Trade Policy And General Equilibrium Under Different Market Regimes With Numerical Applications To Turkey

by

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Quando Io ebbi concluso quel corso di studi, al cui termine si era accolti nel numero dei dotti, io cominciai a pensare in modo del tutto opposto. Compresi infatti di trovarmi avviluppato in tanti dubbi e tanti errori da arrivare a credere che tutto il mio impegno per istruirmi non mi avesse dato altro vantaggio che quello di farmi scoprire sempre piu' profondamente la mia ignoranza.

Cartesio (Dissertatio de Methodo, pp 2-3) *to my wife Antonella*

and my daughter Martina

Summary

This dissertation investigates issues concerning export quotas and tariffs within a general equilibrium (GE) framework, under assumptions of both perfect and imperfect competitive markets, when trade is all intraindustry. The dissertation addresses important, though relatively neglected, contemporary trade policy issues in the developing world, such as Voluntary Export Restraints (VERs) and optimal export taxes. Given the complexity of the GE analysis with increasing returns to scale and imperfect competition, I also employ computational techniques in order to better understand the economic implications of trade policies, especially with regard to the impact on welfare, which is often analytically ambiguous. The empirical analysis has been applied to Turkey, being a middle-income developing country which still applies high tariffs and export quotas. However, the empirical findings have a wider application. Firstly, I provide a different rationale from the standard literature as to why VERs are accepted by exporting firms. The essence of the argument is that a VER serves as an institution to prevent entry and, therefore, to protect the monopoly power of incumbent firms in both domestic and export markets. The impact on social welfare is indeterminate. However, numerical results for Turkey support the conjecture that with the elimination of a VER an exporting country is worse off, and that this welfare loss is larger, the smaller the country in question. Secondly, I argue that an export tax, considered to be optimal in a partial equilibrium (PE) framework, might be sub-optimal in a GE setting. In fact, all numerical simulations support the view that the PE export tax leads to a social welfare loss. I also demonstrate analytically that the PE formula is upwardly biased. Finally, a further issue has been analysed, which refers to the impact of regional agreements on income distribution and employment, which are two of the most contentious issues among economists and policy-makers, in the areas of tariffs and quotas. Given the complexity of the analysis in a multi-household and multi-factor framework, I apply a GE model with constant returns to scale and perfect competition to study the impact on welfare, income distribution and employment of the recent customs union (CU) agreement between Turkey and the European Union (EU) on the Turkish economy. The numerical results indicate that the CU is not trade diverting. Most importantly, this agreement might substantially raise income inequality between urban and rural household members, suggesting that analysis based only on assumptions, which characterise the Stolper-Samuelson theorem, might be misleading. In addition, the CU favour the creation of 148 thousands new jobs, mainly with basic skills. So, in conclusion, I argue that (i) VERs are agreed to protect the monopoly power of incumbent firms and to enhance possibly the welfare of the exporting country; (ii) export taxes are upwardly biased and non-optimal; (iii) the regional agreement with the EU raises Turkish employment and might raise income inequality among household members.

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CHAPTER 1

Introduction and Outline

The aim of this thesis is to analysis a set of trade policy issues within a GE framework. Although tariffs and quotas are often used as a source of government revenues, especially by developing countries, issues such as the economic impact of optimal export taxes and export quota have been relatively neglected by the contemporary economic literature. In fact, the "new trade theory" and, to a certain extent, the "strategic trade theory" concentrated their analysis on import tariffs and subsidies.[1] For example, in a seminal paper by Krugman (1979), he argues that there are mutual gains from trade as, by enlarging markets, international trade would allow both a greater variety of goods and a greater scale of production.[2] Whereas, in a strategic duopoly Cournot game, Brander and Spencer (1985) show that governments could enhance the welfare of their nations by subsidising the exporting firm. In contrast, Eaton and Grossman (1986) find that the Brander-Spencer policy conclusion would be the

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[1] The "new trade theory" began with models facing imperfect competition and increasing returns to scale. Alongside the gains from trade due to the conventional comparative advantage, several authors argue that, by enlarging markets, international trade raises competition and allows greater exploitation of economies of scale (Krugman, 1979, 1981; Lancaster, 1980; Dixit and Norman, 1980; Helpman, 1981; Ethier, 1982). The "strategic trade theory" began with work by Brander and Spencer (1983, 1985), where they argue that governments could raise national incomes at other countries' expense by supporting national firms in international competition.

[2] However, Krugman, in a subsequent study, shows that under increasing returns to scale, protection of a domestic firm by an import tariff can shift the equilibrium to the firm's advantage in the export market by lowering its marginal cost of production (Krugman, 1984).

opposite, if the domestic firm and the foreign firm behave in a Bertrand fashion. In this case, they argue that an export tax is required for the profit-shifting motive to exist. However, if domestic consumption is introduced in this modelling framework, the impact of an export tax on welfare is no longer unambiguous, depending upon the precise forms of the demand and cost functions (Eaton and Grossman, 1986). It must be stressed that the analyses of Brander-Spencer and Eaton-Grossman focused only on the profit-shifting motive, and neglected the effects of trade policies on terms of trade (Rodrik, 1989). In addition, their analyses are based upon a strategic game among two firms, the domestic firm and the foreign firm. By so doing, they exclude *a priori* the effects of trade policies on the degree of competition among domestic firms and on firms' domestic production.

Similarly, Harris (1985) and Krishna (1989) use a duopoly model with Bertrand competition and differentiated products to show that a VER induces the domestic firm of the importing country to become an industry price leader, and therefore obtain the profits of a Stackelberg leader, as the foreign firm makes the credible commitment that it will not increase the level of exports when the domestic firm increases its price. Hence, the imposition of a VER at or close to the free trade level increases prices and profits to both the domestic and the foreign firms. However, their models examine the VER effects on an importing economy and limit the analysis of the exporting country simply to the firm's profits.

