(I) ARMINGTON FUNCTION SHARE PARAMETER
(UNITY)
           AC(I)        ARMINGTON FUNCTION SHIFT PARAMETER
(UNITY)
           RHOC(I)      ARMINGTON FUNCTION EXPONENT
(UNITY)
           RHOT(I)      CET FUNCTION EXPONENT
(UNITY)
           AT(I)        CET FUNCTION SHIFT PARAMETER
(UNITY)
           GAMMA(I)     CET FUNCTION SHARE PARAMETER
(UNITY)
```

```
            THETA(C)     WEIGHTS IN NUMERIA INDEX
(UNITY)
            ETA(I)       EXPORT DEMAND ELASTICITY
(UNITY)
            AD(I)        PRODUCTION FUNCTION SHIFT PARAMETER
(UNITY)
            YH0(HH)      VOLUME OF TOTAL INCOME BY HOUSEHOLD TYPE
            YDH0(HH)     DIPOSABLE INCOME OF HOUSEHOLDS
            GLES(I)      GOVERNMENT CONSUMPTION SHARES
(UNITY)
            SL0(HH)      SHARE OF LABOUR INCOME BY HOUSEHOLD TYPE
(UNITY)
            SC0(HH)      SHARE OF CAPITAL INCOME BY HOUSEHOLD TYPE
(UNITY)
            SR0(HH)      SHARE OF REMITTANCES BY HOUSEHOLD TYPE
(UNITY)
            TR0(HH)      SHARE OF TRANSFERS FROM GOVERNMENT
(UNITY)
            MPS0         MARGINAL PROPENSITY TO SAVE BY HOUSEHOLDS
(UNITY)
            TV0(C)       VAT RATES FOR CONSUMER GOODS
(UNITY)
            TEX0(C)       EXCISE DUTY RATES
(UNITY)
            DEPR(I)      DEPRECIATION RATES
(UNITY)
            DSTR(I)      RATIO OF INVENTORY INVESTMENT TO GROSS OUTPUT
(UNITY)
            KIO(I)       SHARES OF INVESTMENT BY SECTOR OF DESTINATION
(UNITY)
            TM0(I)       TARIFF RATES
(UNITY)
            TE(I)        EXPORT DUTY RATES
(UNITY)
            ITAX(I)      INDIRECT TAX RATES
(UNITY)
            HTAX(HH)     INCOME TAX RATE BY HOUSEHOLD TYPE
(UNITY)
            ALPHL(I)     LABOR SHARE PARAMETER IN PRODUCTION FUNCTION
(UNITY)

*DUMMIES TO HOLD INITIAL DATA

            M0(I)        VOLUME OF IMPORTS                          ('90
BILL TL)
            E0(I)        VOLUME OF EXPORTS                          ('90
BILL TL)
            XD0(I)       VOLUME OF DOMESTIC OUTPUT BY SECTOR        ('90
BILL TL)
            K0(I)        VOLUME OF CAPITAL STOCKS BY SECTOR         ('90
BILL TL)
            ID0(I)       VOLUME OF INVESTMENT BY SECTOR OF ORIGIN   ('90
BILL TL)
            DST0(I)      VOLUME OF INVENTORY INVESTMENT BY SECTOR   ('90
BILL TL)
            INT0(I)      VOLUME OF INTERMEDIATE INPUT DEMANDS       ('90
BILL TL)
            CN0(C)       CONVER OF PRODUCER GOODS INTO CON GOODS    ('90
BILL TL)
            CH(HH)       CONSUMPTION BY HOUSEHOLDS                  ('90
BILL TL)
            XXD0(I)      VOLUME OF DOMESTIC SALES BY SECTOR         ('90
BILL TL)
            X0(I)        VOLUME OF COMPOSITE GOOD SUPPLY            ('90
BILL TL)
            PWE0(I)      WORLD MARKET PRICE OF EXPORTS
(UNITY)
            PWM0(I)      WORLD MARKET PRICE OF IMPORTS
(UNITY)
```

```
            PD0(I)      DOMESTIC GOOD PRICE
(UNITY)
            PC0(C)      PRICE OF CONSUMER GOODS
(UNITY)
            PIND0       PRICE INDEX FOR CONSUMER GOODS
(UNITY)
            PT0(C)      PRICE OF CONSUMER GOODS GROSS OF VAT
(UNITY)
            PE0(I)      DOMESTIC PRICE OF EXPORTS
(UNITY)
            PM0(I)      DOMESTIC PRICE OF IMPORTS
(UNITY)
            PVA0(I)     VALUE ADDED PRICE BY SECTOR
(UNITY)
            QD(I)       DUMMY VARIABLE FOR COMPUTING AD(I)
(UNITY)
            XLLB(I)     DUMMY VARIBALE
(UNITY)
            WA0         AVERAGE WAGE RATE                ('90 BILL TL
PER WORKER)
            LD          EMPLOYMENT                           (100.000
PERSONS)
            XLE(I)      EMPLOYMENT BY SECTOR                 (100.000
PERSONS)
            LS0         LABOUR SUPPLIES BY CATEGORY          (100.000
PERSONS);
*BASE DATA
WA0  = .5471671;
 SCALARS
    ER       REAL EXCHANGE RATE          (UNITY) /    .36  /
    GR0      GOVERNMENT REVENUE           ('90 BILL TL)/  97.5035 /
    GDTOT0   GOVERNMENT CONSUMPTION       ('90 BILL TL) /  43.0834 /
    GOVSAV0  GOVERNMENT SAVING            ('90 BILL TL) /  36.4480/
    TRAN0    TRANSFER PAYMENTS BY GOVERNMENT ('90 BILL TL) /  23.1497/
    FSAV0    FOREIGN SAVING               ('90 BILL DOLLARS)/  12.7915 /
    REMIT0   NET REMITTANCES FROM ABROAD ('90 BILL DOLLARS) /4.1174 /
;

 TABLE IO(I,J) INPUT-OUTPUT COEFFICIENTS  (UNITY)
                  AGRIC      MINING      FOOD-PRO      TEXTILES
LIGHT-INT      PETROL      BASIC-INT      MACHIN      ELEC-GAS      CONST
SERVI
   AGRIC          .170745     .009780     .355598      .077441
.096458          .000000     .000636       .000697      .000425
.000009    .011551
   MINING         .000126     .002389     .003813      .000221
.000856          .000141     .038344       .001241      .045411
.017352    .001561
   FOOD-PRO       .020697     .000581     .163907      .014529
.000641          .000000     .004419       .000113      .000182
.000000    .013253
   TEXTILES       .001528     .001062     .003913      .317600
.006502          .000122     .001066       .003210      .001042
.000000    .001548
   LIGHT-INT      .004517     .004263     .016486      .006093
.255818          .001157     .008392       .029140      .003343
.059426    .014775
   PETROL         .023753     .055817     .014085      .005915
.020361          .428567     .059716       .012078      .092150
.016895    .055362
   BASIC-INT      .030212     .024699     .019404      .013591
.078998          .009728     .281082       .365607      .005575
.204255    .010408
   MACHIN         .004030     .030521     .008275      .005081
.008502          .001550     .017723       .286948      .043496
.037707    .024030
   ELEC-GAS       .002437     .038732     .015190      .025150
.047131          .005242     .044322       .017511      .054915
.003044    .006552
```

```
   CONST          .000000     .000000     .000000      .000000
.000000         .000000     .000000       .000000      .000000
.000000    .000000
   SERVI          .075694     .072853     .114036      .207268
.141140         .043602     .131285       .204105      .073515
.124035    .132537
```

TABLE IMAT(I,J) CAPITAL COMPOSITITON MATRIX (UNITY)

```
                  AGRIC      MINING     FOOD-PRO     TEXTILES     LIGHT-
INT     PETROL      BASIC-INT      MACHIN     ELEC-GAS       CONST
SERVI
   AGRIC          .0069      .0000       .0000        .0000       .0000
.0000       .0000           .0000      .0000        .0000      .0000
   MINING         .0000      .0000       .0000        .0000       .0000
.0000       .0000           .0000      .0000        .0000      .0000
   FOOD-PRO       .0000      .0000       .0115        .0000       .0000
.0000       .0000           .0000      .0000        .0000      .0000
   TEXTILES       .0000      .0000       .0000        .0000       .0000
.0000       .0000           .0000      .0000        .0000      .0000
   LIGHT-INT      .0048      .0049       .0278        .0277       .0277
.0145       .0145           .0142      .0228        .0000      .0112
   PETROL         .0000      .0000       .0000        .0000       .0000
.0000       .0000           .0000      .0000        .0000      .0000
   BASIC-INT      .0399      .0401       .0353        .0367       .0367
.0416       .0416           .0390      .0433        .0365      .0445
   MACHIN         .1584      .1594       .1260        .0981       .0981
.1685       .1685           .1178      .5176        .0130      .4706
   ELEC-GAS       .0000      .0000       .0000        .0000       .0000
.0000       .0000           .0000      .0000        .0000      .0000
   CONST          .6905      .6955       .7037        .7423       .7423
.6755       .6755           .7317      .2990        .8576      .3579
   SERVI          .0995      .1001       .0957        .0952       .0952
.0999       .0999           .0973      .1173        .0929      .1158
```

TABLE CLES(C,HH) PRIVATE CONSUMPTION SHARES