I examine the impact of export quota (Chapter 2) and optimal export taxes (Chapter 3) in a GE setting when firms produce for the export market as well as for the domestic market. Three key assumptions are postulated: (i) imperfect competition and increasing returns to scale; (ii) trade policies have a direct influence on firms' domestic production decisions; (iii) foreign trade is all intraindustry. If the first assumption has been adopted in order to derive the number of firms in equilibrium, the second assumption has been introduced in order to analyse VERs in a context of a strategic trade policy (Chapter 2) and to examine optimal export taxes when markets are segmented (Chapter 3). The third assumption has been required in order to distinguish the price vector of domestic goods from the price vectors of exports and imports. Within this modelling framework, I examine the economic impact of export taxes, which are believed to be optimal in a PE framework, and export quotas in the form of VER agreements, the former under the assumption of constant conjectures, the latter under both Cournot and Bertrand competition. It is important to stress that Eaton and Grossman (1986) show that the form of optimal trade policies depends critically on the nature of the competition between firms; whereas Venables (1994), by using a numerical multi-regional PE model, shows that the impact of trade policies is not significantly important to the different equilibrium concepts employed.

Given the complexity of the GE analysis, under the assumptions that markets are segmented, technology exhibits internal economies of scale, and trade is intraindustry, I also employ numerical GE models to verify if the qualitative effects lead to quantitative aspects of significant magnitude; and if the analytical ambiguity of the policy effects on some of the variables, such as welfare and firm size, can be numerically resolved. The empirical analysis has been applied to Turkey firstly, because it is a middle income developing country, which periodically renews VER agreements on textiles and apparel with the EU (GATT, 1994) and within the Multifibre Arrangement (MFA) scheme; secondly, because of a long tradition of planning, the State Institute of Statistics of Turkey periodically estimates reliable Input-Output tables for the nation as a whole, which are a fundamental data set for the compilation of a benchmark needed for the calibration of Applied General Equilibrium (AGE) models.[3]

A third issue, which is a hot topic among economists and policy-makers, has been examined: that is, the impact of regional agreements on income distribution and

[3] The calibration procedure consists of estimating unknown parameters, such that the observed values of endogenous variables constitute an equilibrium of the numerical model. It is important to stress that the numerical calibration does not involve any econometric testing procedure (Mansur and Whalley, 1984).

employment. Given the complexity of the GE analysis in a multi-household, multi-labour, multi-sectoral framework, I follow the traditional computational GE methodology to numerically quantify the economic impact of the recent CU agreement between Turkey and the European Union (EU) on income distribution and employment in Turkey. The technique employed follows the Arrow-Debreu GE framework, elaborated in Arrow and Hahn (1971), where each consumer has an initial endowment and a set of preferences; producers maximise profits with constant returns to scale technology; and where the standard features of excess demand functions (i.e. continuity, non-negativity and homogeneity of degree zero) and the Walras law (i.e. total value of all expenditures of households and firms is equal to total sales) apply.

It is vital to stress that both the analytical models in Chapter 2 and Chapter 3, and the three AGE models in the three chapters, are static single country open economy models, where dynamic features and retaliation issues are neglected.

The motivation behind each of these studies is simple. The first model is motivated by the fact that a clear answer is still not given as to why small exporting countries agree to voluntary restrain their exports. It is generally accepted that exporting countries receive quota rents, and they are fearful about other forms of protection by the competing importing country (Rosendorff, 1996). However, this argument cannot explain the MFA scheme, where a large number of small exporting countries periodically renew the level of export quotas for each individual country. In addition, numerical results based on multiregional AGE models indicate that several developing countries suffer welfare losses from the MFA scheme (Trela and Whalley, 1990; Francois, *et al.*, 1995; Yang, *et al.*, 1997). I show that incumbent firms keep renewing VERs agreements because these are an instrument to protect these firms from domestic competition, and therefore to protect their monopoly power in both domestic and export markets. In addition, the numerical findings indicate that, as a consequence of the elimination of VERs in Turkish textiles and apparel, there is a modest welfare loss under both quantity setting and price setting oligopolies, and this loss is larger, the smaller the country.

The second model concerns export taxes. The standard PE literature with imperfect competition (Rodrik, 1989; Helpman and Krugman, 1989; RHK, henceforth) argues that a positive optimal export tax policy can be pursued. However, the estimated optimum tax rates are generally very high, normally around 30-40%. Policy suggestions of this kind are obviously not welcome among policy-makers and industry associations. In addition, export taxes are not typically adopted to raise the welfare of a nation. I show that the RHK export tax in a GE framework has an ambiguous impact on welfare and that the Rodrik's formula is upwardly biased. Numerical estimates for Turkey indicate that the introduction of the RHK export tax leads to a social welfare loss, which is much larger if part of firms' costs is sunk.

The third model has been constructed to analyse the impact of the recent CU agreement between Turkey and the EU on income distribution and employment in Turkey.[4] Trade and income distribution, and trade and employment are now two hot topics among trade theorists (Krugman, 1995, 1997; Wood, 1994)). Thus, I build a multi-household model to quantify the impact of this regional policy on income distribution and employment in Turkey, by employing two alternative assumptions on real wages, one fixed and one flexible, as also suggested by Krugman (1995). The numerical results indicate that despite the validity of the Stolper-Samuelson theorem, overall income inequality rises in the scenario with fixed wages, suggesting that an analysis based only on the functional distribution of income and under the assumption of flexible wages might be misleading. In addition, the computed estimates indicate that 148000 new jobs would be created, as a result of the CU.