```
              URB-POOR  URB-MIDDLE  URB-RICH  RUR-POOR  RUR-MIDDLE
RUR-RICH
  FOOD          .3781      .2944       .1971      .4154      .3690
.3384
  TOB-ALCH      .0535      .0418       .0267      .0688      .0517
.0504
  CLOTH         .0932      .1120       .1000      .1179      .1297
.1002
  HOUS          .1739      .2102       .2134      .1173      .0909
.1199
  HOUS-FUR      .1512      .1410       .1528      .0894      .1740
.1721
  HE-PC         .0316      .0335       .0321      .0350      .0265
.0250
  TR-COM        .0648      .0932       .1983      .0791      .0884
.1262
  CU-EDU        .0374      .0449       .0504      .0409      .0346
.0333
  OTH           .0163      .0290       .0292      .0362      .0352
.0345
```

TABLE CON(I,C) CONVERSION MATRIX OF CONSUMER GOODS TO PRODUCER GOODS (UNITY)

```
               FOOD     TOB-ALCH     CLOTH     HOUS     HOUS-FUR     HE-PC
TR-COM     CU-EDU     OTH
 AGRIC          .66056  .00000       .00000    .00000    .00000
.16529     .00000    .00000     .17507
 MINING         .00000  .00000       .00000    .02483    .00000
.00000     .00000    .00000     .00000
```

```
 FOOD-PRO        .23657   .75505        .00000    .00000    .00000
.00000     .00000    .00000     .28244
 TEXTILES        .00000   .00000        .45937    .00000    .08403
.00000     .00000    .00000     .08832
 LIGHT-INT       .00000   .00000        .06752    .04219    .07497
.00000     .00000    .24095     .07426
 PETROL          .00000   .00000        .00000    .10680    .00000
.00000     .00000    .00000     .00000
 BASIC-INT       .00000   .00000        .00000    .00000    .21221
.45819     .00000    .00000     .11301
 MACHIN          .00000   .00000        .00000    .00000    .39167
.00000     .11414    .00000     .10058
 ELEC-GAS        .00000   .00000        .00000    .02949    .00000
.04419     .00000    .00000     .00000
 CONST           .00000   .00000        .00000    .00000    .00000
.00000     .00000    .00000     .00000
 SERVI           .10287   .24495        .47311    .79669    .23712
.33233     .88586    .75905     .16632

 TABLE HHRES(*,HH) SUMMARY MATRIX WITH HOUSEHOLD RESULTS

           URB-POOR    URB-MIDDLE    URB-RICH    RUR-POOR    RUR-MIDDLE
RUR-RICH
  SL0        .1933        .2947         .2451       .0989       .1373
.0307
  SC0        .0436        .1645         .3255       .0463       .1565
.2636
  SR0        .1771        .3666         .0000       .2644       .1919
.0000
  TR0        .1902        .3176         .2384       .0975       .1192
.0371
  HTAX       .1532        .1682         .2054       .1334       .1339
.1511
  MPS0       .0446        .0932         .1590       .1220       .2390
.4675
  CH       29.8128      62.4312       78.5044     19.3508     38.8589
33.2478
  YH0      36.8487      82.7730      117.4765     25.4326     58.9566
73.5549
  YDH0     31.2029      68.8475       93.3469     22.0390     51.0648
62.4379
  ;

 SL0(HH)=HHRES("SL0",HH);
 SC0(HH)=HHRES("SC0",HH);
 SR0(HH)=HHRES("SR0",HH);
 TR0(HH)=HHRES("TR0",HH);
 HTAX(HH)=HHRES("HTAX",HH);
 MPS0(HH)=HHRES("MPS0",HH);
 YH0(HH)=HHRES("YH0",HH);
 YDH0(HH)=HHRES("YDH0",HH);
 CH(HH)=HHRES("CH",HH);

 TABLE CC(*, C) SUMMARY MATRIX WITH CONSUMER GOODS

             FOOD    TOB-ALCH    CLOTH    HOUS    HOUS-FUR    TR-COM    HE-PC
CU-EDU    OTH
  TV0        .0180      .0750     .0780    .0750       .0780     .0750
.0780     .0280     .0680
  TEX0       .0000      .0000     .0000    .0000       .0000     .0000
.0000     .0000     .0000
  CN0      77.3572    10.5295   26.1996  41.7208     36.6298    7.4998
30.2221   10.8027    7.4998
;
 TV0(C)=CC("TV0",C);
 TEX0(C)=CC("TEX0",C);
 CN0(C)=CC("CN0",C);
 PC0(C)=SUM(I,CON(I,C));
 PT0(C)=PC0(C)*(1+TV0(C))*(1+TEX0(C));
 THETA(C)=SUM(HH,CLES(C,HH)*CH(HH));
```

```
 THETA(C)=THETA(C)/SUM(CCD,THETA(CCD));
 PIND0=SUM(C,PC0(C)*THETA(C));
 DISPLAY PC0;
 DISPLAY PT0;
 DISPLAY CN0;
 TABLE ZZ(*,I) MISCELLANEOUS PARAMETERS AND INITIAL DATA

             AGRIC       MINING      FOOD-PRO      TEXTILES      LIGHT-INT
PETROL     BASIC-INT     MACHIN      ELEC-GAS      CONST         SERVI
 M0           2.9630      1.2609      3.9129        2.8336        1.7116
11.7561    18.8660       21.6297       .0136         .0000      4.0869
 E0           2.821        .5055      5.0863       11.2065          .5677
.7674      5.6707        2.5955        .1145         .0000     22.7263
 XD0         99.7085      6.0286     45.1341       39.4392         26.9930
26.1936    55.8029       30.9983      11.5160       70.7294    255.7607
 K           77.0908     37.8181     21.0981       23.9979         34.9087
30.5349    46.5189       27.6329      83.5936      130.1816    212.8996
 DEPR          .0000       .0000       .0000         .0000          .0000
.0000       .0000         .0000       .0000         .0000       .0000
 XLE          92.21        2.23        2.42          8.33           4.60
.21        6.63          6.51          .11          9.04       63.45
 RHOC          1.8         1.4         1.20          1.20           1.10
.6           .50           .50         .80           .80         .70
 RHOT          1.8         1.4         1.20          1.20           1.10
.6           .50           .50         .80           .80         .70
 ETA           1.0         1.0         1.0           4.0            4.0
4.0          4.0           4.0         4.0           4.0         4.0
 PD0           1.0         1.0         1.0           1.00           1.00
1.0          1.0           1.0         1.0           1.0         1.0
 TM0            .24053      .06487      .36267        .04877         .38344
.15554       .15563        .25996      .07407        .00000      .00000
 ITAX          -.00581      .00848      .00000        .00000         .00000
.19809       .00000        .00000      .02218        .01397      .00290
 GLES           .01193      .00680      .02603        .01521         .00521
.03468       .00712        .02312      .01741        .00518      .84731
 KIO            .00117      .00000      .00000        .00108         .00305
.00000       .00000        .27913      .00000        .63481      .08076
 ID             .00073      .00000      .00000        .00000         .45007
.00000     3.41500       7.19383       .00000     70.5064       8.66136
 DSTR           .03921      .14806      .01837        .02616         .00915
-.16185      .03727        .08616      .00000        .00000      .01939
 DST           3.9100       .8926       .8291        1.0318         .2470
-4.2394      2.0796        2.6708        .0000         .0000      4.9593
        ;
*COMPUTATION OF PARAMETERS AND COEFFICIENTS FOR CALIBRATION

 DEPR(I)     = ZZ("DEPR",I);
 RHOC(I)     = (1/ZZ("RHOC",I)) - 1 ;
 RHOT(I)     = (1/ZZ("RHOT",I)) + 1;
 ETA(I)      = ZZ("ETA",I);
 TM0(I)      = ZZ("TM0",I);
 TE(I)       = 0;
*TE(I)       = ZZ("TE0",I);
 ITAX(I)     = ZZ("ITAX",I);
 GLES(I)     = ZZ("GLES",I);
 KIO(I)      = ZZ("KIO",I);
 DSTR(I)     = ZZ("DSTR",I);
 XLE(I)      = ZZ("XLE",I);
 XLLB(I)     = XLE(I) + (1-SIGN(XLE(I)));
 M0(I)       = ZZ("M0",I);
 IT(I)       = YES$M0(I);
 IN(I)       = NOT IT(I);
 E0(I)       = ZZ("E0",I);
 XD0(I)      = ZZ("XD0",I);
 K0(I)       = ZZ("K",I);
 PD0(I)      = ZZ("PD0",I);
 PM0(I)      = PD0(I) ;
 PE0(I)      = PD0(I) ;
 PWM0(I)     = PE0(I)/((1+TM0(I))*ER);
 PWE0(I)     = PE0(I)/((1+TE(I))*ER) ;
```

```
 PVA0(I)     = PD0(I) - SUM(J, IO(J,I)*PD0(J) ) - ITAX(I);
 XXD0(I)     = XD0(I) - E0(I);
 DST0(I)     = ZZ("DST",I);
 ID0(I)      = ZZ("ID",I);
 LS0         = SUM(I,ZZ("XLE",I));
*CALIBRATION OF ALL SHIFT AND SHARE PARAMETERS
* GET DELTA FROM COSTMIN, X0 FROM ABSORPTION , AC FROM ARMINGTON


 DELTA(IT)$M0(IT) = PM0(IT)/PD0(IT)*(M0(IT)/XXD0(IT))**(1+RHOC(IT)) ;
 DELTA(IT) = DELTA(IT)/(1+DELTA(IT)) ;
 X0(I)       = PD0(I)*XXD0(I) + (PM0(I)*M0(I))$IT(I) ;
 AC(IT)      = X0(IT)/(DELTA(IT)*M0(IT)**(-RHOC(IT)) + (1-
DELTA(IT))*XXD0(IT)**(-RHOC(IT)))**(-1/RHOC(IT)) ;
 DISPLAY DELTA, AC;

*GET INT0 FROM INTEQ,CONV0 FROM CONVER, GAMMA FROM ESUPPLY, ALPHL
FROM PROFITMAX
 INT0(I)    = SUM(J, IO(I,J)*XD0(J) );
 GAMMA(IT) = 1/(1 + PD0(IT)/PE0(IT)*(E0(IT)/XXD0(IT))**(RHOT(IT) - 1)
) ;
 GAMMA(IN) = 0;
 ALPHL(I)  =(WA0 * XLE(I)) /(PVA0(I)*XD0(I));
 DISPLAY GAMMA, ALPHL;
* GET AD FROM OUTPUT, LD FROM  PROFITMAX, AT FROM CET
 QD(I)       = (XLLB(I)**ALPHL(I)*(K0(I)**(1-ALPHL(I))));
 AD(I)       = XD0(I)/QD(I);
 LD          = SUM(I,(XD0(I)*PVA0(I)*ALPHL(I)/WA0)) ;
 AT(IT)      = XD0(IT)/( GAMMA(IT)*E0(IT)**RHOT(IT) + ( 1-GAMMA(IT)
)*XXD0(IT)**RHOT(IT) )**(1/RHOT(IT)) ;

*MODEL DEFINITION - VARIABLES

 VARIABLES

*PRICES BLOCK
   PD(I)      DOMESTIC PRICES                                    (UNITY)
   PM(I)      DOMESTIC PRICE OF IMPORTS                          (UNITY)
   PE(I)      DOMESTIC PRICE OF EXPORTS                          (UNITY)
   PC(C)      PRICE OF CONSUMER GOODS                            (UNITY)
   PT(C)      PRICE OF CONSUMER GOODS (GROSS-OF-TAX PRICES)      (UNITY)
   PIND       PRICE INDEX                                        (UNITY)
   PK(I)      RATE OF CAPITAL RENT BY SECTOR                     (UNITY)
   PX(I)      AVERAGE OUTPUT PRICE BY SECTOR                     (UNITY)
   P(I)       PRICE OF COMPOSITE GOODS                           (UNITY)
   PVA(I)     VALUE ADDED PRICE BY SECTOR                        (UNITY)
   PWM(I)     WORLD MARKET PRICE OF IMPORTS                      (UNITY)
   PWE(I)     WORLD MARKET PRICE OF EXPORTS                      (UNITY)
   TM(I)      XXXXXXXXXXXXXXX
*  TM(IT)     TARIFF RATES                                       (UNITY)
   TEX        EXCISE DUTY RATES                                  (UNITY)
   TV(C)      VAT RATES                                          (UNITY)
*PRODUCTION BLOCK
   X(I)       COMPOSITE GOODS SUPPLY                             ('90
BILL TL)
   XD(I)      DOMESTIC OUTPUT BY SECTOR                          ('90
BILL TL)
   XXD(I)     DOMESTIC SALES                                     ('90
BILL TL)
   E(I)       EXPORTS BY SECTOR                                  ('90
BILL TL)
   M(I)       IMPORTS                                            ('90
BILL TL)
   WALRAS     WALRASIAN EQUILIBRIUM
* FACTORS BLOCK
   K(I)       CAPITAL STOCK BY SECTOR                            ('90
BILL TL)
   WA         AVERAGE WAGERATE BY LABOUR CATEGORY                (CURR
MILL. TL)
```

```
   LS         LABOUR SUPPLY BY LABOUR CATEGORY
(100.000 PERSONS)
   L(I)       EMPLOYMENT BY SECTOR AND LABOUR CATEGORY
(100.000 PERSONS)
*DEMAND BLOCK
   INT(I)     INTERMEDIATES USES                                  ('90
BILL TL)
   CONV(C)    CONVERSION MATRIX OF CONS GOODS                     ('90
BILL TL)
   CN(C)      FINAL DEMAND FOR CONSUMER GOODS                     ('90
BILL TL)
   CG(C)      HOUSEHOLD CON
   CD(I)      FINAL DEMAND FOR PRIVATE CONSUMPTION                ('90
BILL TL)
   GD(I)      FINAL DEMAND FOR GOVERNMENT CONSUMPTION             ('90
BILL TL)
   ID(I)      FINAL DEMAND FOR PRODUCTIVE INVESTMENT              ('90
BILL TL)
   DST(I)     INVENTORY INVESTMENT BY SECTOR                      ('90
BILL TL)
   Y          PRIVATE GDP                                         (CURR
BILL TL)
   V(HH)      INDIRECT UTILITY FUNCTION
   IND(HH)    EXPENDITURE FUNCTION
   SL(HH)     SHARE OF LABOUR BY HOUSEHOLD TYPE
(UNITY)
   SC(HH)     SHARE OF CAPITAL BY HOUSEHOLD TYPE
(UNITY)
   SR(HH)     SHARE OF REMITTANCES BY HOUSEHOLD TYPE
(UNITY)
   TRANS      CURRENT TRANSFERS TO HOUSEHOLDS                     (CURR
BILL TL)
   TR(HH)     SHARE OF TRANSFER PAYMENTS BY HOUSEHOLD TYPE
(UNITY)
   GR         GOVERNMENT REVENUE                                  (CURR
BILL TL)
   TARIFF     TARIFF REVENUE                                      (CURR
BILL TL)
   INDTAX     INDIRECT TAX REVENUE                                (CURR
BILL TL)
   TOTHHTAX   HOUSEHOLD TAX REVENUE                               (CURR
BILL TL)
   VATAX      VAT REVENUE                                         (CURR
BILL TL)
   EXTAX      EXCISE DUTY REVENUE                                 (CURR
BILL TL)
   DUTY       EXPORT SUBSIDIES                                    (CURR
BILL TL)
   GDTOT      TOTAL VOLUME OF GOVERNMENT CONSUMPTION              ('90
BILL TL)
   MPS(HH)    MARGINAL PROPENSITY TO SAVE                         (UNITY)
   LBR        TOTAL LABOUR INCOME                                 ('90
BILL TL)
   CPT        TOTAL CAPITAL INCOME                                ('90
BILL TL)
   HHSAV      TOTAL HOUSEHOLD SAVINGS                             (CURR
BILL TL)
   GOVSAV     GOVERNMENT SAVINGS                                  (CURR
BILL TL)
   DEPRECIA   TOTAL DEPRECIATION EXPENDITURE                      (CURR
BILL TL)
   SAVINGS    TOTAL SAVINGS                                       (CURR
BILL TL)
   FSAV       FOREIGN SAVINGS                                    (CURR
BILL DOLLARS)
   TRAN       TRANSFER PAYMENTS TO HOSEHOLDS BY GOVERNMENT        (CURR
BILL TL)
   REMIT      NET REMITTANCES FROM ABROAD                        (CURR
BILL DOLLARS)
```