[4] Harrison, *et al.* (1997) and Mercenier and Yeldan (1997) analyse the CU between Turkey and the EU, by using AGE models with a representative consumer, thus neglecting issues on income distribution.

The thesis consists of five chapters in all. Chapter 1 introduces the general aim of the thesis. Chapter 2 studies the economic implications of the elimination of a VER for an exporting country. Chapter 3 examines the economic implications of what is believed to be a PE optimal export tax in a GE framework. Chapter 4 analysis the economic implications, the income distribution effects, and the impact on employment of the 1996 CU agreement between Turkey and the EU, applying a multi-household, multi-labour GE model to the Turkish economy, and Chapter 5 provides a summary, some conclusions and the perspectives for future research. The appendices related to each chapter are reported in the last section of the thesis.

CHAPTER 2

Why Exporting Countries Agree to Voluntary Export Restraints: The Oligopolistic Power of the Foreign Supplier

[2.1] Introduction

The economic literature on VERs was developed in the eighties, when such agreements started to be used internationally as an instrument to protect the domestic economy from international competition, without breaking the GATT rules. The standard analysis of a VER, in the context of perfectly competitive markets, identifies three effects: the higher price paid by consumers of the importing country, the transfer of rents associated with artificially high prices from the importing to the exporting country, and the lower supply price for exports, as the marginal revenue product decreases.[5] It can be shown that the global welfare loss for a two-country economy as a whole is represented by the loss in the consumer surplus faced by the importing country, plus the loss in the producer surplus faced by the exporting country. In an imperfectly competitive market Harris (1985), Krishna (1989) and Rosendorff (1996)

[5] de Melo and Winters (1990) estimate a 9% fall of the marginal revenue product of factors employed in the Korean footwear industry leading the industry to contract, as a consequence of a VER agreement with the US in the period 1977-81. This econometric finding supports the view that a VER decreases the supply price of exports. The economic effects of VERs are surveyed by Hamilton (1985) and Pomfret (1989).

show that a further effect arises since quantitative restrictions may increase the market power of some firms. However, their models examine the VER effects on an importing economy and limit the analysis of the exporting country simply to the firm's profits. Harris (1985) and Krishna (1989) use a duopoly model with Bertrand competition and differentiated products in a partial equilibrium setting to show that a VER induces the domestic firm of the importing country to become an industry price leader (assumed in Harris, but derived endogenously by Krishna), and therefore obtain the profits of a Stackelberg leader, as the foreign firm makes the credible commitment that it will not increase the level of exports when the domestic firm increases its price. Hence, the imposition of a VER at or close to the free trade level increases prices and profits to both the domestic and the foreign firms.[6] Rosendorff claims that an exporting country agrees a VER for fear of antidumping actions or other forms of administered protection by the importing country.[7] Suzumura and Ishikawa (1997) extend the Harris's result to the welfare implications of a VER. They show that, whether the duopolists compete in prices or quantities, a VER set equal to the free-trade level of exports enhances the welfare of the importing country if, and only if, it reduces the profits of the exporting firm. Kemp, *et al.* (1997) show that the Suzumura-Ishikawa proposition survives in a general equilibrium setting if, and only if, the two goods are substitutes, the own price elasticities are larger than the cross price elasticities, and the price effects outweigh the income effects of the trade policy.

Most of the literature on VERs focuses upon the effect of a VER on an importing economy. The implication for an exporting country have been mainly analysed with empirical models. de Melo and Winters (1993), for example, argue that with a VER the contraction in the restrained industry is associated with spillovers of

[6] Harris (1985) argues that the introduction of a VER serves as a collusive focal point for domestic pricing. Hence, a VER may be an instrument to hold and reinforce the oligopolistic power of established domestic firms of the importing country, rather than an instrument for import substitution.
[7] Rosendorff shows that the government of the importing country prefers a VER to an optimal tariff if the domestic firm's profits, multiplied by a factor indicating the lobbying pressure on the government, are greater than the losses in tariff revenues.

exports to unrestricted markets.[8] Applying a partial equilibrium econometric model to the Taiwan footwear industry, they also found that this country suffered a welfare loss as a consequence of a VER. Trela and Whalley (1990) report estimates of national and global welfare costs of both developed country tariffs and bilateral quotas on textiles and apparel using an AGE model with constant returns to scale. When bilateral quotas alone are removed, results clearly show that the developed countries and the vast majority of developing countries gain. Based on 1986 data, the total gain has been estimated to be of around $ 22 billion. On aggregate, developing countries gain around $ 3 billion.[9] Similar results for developing countries are found by Yang (1994) and Yang, *et al.* (1997).

Francois, *et al.* (1995), by using various types of multiregional AGE models characterised by perfect competition, or imperfect competition, or endogenous capital stock, found that the elimination of the MFA would result in welfare gains for most of developing countries, and for developing countries as a whole.[10] In contrast, Harrison, *et al.* (1997), by using a similar modelling approach, found that the elimination of the MFA would result in welfare gains for few countries, and in losses for developing countries as a whole. They argue that this aggregate welfare loss is due to the transfer of MFA quota rents from developing to industrialised countries. Only in the long run, after capital stock has optimally adjusted, do they estimate an aggregate welfare gain for developing countries as a whole. Similar results have been also obtained by Hertel,

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[8] However, in a previous study, by investigating the effects of VERs on resource allocation in the Korean leather footwear industry, de Melo and Winters (1990) estimate that the reduction of the industry size is mainly due to the difficulty of switching sales towards markets which are not constrained by VERs.