```
   YH(HH)     TOTAL INCOME BY HOUSEHOLD TYPE                          (CURR
BILL TL)
   YDH(HH)    DISPOSABLE INCOME BY HOUSEHOLD TYPE                     (CURR
BILL TL)
   U(HH)      UTILITY IN THE BASE YEAR                                (UNITY)
   MET(HH)    EXPENDITURE FNCTION IN THE BASE YEAR                    (UNITY)
   UN(HH)     UTILITY AFTER POLICY CHANGES                            (UNITY)
   METN(HH)   EXPENDITURE FUNCTION AFTER THE POLICY CHNAGES           (UNITY)
   DK(I)      VOLUME OF INVESTMENT BY SECTOR OF DESTINATION           ('90
BILL TL)
*WELFARE INDICATOR FOR OBJECTIVE FUNCTION
   OMEGA      OBJECTIVE FUNCTION VARIABLE                             ('90
BILL TL)
                  ;

 P.LO(I) = .01 ;PD.LO(I) = .01 ; PM.LO(IT) =.01; PC.LO(C)=.01;
PWE.LO(IT) = .01 ; PK.LO(I) = .01 ; PX.LO(I) = .01 ; X.LO(I) = .01 ;
 XD.LO(I) = .01 ; M.LO(IT) = .01 ; XXD.LO(IT) = .01 ; WA.LO=.01;
INT.LO(I)$(INT0(I) NE 0) = .01; Y.LO = .01
;SL.LO(HH)=.01;SC.LO(HH)=.01;SR.LO(HH)=.01;
 TR.LO(HH)=.01;E.LO(IT) = .01 ; L.LO(I) = .01 ;

*MODEL DEFINITION - EQUATIONS

 EQUATIONS
*PRICE BLOCK
   PMDEF(I)          DEFINITION OF DOMESTIC IMPORT PRICES
(UNITY)
   PCDEF(C)          DEFINITION OF CONSUMER GOOD PRICES
(UNITY)
   PTDEF             DEFINITION OF CONSUMER GOOD PRICES INCLUDING VAT
(UNITY)
   PEDEF(I)          DEFINITION OF DOMESTIC EXPORT PRICES
(UNITY)
   ABSORPTION(I)     VALUE OF DOMESTIC SALES
(CURR BILL TL)
   SALES(I)          VALUE OF DOMESTIC OUTPUT
(CURR BILL TL)
   ACTP(I)           DEFINITION OF ACTIVITY PRICES
(UNITY)
   PKDEF(I)          DEFINITION OF CAPITAL GOODS PRICE
(UNITY)
   PINDEX            PRICE DEFLATOR
(UNITY)
*OUTPUT BLOCK
   ACTIVITY(I)       PRODUCTION FUNCTION
('90 BILL TL)
   PROFITMAX(I)      FIRST ORDER CONDITION FOR PROFIT MAXIMUM
(1000 PERSONS)
   LMEQUIL           LABOR MARKET EQUILIBRIUM
(1000 PERSONS)
   CET(I)            CET FUNCTION
('90 BILL TL)
   EDEMAND(I)        EXPORT DEMAND
(UNITY)
   ESUPPLY(I)        EXPORT SUPPLY
(UNITY)
   ARMINGTON(I)      COMPOSITE GOOD AGGREGATION FUNCTION
('90 BILL TL)
   COSTMIN(I)        FIRST ORDER CONDITION FOR COST MINIMIZATION OF
COMPOSITE GOOD (UNITY)
   XXDSN(I)          DOMESTIC SALES FOR NONTRADED SECTORS
('90 BILL TL)
   XSN(I)            COMPOSITE GOOD AGGREGATION FOR NONTRADED SECTORS
('90 BILL TL)
*DEMAND BLOCK
   INTEQ(I)          TOTAL INTERMEDIATE USES
('90 BILL TL)
   CONVEQ(C)         CONSUMER DEMAND FOR CON GOODS
('90 BILL TL)
```

```
   CDEQ(I)          PRIVATE CONSUMPTION BEHAVIOUR FOR PRODUCTION
GOODS             (CURR BILL TL)
   CNEQ(C)          PRIVATE CONSUMPTION BEHAVIOUR FOR CONSUMER GOODS
(CURR BILL TL)
   DSTEQ(I)         INVENTORY INVESTMENT
('90 BILL TL)
   GNP              PRIVATE GNP
(CURR BILL TL)
   YDEQ(HH)         DISPOSABLE INCOME OF HOUSEHOLDS
(CURR BILL TL)
   INEQ(HH )        THE EXPENDITURE FUNCT
(CURR BILL TL)
   VEXEQ(HH)        THE INDIRECT UTILITY FUNCTION
(CURR BILL TL)
   LABY             TOTAL INCOME ACCRUING TO LABOUR
(CURR BILL TL)
   CAPY             TOTAL INCOME ACCRUING TO CAPITAL
(CURR BILL TL)
   HHLDY(HH)        TOTAL INCOME ACCRUING TO  HOUSEHOLDS
(CURR BILL TL)
   GDEQ              GOVERNMENT CONSUMPTION BEHAVIOR
('90 BILL TL)
  TRANSDEF          TOTAL TRANSFERS TO THE HOUSEHOLDS
('90 BILL TL)
  GREQ              GOVERNMENT REVENUE
(CURR BILL TL)
  VATAXDEF          VAT REVENUE
(CURR BILL TL)
  EXDUTY            EXCISE TAXES REVENUE
(CURR BILL TL)
  TARIFFDEF         TARIFF REVENUE
(CURR BILL TL)
   INDTAXDEF        INDIRECT TAXES ON DOMESTIC PRODUCTION
(CURR BILL TL)
   SUBDEF           EXPORT DUTIES
(CURR BILL TL)
   HHTAXDEF         TOTAL HOUSEHOLD TAXES COLLECTED BY THE GOVERNMENT
(CURR BILL  TL)
*SAVINGS-INVESTMENT BLOCK
   HHSAVEQ          HOUSEHOLD SAVINGS
(CURR BILL TL)
   GRUSE            GOVERNMENT SAVINGS
(CURR BILL TL)
   DEPREQ           DEPRECIATION EXPENDITURE
(CURR BILL TL)
   TOTSAV           TOTAL SAVINGS
(CURR BILL TL)
   PRODINV(I)       INVESTMENT BY SECTOR OF DESTINATION
(CURR BILL TL)
   IEQ(I)           INVESTMENT BY SECTOR OF ORIGIN
('90 BILL TL)
*BALANCE OF PAYMENTS
   CAEQ             CURRENT ACCOUNT BALANCE
(CURR BILL DOLLAR)
*MARKET CLEARING
   EQUIL(I)         GOODS MARKET EQUILIBRIUM
('90 BILL TL)
*OBJECTIVE FUNCTION
   OBJ              OBJECTIVE FUNCTION
('90 BILL TL)  ;


*MODEL DEFINITION - PRICE BLOCK

 PMDEF(IT)..       PM(IT) =E= PWM(IT)*ER*(1 + TM(IT)) ;

 PCDEF(C)..        PC(C) =E= SUM(I, P(I)* CON(I,C));

 PTDEF(C)..        PT(C) =E= PC(C)*(1+TV(C));
```

```
 PEDEF(IT)..        PE(IT)*(1 + TE(IT)) =E= PWE(IT)*ER ;

 ABSORPTION(I)..    P(I)*X(I) =E= PD(I)*XXD(I) + (PM(I)*M(I))$IT(I) ;

 SALES(I)..         PX(I)*XD(I) =E= PD(I)*XXD(I) + (PE(I)*E(I))$IT(I)
;

 ACTP(I)..          PX(I)*(1-ITAX(I)) =E= PVA(I) + SUM(J, IO(J,I)*P(J)
) ;

 PKDEF(I)..         PK(I) =E= SUM(J, P(J)*IMAT(J,I) );