[9] In a subsequent study, Trela and Whalley (1995) focus their attention upon the extra costs on exporting countries of their own internal quota-allocation procedures. Since quotas are typically allocated to established rather than new and more efficient firms, the cost of quota restriction in their model is estimated to be $ 23 billion per year compared to the $ 3 billion without internal quota-allocation schemes.

[10] The main feature of the MFA is the use of bilateral agreements on export quotas to regulate textiles and apparel trade. VERs are typically agreed so as to limit textiles and apparel exports from developing countries. Under the MFA, in addition to bilateral quotas, importing countries also levy non-discriminatory tariffs (Yang, *et al.* 1997).

et al. (1995). These empirical findings support the dominant view that several exporting countries, especially small countries, are forced, rather than agree voluntarily, to export restraints.

This paper explores the economic effects of a VER on a foreign supplier when the VER also modifies the degree of competition in the exporting country's domestic market, under both Bertrand and Cournot conjectures. I show that the elimination of a VER certainly leads to a more efficient allocation of resources, favouring the expansion of the previously restrained industry. However, the elimination of an export quota causes an increase in the producer price of exports, which brings about a rise in the composite producer price. The export expansion and the higher average cost allow less efficient firms to break even. As the number of the competing symmetric firms within the industry increases, the firms' perceived elasticity of export demand rises. As a result, the power of incumbent firms declines regardless of the firms' conjectures. However, the smaller the country, the larger the possibility that the monopoly power in the domestic market declines more than in the export market. With regard to the impact on firm size, it positively depends upon the size of export growth for the industry as a whole, and on the impact on firms' domestic production, and negatively on the extent of new entry.

From the social point of view, I show that the elimination of a VER has two positive, two negative and two indeterminate effects on the welfare of the exporting country. The positive effects are due to the increase in the producer price of exports, as foreign consumers are more sensitive to price changes, rather than to quota premium variation (*export producer price* effect);[11] and to increased product diversity, as domestic brands enter in pursuit of positive profits (*variety* effect). The negative effects on welfare are due to the loss of the economic rent (*rent loss* effect), and the greater cost of purchasing intermediate inputs (*increased intermediate inputs cost*

[11] In models with perfect competition and constant returns to scale, with the elimination of a VER, the rise in the supply price of exports is due to the fact that the marginal revenue product rises (de Melo and Winters, 1990).

effect). In fact, I show that the impact on the costs of intermediate inputs might be substantial and might be larger than the rise in the producer price of exports. The impact on the consumer price index (*consumer price* effect) and on total production (*global efficiency* effect) cannot be classified. Thus, the welfare implications of VERs on an exporting economy are analytically indeterminate.

In order to comprehend the significance of the analytical results, to understand better the uncertain outcome on welfare and firm size, and to examine how sensitive the results are to alternative equilibrium concepts, an AGE model with the restrained sectors facing increasing returns to scale, identical firms, and free entry/exit has been built. This model studies the main effects of the elimination of VERs on welfare, output, resource allocation, average cost, firm size, concentration of the industry and price cost margin, under both Bertrand and Cournot conjectures. The model has been applied to the Turkish textiles and apparel industries, which have been subject to VERs in relation to the European market since 1982 for textiles and 1986 for apparel, and since then periodically renewed and now broken as a consequence of the recent customs union agreement (GATT, 1994). The numerical results clearly indicate that regardless of market conjectures, as a consequence of the elimination of VERs, the contraction of industry concentration is substantial, whilst it is modest regarding the negative impact on price cost margins. In addition, it supports the hypothesis that the negative welfare effects dominate the positive effects with trade, thus decreasing the aggregate welfare of a nation, although by a small amount. It also confirms the analytical result that the smaller the country the larger the negative economic implications of the abrogation of VERs for incumbent firms. Similarly, there is a larger welfare loss for the nation as a whole. The quantitative results are less sensitive to equilibrium concepts. However, incumbent firms would be worse off in terms of new entry, size and average cost under Bertrand conjectures. as they are inherently more competitive. Hence, it seems that industry associations, with the consent of policy-makers of exporting countries, reach agreements about VERs for rational economic reasons.

[2.2] A model with imperfect competition and symmetric firms

A VER is an entry barrier in the market for exports. It favours the concentration of the industry, and allows established firms, especially those which receive the export licence, to better exploit economies of scale by producing at lower average cost. Since the break-even price for potential entrants is the average cost, a VER can also be regarded as an effective entry barrier in the domestic market. Thus, the voluntary acceptance of export restraints not only generates forms of oligopoly in the market for exports, but also modifies the degree of competition in the foreign supplier's domestic market. I model the oligopolistic behaviour of firms as a noncooperative game, where the stable solution is represented by a Nash equilibrium in prices or quantities. To justify that, it can be argued that a VER may facilitate the learning process of each established firm with regard to the reaction functions of other competing firms, such that each incumbent firm chooses the amount of output (exported and sold in the domestic market) in order to maximise its own profit, given the output or the price choice of other competing firms. So a VER may serve as an institution to protect an established domestic oligopoly of an exporting country, which behaves in a Cournot or Bertrand fashion.

The model presented in this section is an intraindustry GE model with increasing returns to scale, segmented markets and symmetric firms used to study the impact of the elimination of a VER on the average cost, the number of firms, firm size, industrial output, price cost margin and welfare, under both Bertrand and Cournot conjectures. I also assume the existence of sectors not subject to VERs, which face perfect competition and constant returns to scale. The latter sectors are indexed with *crs*, whilst the sectors subject to VERs are indexed with *i*. To represent all sectors of the economy, I use $j = i \cup crs$.

To model domestic and foreign trade, I assume that each firm in sector *i* and each industry *crs* employ factors and intermediate inputs to produce two imperfect substitute goods, one sold in the domestic market and the other exported. The representative consumer gains utility from the consumption of domestic goods produced by the industry *crs* and their imperfect substitute imports, and from the consumption of a variety of domestic goods produced by the sectors of differentiated products and a variety of imperfect substitute imports. Also the sectoral intermediate demand, which is defined as a Leontief specification of sectoral output, is satisfied with the supply of domestic goods and imports.

[2.2.1] Technology and cost function

The production function of a single representative firm, Θ, is additively separable in Φ_1 and Φ_2, and such that $\partial^2\Theta/(\partial\Phi_1\partial\Phi_2) > 0$:

(2.1) $$y_i = \Theta\left[\Phi_1\left(x_{ji}\right), \Phi_2\left(l_i, k_i\right)\right]$$
$$= 0 \text{ if } l_i < l_i^f \text{ or } k_i < k_i^f$$

where y_i represents composite production of domestic goods and exports; x_{ji} denote intermediate inputs, assumed to be net complements; l_i and k_i represent labour and capital inputs; and l_i^f and k_i^f the fixed factor inputs needed to start the production process. Due to the presence of fixed setup costs, the production sets are not-convex. Φ_2 is locally assumed to be twice differentiable, so that $\Phi'_2 > 0$ and $\Phi''_2 < 0$.

The production possibility frontier of each firm is represented by

(2.2) $$y_i = \Omega(d_i, e_i), \qquad \Omega_d > 0,\ \Omega_e > 0,\ \partial^2\Omega/(\partial d_i \partial e_i) < 0,$$

which locally is a separable, differentiable transformation curve of domestic goods (d_i) and exports (e_i). The transformation curve is locally assumed to be twice differentiable with respect to d_i and e_i, such that $\Omega''(d_i)<0$ and $\Omega''(e_i)<0$.

The fixed factor inputs, l_i^f and k_i^f, multiplied by their respective returns, determine the firm's fixed cost. It is important to emphasise the benefits for each firm of raising production, as each firm would bear a reduced fixed cost element per unit of output. The total cost faced by each firm is the sum of variable and fixed costs, hence the average cost (ac_i) to produce one unit of output is

$$ac_i = \left(wl_i + rk_i + \sum_j p_j x_{ji} \right) \Big/ y_i , \tag{2.3}$$

where p_j denotes the price vector of final and intermediate goods. The factor demands of each firm and the marginal cost equation can be derived by solving a standard dual problem. The marginal cost is independent of output, and is a function of factor prices and sector specific parameters.

The production function and the transformation curve for sectors facing perfect competition and constant returns to scale take respectively the following form:

$$Y_{crs} = \Theta^{crs}\left[\Phi_1^{crs}\left(x_{jcrs}\right), \Phi_2^{crs}\left(L_{crs}, K_{crs}\right)\right] \tag{2.4}$$

$$Y_{crs} = \Omega^{crs}\left(D_{crs}, E_{crs}\right), \tag{2.5}$$

where Y_{crs} denotes composite output, D_{crs} domestic output, E_{crs} exports, L_{crs} labour, and K_{crs} capital for the industry as a whole. Θ^{crs} is globally linear homogenous, additively separable in Φ_1^{crs} and Φ_2^{crs}, and such that $\partial^2\Theta^{crs} / \left(\partial\Phi_1^{crs}\partial\Phi_2^{crs}\right) > 0$. Φ_2^{crs} is twice differentiable. Ω^{crs} is globally linear homogenous, separable, differentiable and concave.

[2.2.2] Number of firms

The model is characterised by free entry/exit. One key feature of the model is the definition of the profit function:

(2.6) $$\pi_i = pd_i d_i + pe_i e_i - c_i(d_i + e_i) - f_i,$$

where π_i denotes pure profits net of rents from VERs, pd_i the domestic price, pe_i the producer price of exports, c_i the marginal cost and f_i the fixed cost. It does not include rents from VERs, because entry in the export market is restricted to those owning the licence to export. So economic rents can be still made by firms with the licence to export. In summary, the number of firms is endogenously determined by the zero profit condition: $\pi_i = 0$.

[2.2.3] Domestic and foreign demand functions

Armington (1969) argues that goods produced by industries located in different countries, but which compete in the same market, are imperfect substitute. The Armington specification is typically a CES function of domestically produced goods and imports. This approach is very useful to derive the demand for domestic goods (D_i) and the demand for imports (M_i) by solving the Armington-dual problem:

(2.7) $$D_i = \varphi_i^{\varepsilon_i} pd_i^{-\varepsilon_i} p_i^{\varepsilon_i} Q_i$$

(2.8) $$M_i = (1-\varphi_i)^{\varepsilon_i} \overline{pwm_i}^{-\varepsilon_i} p_i^{\varepsilon_i} Q_i,$$

(2.9) $$Q_i = f(HR, p_i) + X_i$$

where Q_i is the sum in quantities of final demand (f) and intermediate demand (X_i), HR denotes the representative consumer income, $\overline{pwm_i}$ the fixed world price of imports, φ_i a share parameter of the Armington function, ε_i the elasticity of substitution between imports and domestic goods, $p_i = \left[\varphi_i^{\varepsilon_i} pd_i^{1-\varepsilon_i} + (1-\varphi_i)^{\varepsilon_i} \overline{pwm}_i^{1-\varepsilon_i}\right]^{1/(1-\varepsilon_i)}$, $X_i = \sum_j a_{ji} Y_j$. (2.9) is the equilibrium condition in the goods market. The Marshallian demand functions, f, are derived by solving a three stages utility maximisation problem, with the representative consumer facing a convex indifference curve *a la* Dixit-Stiglitz (Dixit and Stiglitz, 1977). In the first stage, consumers allocate income between goods which are produced by the differentiated industries; in the second stage, they allocate income between imports and domestic competing goods; and, in the third stage, they allocate income between the differentiated domestic products and the differentiated imports.