 PINDEX..           PIND=E=SUM(C,PC(C)*THETA(C));

*OUTPUT AND FACTORS OF PRODUCTION BLOCK

 ACTIVITY(I)..      XD(I) =E= AD(I)*(L(I)**ALPHL(I)*K(I)**(1-
ALPHL(I)));

 PROFITMAX(I)..     WA*L(I) =E= XD(I)*PVA(I)*ALPHL(I) ;

 LMEQUIL..          SUM(I,L(I)) =E= LS;

 CET(IT)..          XD(IT) =E= AT(IT)*( GAMMA(IT)*E(IT)**RHOT(IT) + (
1-GAMMA(IT) )*XXD(IT)**RHOT(IT) )**(1/RHOT(IT)) ;

 EDEMAND(IT)..      E(IT)/E0(IT) =E= ( PWE0(IT)/PWE(IT) )**ETA(IT) ;

 ESUPPLY(IT)..      E(IT)/XXD(IT) =E= ( PE(IT)/PD(IT)*(1 -
GAMMA(IT))/GAMMA(IT) )**(1/(RHOT(IT)-1) ) ;

 ARMINGTON(IT)..    X(IT) =E= AC(IT)*(DELTA(IT)*M(IT)**(-RHOC(IT)) +
(1-DELTA(IT))*XXD(IT)**(-RHOC(IT)))**(-1/RHOC(IT)) ;

 COSTMIN(IT)..      M(IT)/XXD(IT) =E= ( PD(IT)/PM(IT)*DELTA(IT)/(1-
DELTA(IT)) )**(1/(1 + RHOC(IT))) ;
 XXDSN(IN)..        XXD(IN) =E= XD(IN) ;

 XSN(IN)..          X(IN) =E= XXD(IN) ;


*DEMAND BLOCK

 INTEQ(I)..         INT(I) =E= SUM(J, IO(I,J)*XD(J) );

 DSTEQ(I)..         DST(I) =E= DSTR(I)*XD(I);


 CDEQ(I)..          CD(I) =E= SUM(C,CON(I,C)*CN(C));

 CNEQ(C)..          PT(C)*CN(C) =E= SUM(HH, CLES(C, HH)*(1-
MPS(HH))*YH(HH)*(1-HTAX(HH))) ;

 GNP..              Y =E= SUM(HH,YH(HH)) ;


 INEQ(HH)..         IND(HH)=E=(1-MPS(HH))*YH(HH)*(1-HTAX(HH));

 VEXEQ(HH)..
V(HH)=E=PROD(C, (CLES(C,HH)*IND(HH)/(PC(C)*(1+TV(C))))**CLES(C,HH));

 YDEQ(HH)..         YDH(HH)=E=YH(HH)*(1-HTAX(HH));

 LABY..             LBR=E=(WA*LS);

 CAPY..             CPT=E=SUM(I,PVA(I)*XD(I))-DEPRECIA-LBR;

 HHLDY(HH)..
YH(HH)=E=(SL(HH)*LBR)+(SC(HH)*CPT)+(SR(HH)*REMIT*ER)+(TR(HH)*TRANS);
```

```
 HHSAVEQ..          HHSAV =E=SUM(HH, MPS(HH)*YH(HH)*(1-HTAX(HH))) ;

 TRANSDEF..         TRANS =E=SUM(HH, TR(HH))*TRAN;

 GREQ..             GR =E= TARIFF - DUTY + INDTAX +TOTHHTAX-
TRANS+VATAX+EXTAX  ;

 GRUSE..            GR =E= SUM(I, P(I)*GD(I)) + GOVSAV ;

 GDEQ(I)..          GD(I) =E= GLES(I)*GDTOT ;

 TARIFFDEF..        TARIFF =E= SUM(IT, TM(IT)*M(IT)*PWM(IT) )*ER ;

 INDTAXDEF..        INDTAX =E= SUM(I, ITAX(I)*PX(I)*XD(I) );

 VATAXDEF..         VATAX =E=SUM(C,TV(C)*CN(C)*PC(C));

 EXDUTY..           EXTAX=E=SUM(C,TEX(C)*CN(C)*PC(C));

 HHTAXDEF..         TOTHHTAX =E=SUM(HH,HTAX(HH)*YH(HH));

 SUBDEF..           DUTY =E= SUM(IT, TE(IT)*E(IT)*PE(IT) ) ;

 DEPREQ..           DEPRECIA =E= SUM(I, DEPR(I)*PK(I)*K(I) ) ;

 TOTSAV..           SAVINGS =E= HHSAV + GOVSAV + DEPRECIA + FSAV*ER  ;

 PRODINV(I)..       PK(I)*DK(I) =E= KIO(I)*SAVINGS - KIO(I)*SUM(J,
DST(J)*P(J)) ;

 IEQ(I)..           ID(I) =E= SUM(J, IMAT(I,J)*DK(J));

 CAEQ..             SUM(IT, PWM(IT)*M(IT)) =E= SUM(IT, PWE(IT)*E(IT))
+ FSAV + REMIT ;


*MARKET CLEARING

 EQUIL(I)..         X(I) =E= INT(I) + CD(I)+ GD(I) + ID(I) +
DST(I)+WALRAS;


 OBJ..              OMEGA =E= PROD(C$CLES(C,"URB-MIDDLE"),
CN(C)**CLES(C,"URB-MIDDLE")) ;


*MODEL SETUP - INITIALIZATION

 X.L(I) = X0(I) ; XD.L(I) = XD0(I); XXD.L(I) = XXD0(I); M.L(I) =
M0(I);
 E.L(I) = E0(I); ID.L(I) = ID0(I); DST.L(I) = DST0(I); INT.L(I) =
INT0(I); PD.L(I) = PD0(I);
 PM.L(I) = PM0(I);  PE.L(I) = PE0(I); P.L(I) = PD0(I); PX.L(I) =
PD0(I);
 PK.L(I) = PD0(I);
 PVA.L(I) = PVA0(I); PWE.L(I) = PWE0(I); WA.L =WA0;L.L(I)=XLE(I) ;
GR.L = GR0;
SC.L(HH)=SC0(HH);SL.L(HH)=SL0(HH);SR.L(HH)=SR0(HH);TR.L(HH)=TR0(HH);
TEX.L(C)=TEX0(C);
MPS.L(HH)=MPS0(HH);YH.L(HH)=YH0(HH);YDH.L(HH)=YDH0(HH);TRAN.L=TRAN0;
FSAV.L=FSAV0; REMIT.L=REMIT0; TM.L(IT) = TM0(IT);TV.L(C)=TV0(C) ;
 TARIFF.L = 10.8857;
 INDTAX.L = 20.5143;
 SAVINGS.L= 102.6082;
 TOTHHTAX.L =66.1035;
 Y.L = 395.0425;
 TRAN.L =  32.4289;
 LBR.L  =107.1025;
 CPT.L  =263.3080;
*CLOSURE
```

```
 K.FX(I)    = K0(I);
 PWM.FX(I) = PWM0(I);
 LS.FX      = LS0;
 SL.FX(HH) = SL0(HH);
 SC.FX(HH) = SC0(HH);
 SR.FX(HH) = SR0(HH);
 TR.FX(HH) = TR0(HH);
 TV.FX(C)   = TV0(C);
 TM.FX(IT) = TM0(IT);
 TEX.FX(C) = TEX0(C);
 FSAV.FX    = FSAV0 ;
 TRAN.FX    = TRAN0;
 MPS.FX(HH)=MPS0(HH);
 REMIT.FX   = REMIT0;
 GDTOT.FX    =GDTOT0;
 M.FX(IN)   = 0;
 E.FX(IN)   = 0;


 MODEL TURKCGE  SQUARE BASE MODEL  /PMDEF,PCDEF,PTDEF, PEDEF,
ABSORPTION, SALES,
 ACTP, PKDEF,
ACTIVITY, PROFITMAX, LMEQUIL, CET, EDEMAND, ESUPPLY, ARMINGTON,
COSTMIN
XXDSN, XSN, INTEQ,CDEQ,CNEQ, INEQ,VEXEQ,DSTEQ, GNP,YDEQ,LABY,CAPY
,HHLDY,PINDEX,
GDEQ,CAEQ,TRANSDEF, GREQ,VATAXDEF,EXDUTY, TARIFFDEF, INDTAXDEF,
SUBDEF
HHTAXDEF, HHSAVEQ, GRUSE, DEPREQ, TOTSAV, PRODINV, IEQ, EQUIL, OBJ /;