An oligopolistic profit maximising firm is characterised by a decreasing marginal revenue curve in the domestic market as well as in the market for exports. This implies that domestic demand and export demand ought to be downward sloping. The solution of the Armington-dual problem leads to the desired downward sloping domestic demand curve [see (2.7)], whilst the industry export demand function (E_i) is assumed negative and iso-elastic:

(2.10) $$E_i = A_i pwe_i^{-\eta_i},$$

where pwe_i is the price paid by foreign consumers for goods under VER, η_i the absolute value of the foreign price elasticity and A_i a positive constant.[12]

The Armington specification and an infinitely elastic export demand function are postulated for sectors facing perfect competition and constant returns to scale.

[12] Note that the criticism by Whalley and Young (1984), about the external sector closure rules in AGE models, does not hold in this modelling framework for two reasons: firstly, the exchange rate does not appear in the model; secondly, the foreign import-supply function is assumed to be infinitely elastic.

[2.2.4] Price mark-ups and firms' perceived elasticities

The fact that the domestic market and the export market are segmented implies that firms maximise (2.6) with respect to both d_i and e_i. The profit maximising conditions result in the Lerner mark-ups formula:

$$pd_i\left(1-\frac{1}{|\tau_i|}\right)=c_i, \tag{2.11}$$

$$pe_i\left(1-\frac{1}{|\delta_i|}\right)=c_i, \tag{2.12}$$

where τ_i and δ_i represent the firm's perceived price elasticities of domestic demand and export demand, respectively.

τ_i can be derived by considering the consumer three-stage budgeting procedure. To derive δ_i, I also assume that a hypothetical foreign consumer purchases different brands of the industry under VER.

In the third stage of the budgeting procedure, the representative domestic consumer maximises the following subutility function subject to the budget devoted to the purchase of domestic goods:

$$\max_{\tilde{d}_{is}}\left\{D_i=\left[\sum_{s=1}^{n}\tilde{\beta}_{is}\tilde{d}_{is}^{(\varsigma_i-1)/\varsigma_i}\right]^{\varsigma_i/(\varsigma_i-1)}\right\} \quad \text{s.t.} \quad \sum_{s=1}^{n}\tilde{pd}_{is}\tilde{d}_{is}=pd_iD_i, \qquad \sum_{s=1}^{n}\tilde{\beta}_{is}=1,$$

where ς_i, which is greater than one, is the elasticity of substitution among n domestic varieties; $\tilde{\beta}_{is}$ are demand parameters describing the consumer preferences for a brand s produced by a sector i, $\tilde{d}_{is}$, which are priced at $\tilde{pd}_{is}$; and $pd_i=\left[\sum_{s=1}^{n}\tilde{\beta}_{is}^{\varsigma_i}\tilde{pd}_{is}^{(1-\varsigma_i)}\right]^{1/(1-\varsigma_i)}$ represents the price index (or unit expenditure function).

Similarly, the foreign consumer in the purchase of brands subject to a VER faces the following problem

$$\max_{\tilde{e}_{is}}\left\{E_i=\left[\sum_{s=1}^{n}\tilde{\gamma}_{is}\,\tilde{e}_{is}^{\,(\xi_i-1)/\xi_i}\right]^{\xi_i/(\xi_i-1)}\right\}\quad \text{s.t.}\quad \sum_{s=1}^{n}\tilde{pwe}_{is}\,\tilde{e}_{is}=pwe_iE_i,\qquad \sum_{s=1}^{n}\tilde{\gamma}_{is}=1.$$

where ξ_i, which is greater than one, is the elasticity of substitution among n exported brands; $\tilde{\gamma}_{is}$ are demand parameters describing the preferences of the foreign consumer for a brand s exported by sector i, $\tilde{e}_{is}$; $\tilde{pwe}_{is}$ denote their price, and

$pwe_i=\left[\sum_{s=1}^{n}\tilde{\gamma}_{is}^{\,\xi_i}\,\tilde{pwe}_{is}^{\,(1-\xi_i)}\right]^{1/(1-\xi_i)}$ is the price of the aggregate, E_i.

Utility maximisation implies that the demand for product varieties is a negative function of the price of the varieties and a positive function of the aggregate price index. In fact, the first order conditions yield:

$$\text{(2.13)}\qquad \tilde{d}_{is}=\tilde{\beta}_{is}^{\,\varsigma_i}\,D_ipd_i^{\,\varsigma_i}\,\tilde{pd}_{is}^{\,-\varsigma_i},$$

$$\text{(2.14)}\qquad \tilde{e}_{is}=\tilde{\gamma}_{is}^{\,\xi_i}\,E_ipwe_i^{\,\xi_i}\,\tilde{pwe}_{is}^{\,-\xi_i}.$$

As a result, (2.10) and (2.14) imply that $\xi_i>\eta_i$.

As already described in section [2.2.3], domestic demand and export demand have different characteristics. Domestic demand is derived by solving a dual problem, whilst export demand is assumed to be iso-elastic. So two different approaches have been employed to derive τ_i and δ_i under both Cournot and Bertrand competition. τ_i has been obtained following Harrison, *et al.* (1994), who in their model employ the Armington specification;[13] whereas δ_i has been obtained following Smith and Venables (1988), where a iso-elastic demand function is postulated. Under both Bertrand and Cournot conjectures, the profit maximising conditions take the form of (2.11) and (2.12). However, if firms maximise profits given rivals' prices (i.e. Bertrand competition), then τ_i and δ_i take the form,

[13] Harrison, *et al.* (1994) derive the price elasticity of demand under Cournot conjectures and under the assumption that the price elasticity of aggregate demand (χ_i) is unity, whilst I assume that χ_i is endogenously specified. The Bertrand formula is my derivation.

(2.15) $$\tau_i = -\frac{1}{n_i}\left[(1-\Psi_i)\varepsilon_i + \Psi_i\chi_i\right] - \left(1-\frac{1}{n_i}\right)\varsigma_i,$$

(2.16) $$\delta_i = -\xi_i\left(1-\frac{1}{n_i}\right) - \frac{\eta_i}{n_i},$$

where $\Psi_i = pd_iD_i/\left(pd_iD_i + \overline{pwm}_iM_i\right)$ denotes the consumption share for domestic goods and χ_i the absolute value of the price elasticity of aggregate demand.[14] If, in contrast, firms maximise profits given rivals' output (i.e. Cournot competition), then τ_i and δ_i take the form,

(2.17) $$\frac{1}{\tau_i} = -\frac{1}{\varsigma_i} - \frac{1}{n_i}\left[\frac{(\varsigma_i - \varepsilon_i)}{\varsigma_i\varepsilon_i} + \Psi_i\left(\frac{\varepsilon_i - \chi_i}{\chi_i\varepsilon_i}\right)\right],$$

(2.18) $$\frac{1}{\delta_i} = -\frac{1}{\xi_i} - \frac{1}{n_i}\frac{(\xi_i - \eta_i)}{\xi_i\eta_i}.$$

(2.15)-(2.18) show that the larger the price elasticities of domestic (foreign) demand, or the larger the elasticities of substitution among domestic (export) varieties, the larger the absolute value of the price elasticity perceived by firms in the domestic (export) market and, as a result, the lower the price cost margin in the domestic (export) market. In addition, (2.15) and (2.17), and (2.16) and (2.18) provide a formal demonstration that the individual producer faces a more elastic demand curves with entry, if $\varsigma_i > \varepsilon_i > \chi_i$ and $\xi_i > \eta_i$, respectively. It is also interesting to note that as the number of firms rises, the absolute value of both price elasticities converges towards the elasticity of substitution among brands under both Cournot and Bertrand competition. This implies that the impact of trade policies on the main variables would vary under Cournot and Bertrand conjectures only with respect to the magnitude of the

[14] See Appendix 2.A for derivation of equations (2.15)-(2.18).

change. Whereas the direction of the change of the variables would remain substantially similar.[15]

[2.2.5] Rents and the supply price of exports

The policy experiment performed in this study is the evaluation of the impact of the elimination of a VER, when rents accrue to firms. So I assume that the industry associations of an exporting country already agreed with an importing country to restrain their level of exports. This implies that the government does not intervene in allocating export licenses and is not the recipient of the rents. The rents accrue to the private sector, and each firm receives a rent (ver_i) which is equal to the *ad valorem* quota premium parameter (qr_i) times exports, evaluated at pe_i:

(2.19) $$ver_i = qr_i pe_i e_i$$

The producer price of exports (pe_i) is equal to the agreed price adjusted by qr_i:

(2.20) $$pe_i = \frac{pwe_i}{1+qr_i}.$$

As I am interested in examining the economic implications of the elimination of VERs, qr_i is assumed to be exogenous. When qr_i is zero, the rent disappears and $pe_i = pwe_i$.

[15] It is important to stress that a similar conclusion has been drawn by Venables (1994). By using a multiregional computable partial equilibrium model of trade under imperfect competition, Venables finds that the gains from an import tariff and an export subsidy are not significantly sensitive to the change of the equilibrium concept. The equilibrium types used in his study are the cases of price and quantity competition, segmented markets, and oligopoly and monopolistic competition.

[2.2.6] Representative household income

The sources of household income are value added, pure profits, plus the economic rents which originate from sales on foreign markets:

(2.21) $$HR = \sum_j \left(pd_j D_j + pe_j E_j - p_j X_j\right) + \sum_i n_i \pi_i + \sum_i n_i ver_i\,,$$

where the first term represents the value added, that is the value of production minus the cost of intermediate inputs. In order to study the impact of VERs alone, it is assumed free entry/exit, so that the number of firms adjusts until pure profits are zero.

[2.3] Analytical results

[2.3.1] The impact on the export producer price and the average cost

If the VER agreement is broken and the country can have an impact on its terms of trade, the immediate effect is a lower level of pwe_i and an increase of the demand for exports (2.10). However, the producer price of exports rises if foreign consumers are more sensitive to price changes, rather than to *ad valorem* quota premium variation. In fact, by using (2.10) and (2.20), pe_i can be written as

(2.22) $$pe_i = A_i^{1/\eta_i} E_i^{-1/\eta_i} \left(1 + qr_i\right)^{-1}.$$

By differentiating the latter expression with respect to qr_i, then

(2.23) $$\frac{dpe_i}{dqr_i} = -A_i^{1/\eta_i} E_i^{-1/\eta_i} \left(1 + qr_i\right)^{-2} \left(1 - \frac{\psi_i}{\eta_i}\right),$$

where $\psi_i = -\left[\left(1 + qr_i\right)/E_i\right] dE_i/dqr_i$. Then, $dpe_i/dqr_i < 0$ if, and only if, $\eta_i > \psi_i$. Since consumers are more sensitive to changes of prices gross of equivalent taxes, rather than to the variation of the equivalent tax rate itself, I argue that the elimination of a VER raises the producer price of exports. Obviously, the smaller the country (that is the larger η_t), the greater the negative impact on pe_t. In summary, pe_t under free trade is greater than its value under VER, but smaller than pwe_t under VER.