SOLVE TURKCGE MAXIMIZING OMEGA USING NLP;
 U.FX(HH)=V.L(HH);
 MET.FX(HH)=IND.L(HH);
 DISPLAY U.L;
 DISPLAY MET.L;

*COUNTERFACTUAL ANALYSIS (VAT 14 % LOWER LEVEL)
 TV.FX("FOOD")=1.67*TV0("FOOD");
 TV.FX("TOB-ALCH")=1.4*TV0("TOB-ALCH");
 TV.FX("HOUS")=1.4*TV0("HOUS");
 TV.FX("TR-COM")=1.4*TV0("TR-COM");
 TV.FX("CLOTH")=1.36*TV0("CLOTH");
 TV.FX("HOUS-FUR")=1.36*TV0("HOUS-FUR");
 TV.FX("HE-PC")=1.36*TV0("HE-PC");
 TV.FX("CU-EDU")=1.08*TV0("CU-EDU");
 TV.FX("OTH")=1.44*TV0("OTH");
 SOLVE TURKCGE MAXIMIZING OMEGA USING NLP;
 PARAMETER
 HEV (HH)                  HICKSIAN EQUIVALENT VARIATION
 HCV(HH)                   HICKSIAN COMPENSATION VARIATION;
 UN.FX(HH)=V.L(HH);
 METN.FX(HH)=IND.L(HH);
 DISPLAY UN.L;
 DISPLAY METN.L;
 HEV(HH)=(UN.L(HH)-U.L(HH))/U.L(HH)*MET.L(HH);
 HCV(HH)=(UN.L(HH)-U.L(HH))/UN.L(HH)*METN.L(HH);
 DISPLAY HEV;
 DISPLAY HCV;
```

APPENDIX 7

BENCHMARK EQUILIBRIUM OUTPUT AFTER CALIBRATION

---- VAR PD DOMESTIC PRICES

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	1.000	+INF	.
MINING	0.010	1.000	+INF	.
FOOD-PRO	0.010	1.000	+INF	.
TEXTILES	0.010	1.000	+INF	.
LIGHT-INT	0.010	1.000	+INF	.
PETROL	0.010	1.000	+INF	.
BASIC-INT	0.010	1.000	+INF	.
MACHIN	0.010	1.000	+INF	.
ELEC-GAS	0.010	1.000	+INF	.
CONST	0.010	1.000	+INF	.
SERVI	0.010	1.000	+INF	.

---- VAR PM DOMESTIC PRICE OF IMPORTS
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	1.000	+INF	.
MINING	0.010	1.000	+INF	.
FOOD-PRO	0.010	1.000	+INF	.
TEXTILES	0.010	1.000	+INF	.
LIGHT-INT	0.010	1.000	+INF	.
PETROL	0.010	1.000	+INF	.
BASIC-INT	0.010	1.000	+INF	.
MACHIN	0.010	1.000	+INF	.
ELEC-GAS	0.010	1.000	+INF	.
SERVI	0.010	1.000	+INF	.

---- VAR PE DOMESTIC PRICE OF EXPORTS
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	-INF	1.000	+INF	.
MINING	-INF	1.000	+INF	.
FOOD-PRO	-INF	1.000	+INF	.
TEXTILES	-INF	1.000	+INF	.
LIGHT-INT	-INF	1.000	+INF	.
PETROL	-INF	1.000	+INF	.
BASIC-INT	-INF	1.000	+INF	.
MACHIN	-INF	1.000	+INF	.
ELEC-GAS	-INF	1.000	+INF	.
SERVI	-INF	1.000	+INF	.

---- VAR PC PRICE OF CONSUMER GOODS
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
FOOD	0.010	1.000	+INF	.
TOB-ALCH	0.010	1.000	+INF	.
CLOTH	0.010	1.000	+INF	.
HOUS	0.010	1.000	+INF	.
HOUS-FUR	0.010	1.000	+INF	.
TR-COM	0.010	1.000	+INF	.

HE-PC	0.010	1.000	+INF	.
CU-EDU	0.010	1.000	+INF	.
OTH	0.010	1.000	+INF	.

---- VAR PT PRICE OF CONSUMER GOODS (GROSS-OF-TAX PRICES)

	LOWER	LEVEL	UPPER	MARGINAL
FOOD	-INF	1.018	+INF	.
TOB-ALCH	-INF	1.075	+INF	.
CLOTH	-INF	1.078	+INF	.
HOUS	-INF	1.075	+INF	.
HOUS-FUR	-INF	1.078	+INF	.
TR-COM	-INF	1.075	+INF	.
HE-PC	-INF	1.078	+INF	.
CU-EDU	-INF	1.028	+INF	.
OTH	-INF	1.068	+INF	.

	LOWER	LEVEL	UPPER	MARGINAL
---- VAR PIND	-INF	1.000	+INF	.

PIND PRICE INDEX
(UNITY)

---- VAR PK RATE OF CAPITAL RENT BY SECTOR
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	1.000	+INF	.
MINING	0.010	1.000	+INF	.
FOOD-PRO	0.010	1.000	+INF	.
TEXTILES	0.010	1.000	+INF	.
LIGHT-INT	0.010	1.000	+INF	.
PETROL	0.010	1.000	+INF	.
BASIC-INT	0.010	1.000	+INF	.
MACHIN	0.010	1.000	+INF	.
ELEC-GAS	0.010	1.000	+INF	.
CONST	0.010	1.000	+INF	.
SERVI	0.010	1.000	+INF	.

---- VAR PX AVERAGE OUTPUT PRICE BY SECTOR
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	1.000	+INF	.
MINING	0.010	1.000	+INF	.
FOOD-PRO	0.010	1.000	+INF	.
TEXTILES	0.010	1.000	+INF	.
LIGHT-INT	0.010	1.000	+INF	.
PETROL	0.010	1.000	+INF	.
BASIC-INT	0.010	1.000	+INF	.
MACHIN	0.010	1.000	+INF	.
ELEC-GAS	0.010	1.000	+INF	.
CONST	0.010	1.000	+INF	.
SERVI	0.010	1.000	+INF	.

---- VAR P PRICE OF COMPOSITE GOODS
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL

AGRIC	0.010	1.000	+INF	.
MINING	0.010	1.000	+INF	.
FOOD-PRO	0.010	1.000	+INF	.
TEXTILES	0.010	1.000	+INF	.
LIGHT-INT	0.010	1.000	+INF	.
PETROL	0.010	1.000	+INF	.
BASIC-INT	0.010	1.000	+INF	.
MACHIN	0.010	1.000	+INF	.
ELEC-GAS	0.010	1.000	+INF	.
CONST	0.010	1.000	+INF	.
SERVI	0.010	1.000	+INF	.

---- VAR PVA VALUE ADDED PRICE BY SECTOR
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	-INF	0.672	+INF	.
MINING	-INF	0.751	+INF	.
FOOD-PRO	-INF	0.285	+INF	.
TEXTILES	-INF	0.327	+INF	.
LIGHT-INT	-INF	0.344	+INF	.
PETROL	-INF	0.312	+INF	.
BASIC-INT	-INF	0.413	+INF	.
MACHIN	-INF	0.079	+INF	.
ELEC-GAS	-INF	0.658	+INF	.
CONST	-INF	0.523	+INF	.
SERVI	-INF	0.726	+INF	.

---- VAR PWM WORLD MARKET PRICE OF IMPORTS
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	2.239	2.239	2.239	-0.136
MINING	2.609	2.609	2.609	-0.055
FOOD-PRO	2.038	2.038	2.038	-0.280
TEXTILES	2.649	2.649	2.649	-0.159
LIGHT-INT	2.008	2.008	2.008	-0.114
PETROL	2.404	2.404	2.404	-0.867
BASIC-INT	2.404	2.404	2.404	-0.968
MACHIN	2.205	2.205	2.205	-1.197
ELEC-GAS	2.586	2.586	2.586	-0.002
SERVI	2.778	2.778	2.778	-0.195

---- VAR PWE WORLD MARKET PRICE OF EXPORTS
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	2.778	+INF	.
MINING	0.010	2.778	+INF	.
FOOD-PRO	0.010	2.778	+INF	.
TEXTILES	0.010	2.778	+INF	.
LIGHT-INT	0.010	2.778	+INF	.
PETROL	0.010	2.778	+INF	.
BASIC-INT	0.010	2.778	+INF	.
MACHIN	0.010	2.778	+INF	.
ELEC-GAS	0.010	2.778	+INF	.
SERVI	0.010	2.778	+INF	.

---- VAR TM XXXXXXXXXXXXXXX

	LOWER	LEVEL	UPPER	MARGINAL

AGRIC	0.241	0.241	0.241	-0.005
MINING	0.065	0.065	0.065	0.004
FOOD-PRO	0.363	0.363	0.363	-0.155
TEXTILES	0.049	0.049	0.049	-0.079
LIGHT-INT	0.383	0.383	0.383	-0.054
PETROL	0.156	0.156	0.156	-0.703
BASIC-INT	0.156	0.156	0.156	-0.248
MACHIN	0.260	0.260	0.260	-0.392
ELEC-GAS	0.074	0.074	0.074	-0.003
SERVI	.	.	.	-0.031

---- VAR TEX EXCISE DUTY RATES
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
FOOD	.	.	.	8.581
TOB-ALCH	.	.	.	1.168
CLOTH	.	.	.	2.909
HOUS	.	.	.	4.628
HOUS-FUR	.	.	.	4.066
TR-COM	.	.	.	3.351
HE-PC	.	.	.	0.833
CU-EDU	.	.	.	1.200
OTH	.	.	.	0.811

---- VAR TV VAT RATES
(UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
FOOD	0.018	0.018	0.018	-4.179
TOB-ALCH	0.075	0.075	0.075	-0.470
CLOTH	0.078	0.078	0.078	-1.451
HOUS	0.075	0.075	0.075	-3.163
HOUS-FUR	0.078	0.078	0.078	-1.467
TR-COM	0.075	0.075	0.075	-0.686
HE-PC	0.078	0.078	0.078	-0.443
CU-EDU	0.028	0.028	0.028	-0.655
OTH	0.068	0.068	0.068	-0.349

---- VAR X COMPOSITE GOODS SUPPLY
('90
BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	99.855	+INF	.
MINING	0.010	6.784	+INF	.
FOOD-PRO	0.010	43.961	+INF	.
TEXTILES	0.010	31.069	+INF	.
LIGHT-INT	0.010	28.138	+INF	.
PETROL	0.010	37.182	+INF	.
BASIC-INT	0.010	68.997	+INF	.
MACHIN	0.010	50.030	+INF	.
ELEC-GAS	0.010	11.415	+INF	.
CONST	0.010	70.729	+INF	.
SERVI	0.010	237.118	+INF	.

---- VAR XD DOMESTIC OUTPUT BY SECTOR
('90
BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	99.712	+INF	.

MINING	0.010	6.028	+INF	.
FOOD-PRO	0.010	45.134	+INF	.
TEXTILES	0.010	39.441	+INF	.
LIGHT-INT	0.010	26.994	+INF	.
PETROL	0.010	26.194	+INF	.
BASIC-INT	0.010	55.802	+INF	.
MACHIN	0.010	30.997	+INF	.
ELEC-GAS	0.010	11.516	+INF	.
CONST	0.010	70.729	+INF	.
SERVI	0.010	255.757	+INF	.

---- VAR XXD DOMESTIC SALES
('90 BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	96.891	+INF	.
MINING	0.010	5.523	+INF	.
FOOD-PRO	0.010	40.048	+INF	.
TEXTILES	0.010	28.235	+INF	.
LIGHT-INT	0.010	26.426	+INF	.
PETROL	0.010	25.426	+INF	.
BASIC-INT	0.010	50.131	+INF	.
MACHIN	0.010	28.401	+INF	.
ELEC-GAS	0.010	11.402	+INF	.
CONST	-INF	70.729	+INF	.
SERVI	0.010	233.031	+INF	.

---- VAR E EXPORTS BY SECTOR
('90 BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	2.821	+INF	.
MINING	0.010	0.506	+INF	.
FOOD-PRO	0.010	5.086	+INF	.
TEXTILES	0.010	11.206	+INF	.
LIGHT-INT	0.010	0.568	+INF	.
PETROL	0.010	0.767	+INF	.
BASIC-INT	0.010	5.671	+INF	.
MACHIN	0.010	2.595	+INF	.
ELEC-GAS	0.010	0.114	+INF	.
SERVI	0.010	22.726	+INF	.

---- VAR M IMPORTS
('90 BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	2.963	+INF	.
MINING	0.010	1.261	+INF	.
FOOD-PRO	0.010	3.913	+INF	.
TEXTILES	0.010	2.834	+INF	.
LIGHT-INT	0.010	1.712	+INF	.
PETROL	0.010	11.756	+INF	.
BASIC-INT	0.010	18.866	+INF	.
MACHIN	0.010	21.629	+INF	.
ELEC-GAS	0.010	0.014	+INF	.
SERVI	0.010	4.087	+INF	.

	LOWER	LEVEL	UPPER	MARGINAL
---- VAR WALRAS	-INF	.	+INF	.

WALRAS WALRASIAN EQUILIBRIUM

---- VAR K CAPITAL STOCK BY SECTOR
('90
BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	77.091	77.091	77.091	0.023
MINING	37.818	37.818	37.818	0.007
FOOD-PRO	21.098	21.098	21.098	0.068
TEXTILES	23.998	23.998	23.998	0.042
LIGHT-INT	34.909	34.909	34.909	0.020
PETROL	30.535	30.535	30.535	0.113
BASIC-INT	46.519	46.519	46.519	0.024
MACHIN	27.633	27.633	27.633	-0.003
ELEC-GAS	83.594	83.594	83.594	0.044
CONST	130.182	130.182	130.182	-0.032
SERVI	212.900	212.900	212.900	0.078

	LOWER	LEVEL	UPPER	MARGINAL
---- VAR WA	0.010	0.547	+INF	.
---- VAR LS	195.740	195.740	195.740	0.052

WA AVERAGE WAGERATE BY LABOUR CATEGORY (CURR
MILL. TL)

LS LABOUR SUPPLY BY LABOUR CATEGORY
(100.000
PERSONS)

---- VAR L EMPLOYMENT BY SECTOR AND LABOUR CATEGORY
(100.000
PERSONS)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	92.215	+INF	.
MINING	0.010	2.230	+INF	.
FOOD-PRO	0.010	2.420	+INF	.
TEXTILES	0.010	8.331	+INF	.
LIGHT-INT	0.010	4.601	+INF	.
PETROL	0.010	0.210	+INF	.
BASIC-INT	0.010	6.629	+INF	.
MACHIN	0.010	6.510	+INF	.
ELEC-GAS	0.010	0.110	+INF	.
CONST	0.010	9.039	+INF	.
SERVI	0.010	63.446	+INF	.

---- VAR INT INTERMEDIATES USES
('90
BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	0.010	41.809	+INF	.
MINING	0.010	4.562	+INF	.
FOOD-PRO	0.010	13.697	+INF	.
TEXTILES	0.010	13.607	+INF	.
LIGHT-INT	0.010	17.788	+INF	.
PETROL	0.010	35.471	+INF	.
BASIC-INT	0.010	51.151	+INF	.
MACHIN	0.010	20.627	+INF	.
ELEC-GAS	0.010	9.103	+INF	.
CONST	-INF	.	+INF	.

SERVI	0.010	83.430	+INF	.

---- VAR CN FINAL DEMAND FOR CONSUMER GOODS
('90 BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
FOOD	-INF	77.361	+INF	.
TOB-ALCH	-INF	10.527	+INF	.
CLOTH	-INF	26.228	+INF	.
HOUS	-INF	41.721	+INF	.
HOUS-FUR	-INF	36.660	+INF	.
TR-COM	-INF	30.215	+INF	.
HE-PC	-INF	7.506	+INF	.
CU-EDU	-INF	10.815	+INF	.
OTH	-INF	7.307	+INF	.

---- VAR CD FINAL DEMAND FOR PRIVATE CONSUMPTION
('90 BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	-INF	53.621	+INF	.
MINING	-INF	1.036	+INF	.
FOOD-PRO	-INF	28.314	+INF	.
TEXTILES	-INF	15.774	+INF	.
LIGHT-INT	-INF	9.428	+INF	.
PETROL	-INF	4.456	+INF	.
BASIC-INT	-INF	12.045	+INF	.
MACHIN	-INF	18.542	+INF	.
ELEC-GAS	-INF	1.562	+INF	.
CONST	-INF	.	+INF	.
SERVI	-INF	103.563	+INF	.

---- VAR GD FINAL DEMAND FOR GOVERNMENT CONSUMPTION
('90 BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	-INF	0.514	+INF	.
MINING	-INF	0.293	+INF	.
FOOD-PRO	-INF	1.121	+INF	.
TEXTILES	-INF	0.655	+INF	.
LIGHT-INT	-INF	0.224	+INF	.
PETROL	-INF	1.494	+INF	.
BASIC-INT	-INF	0.307	+INF	.
MACHIN	-INF	0.996	+INF	.
ELEC-GAS	-INF	0.750	+INF	.
CONST	-INF	0.223	+INF	.
SERVI	-INF	36.505	+INF	.

---- VAR ID FINAL DEMAND FOR PRODUCTIVE INVESTMENT
('90 BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	-INF	7.2839E-4	+INF	.
MINING	-INF	.	+INF	.
FOOD-PRO	-INF	.	+INF	.
TEXTILES	-INF	.	+INF	.
LIGHT-INT	-INF	0.450	+INF	.
PETROL	-INF	.	+INF	.

BASIC-INT	-INF	3.415	+INF	.
MACHIN	-INF	7.194	+INF	.
ELEC-GAS	-INF	.	+INF	.
CONST	-INF	70.506	+INF	.
SERVI	-INF	8.661	+INF	.

---- VAR DST INVENTORY INVESTMENT BY SECTOR ('90 BILL TL)

	LOWER	LEVEL	UPPER	MARGINAL
AGRIC	-INF	3.910	+INF	.
MINING	-INF	0.893	+INF	.
FOOD-PRO	-INF	0.829	+INF	.
TEXTILES	-INF	1.032	+INF	.
LIGHT-INT	-INF	0.247	+INF	.
PETROL	-INF	-4.239	+INF	.
BASIC-INT	-INF	2.080	+INF	.
MACHIN	-INF	2.671	+INF	.
ELEC-GAS	-INF	.	+INF	.
CONST	-INF	.	+INF	.
SERVI	-INF	4.959	+INF	.

	LOWER	LEVEL	UPPER	MARGINAL
---- VAR Y	0.010	395.048	+INF	.

Y PRIVATE GDP (CURR BILL TL)

---- VAR V INDIRECT UTILITY FUNCTION

	LOWER	LEVEL	UPPER	MARGINAL
URB-POOR	-INF	4.629	+INF	.
URB-MIDDLE	-INF	8.674	+INF	.
URB-RICH	-INF	10.533	+INF	.
RUR-POOR	-INF	2.936	+INF	.
RUR-MIDDLE	-INF	5.786	+INF	.
RUR-RICH	-INF	4.774	+INF	.

---- VAR IND EXPENDITURE FUNCTION

	LOWER	LEVEL	UPPER	MARGINAL
URB-POOR	-INF	29.812	+INF	.
URB-MIDDLE	-INF	62.435	+INF	.
URB-RICH	-INF	78.506	+INF	.
RUR-POOR	-INF	19.351	+INF	.
RUR-MIDDLE	-INF	38.859	+INF	.
RUR-RICH	-INF	33.250	+INF	.

---- VAR SL SHARE OF LABOUR BY HOUSEHOLD TYPE (UNITY)

	LOWER	LEVEL	UPPER	MARGINAL
URB-POOR	0.193	0.193	0.193	16.524
URB-MIDDLE	0.295	0.295	0.295	16.222
URB-RICH	0.245	0.245	0.245	15.496
RUR-POOR	0.099	0.099	0.099	16.165
RUR-MIDDLE	0.137	0.137	0.137	15.454
RUR-RICH	0.031	0.031	0.031	14.304

```
---- VAR TRANS           -INF      23.150      +INF        .

  TRANS        CURRENT TRANSFERS TO HOUSEHOLDS                    (CURR
BILL TL)


---- VAR TR            SHARE OF TRANSFER PAYMENTS BY HOUSEHOLD TYPE
(UNITY)

               LOWER      LEVEL      UPPER    MARGINAL

URB-POOR       0.190      0.190      0.190      4.448
URB-MIDDLE     0.318      0.318      0.318      4.383
URB-RICH       0.238      0.238      0.238      4.226
RUR-POOR       0.097      0.097      0.097      4.371
RUR-MIDDLE     0.119      0.119      0.119      4.217
RUR-RICH       0.037      0.037      0.037      3.969

                          LOWER      LEVEL      UPPER    MARGINAL

---- VAR GR                -INF     74.349      +INF        .
---- VAR TARIFF            -INF     10.886      +INF        .
---- VAR INDTAX            -INF      6.645      +INF        .
---- VAR TOTHHTAX          -INF     66.099      +INF        .
---- VAR VATAX             -INF     13.868      +INF        .
---- VAR EXTAX             -INF          .      +INF        .
---- VAR DUTY              -INF          .      +INF        .
---- VAR GDTOT           43.083     43.083     43.083     -0.092

 LOWER      LEVEL      UPPER    MARGINAL

URB-POOR       0.045      0.045      0.045     -1.672
URB-MIDDLE     0.093      0.093      0.093     -3.700
URB-RICH       0.159      0.159      0.159     -4.715
RUR-POOR       0.122      0.122      0.122     -1.159
RUR-MIDDLE     0.239      0.239      0.239     -2.585
RUR-RICH       0.467      0.467      0.467     -3.126

                          LOWER      LEVEL      UPPER    MARGINAL

---- VAR LBR               -INF    107.106      +INF        .
---- VAR CPT               -INF    263.310      +INF        .
---- VAR HHSAV             -INF     66.735      +INF        .
---- VAR GOVSAV            -INF     31.265      +INF        .
---- VAR DEPRECIA          -INF          .      +INF        .
---- VAR SAVINGS           -INF    102.606      +INF        .
---- VAR FSAV            12.791     12.791     12.791      0.045
---- VAR TRAN            23.150     23.150     23.150      0.038
---- VAR REMIT            4.117      4.117      4.117      0.059

  LBR          TOTAL LABOUR INCOME                                ('90
BILL TL)
  CPT          TOTAL CAPITAL INCOME                               ('90
BILL TL)
  HHSAV        TOTAL HOUSEHOLD SAVINGS                            (CURR
BILL TL)
  GOVSAV       GOVERNMENT SAVINGS                                 (CURR
BILL TL)
  DEPRECIA     TOTAL DEPRECIATION EXPENDITURE                     (CURR
BILL TL)
  SAVINGS      TOTAL SAVINGS                                      (CURR
BILL TL)
  FSAV         FOREIGN SAVINGS                                   (CURR
BILL
               DOLLARS)
  TRAN         TRANSFER PAYMENTS TO HOSEHOLDS BY GOVERNMENT       (CURR
BILL TL)
```

```
  REMIT          NET REMITTANCES FROM ABROAD                          (CURR
BILL
                 DOLLARS)


---- VAR YH              TOTAL INCOME BY HOUSEHOLD TYPE
(CURR
                         BILL TL)

                 LOWER      LEVEL      UPPER     MARGINAL

URB-POOR          -INF      36.850      +INF         .
URB-MIDDLE        -INF      82.774      +INF         .
URB-RICH          -INF     117.478      +INF         .
RUR-POOR          -INF      25.433      +INF         .
RUR-MIDDLE        -INF      58.958      +INF         .
RUR-RICH          -INF      73.555      +INF         .


---- VAR YDH             DISPOSABLE INCOME BY HOUSEHOLD TYPE
(CURR
                         BILL TL)

                 LOWER      LEVEL      UPPER     MARGINAL

URB-POOR          -INF      31.204      +INF         .
URB-MIDDLE        -INF      68.852      +INF         .
URB-RICH          -INF      93.348      +INF         .
RUR-POOR          -INF      22.040      +INF         .
RUR-MIDDLE        -INF      51.063      +INF         .
RUR-RICH          -INF      62.441      +INF         .

---- VAR DK              VOLUME OF INVESTMENT BY SECTOR OF DESTINATION
('90
                         BILL TL)

               LOWER      LEVEL      UPPER     MARGINAL

AGRIC             -INF      0.106      +INF         .
MINING            -INF          .      +INF         .
FOOD-PRO          -INF          .      +INF         .
TEXTILES          -INF      0.097      +INF         .
LIGHT-INT         -INF      0.275      +INF         .
PETROL            -INF          .      +INF         .
BASIC-INT         -INF          .      +INF         .
MACHIN            -INF     25.185      +INF         .
ELEC-GAS          -INF          .      +INF         .
CONST             -INF     57.277      +INF         .
SERVI             -INF      7.287      +INF         .

                         LOWER      LEVEL      UPPER     MARGINAL

---- VAR OMEGA            -INF      36.102      +INF         .
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