The composite producer price (py_t) is equal to

$$py_t = \frac{D_t}{Y_t} pd_t + \frac{E_t}{Y_t} pe_t . \tag{2.24}$$

Since qr_t has a secondary impact on pd_t and D_t, then also py_t rises as a consequence of the VER abrogation. Given the zero profit condition, then, $dac_t/dqr_t < 0$. In summary:

PROPOSITION 2.1: *The elimination of a VER increases the producer price of exports. The liberalisation process is thus associated with a rise in the average cost, which is larger, the smaller the country.*

[2.3.2] The impact on the number of firms

The profit maximisation conditions can be also written as:

$$pd_t\left[1-(1+\lambda_t)(n_t\omega_t)^{-1}\right] = c_t , \tag{2.25}$$

$$pe_t\left[1-(1+\lambda_t)(n_t\eta_t)^{-1}\right] = c_t , \tag{2.26}$$

where ω_t is the absolute value of the price elasticity of domestic demand and λ_t the firms' conjectural variation parameter, which for simplicity is assumed to be equal in both markets.[16] By multiplying (2.25) by D_t and (2.26) by E_t, and rearranging, the

[16] Appendix 2.A shows that under Bertrand conjectures $\omega_t = \varepsilon_t - (\varepsilon_t - \chi_t)\Psi_t$, whilst under Cournot conjectures $\omega_t = \left[1/\varepsilon_t - (1/\varepsilon_t - 1/\chi_t)\Psi_t\right]^{-1}$.

zero profit condition and the assumption that the marginal cost is independent of output yield

(2.27) $$n_i = \left\{ \frac{1+\lambda_i}{f_i} \left[\frac{pd_i D_i}{\omega_i} + \frac{pe_i E_i}{\eta_i} \right] \right\}^{1/2} .$$

The reduced form for n_i is very simple to interpret. Firstly, an expansion of domestic sales or export sales invites entry; secondly, markets, which are characterised by a greater price elasticity, fear more competition, than those characterised by a smaller price elasticity; thirdly, the larger the fixed cost to produce one unit of output, the smaller the number of firms in equilibrium; finally, markets, which are characterised by a lower degree of competition (i.e. a larger λ_i), allow a larger number of firms in equilibrium, which cooperate to a certain extent.

The total differential of (2.27) with respect to qr_i yields

(2.28) $$\frac{dn_i}{dqr_i} = \frac{1}{2} \left\{ \frac{f_i}{1+\lambda_i} \left[\frac{pd_i D_i}{\omega_i} + \frac{pe_i E_i}{\eta_i} \right] \right\}^{-1/2} \left[\frac{1}{\omega_i} \frac{d(pd_i D_i)}{dqr_i} - \frac{pd_i D_i}{\omega_i^2} \frac{d\omega_i}{dqr_i} + \frac{1}{\eta_i} \frac{d(pe_i E_i)}{dqr_i} \right] .$$

Given the secondary impact of qr_i on the variables related to domestic production and domestic consumption, the elimination of a VER, by raising export sales, determines the entry of new firms: $dn_i / dqr_i < 0$. So,

PROPOSITION 2.2: *The elimination of a VER raises the number of firms in equilibrium.*

It is important to stress that markets characterised by an infinite demand elasticity do not determine the number of firms in equilibrium. This feature is important to explain the empirical finding in section [2.4.2.1], where a third unrestricted export market is introduced.

[2.3.3] The impact on the price-cost margin

(2.16) and (2.18) clearly show that, with the elimination of a VER, as the number of firms rises, each producer faces a more elastic export demand curve, under both Cournot and Bertrand competition. This implies that with the elimination of a VER, the price cost margin in the export market declines. In contrast, the impact on τ_i also depends upon the impact on Ψ_i and χ_i. However, by differentiating (2.15)-(2.18) by qr_i, the incumbent firms' power in the domestic market would also fall, and at a larger rate than the drop in the export market, if

(2.29) $$\left[\varsigma_i - (1-\Psi_i)\varepsilon_i - \Psi_i\chi_i\right]\frac{dn_i}{dqr_i} + n_i\left[(\chi_i - \varepsilon_i)\frac{d\Psi_i}{dqr_i} + \Psi_i\frac{d\chi_i}{dqr_i}\right] > (\xi_i - \eta_i)\frac{dn_i}{dqr_i}$$

under Bertrand conjectures, and if

(2.30) $$\left[\frac{(\varsigma_i - \varepsilon_i)}{\varsigma_i\varepsilon_i} + \Psi_i\left(\frac{1}{\chi_i} - \frac{1}{\varepsilon_i}\right)\right]\frac{dn_i}{dqr_i} - n_i\left[\left(\frac{1}{\chi_i} - \frac{1}{\varepsilon_i}\right)\frac{d\Psi_i}{dqr_i} - \frac{\Psi_i}{\chi_i^2}\frac{d\chi_i}{dqr_i}\right] > \frac{(\xi_i - \eta_i)}{\xi_i\eta_i}\frac{dn_i}{dqr_i}$$

under Cournot conjectures. It is clear that, given the curvature of the foreign consumer's preferences (ξ_i), the smaller the country (that is, the larger η_i) the greater the possibility that the price cost margin would fall more in the domestic market as a result of a VER abrogation.

PROPOSITION 2.3: *The elimination of a VER leads to a fall of incumbent firms' monopoly power in the export market. The impact on the monopoly power in the domestic market is ambiguous. However, the smaller the country, the greater the possibility that the price cost margin would decline more in the domestic market than in the export market.*

[2.3.4] The impact on firm size

The impact on firm size is ambiguous. Since $dY_t/dqr_t = y_t(dn_t/dqr_t)+n_t(dy_t/dqr_t)$, where $Y_t = n_t y_t$; and since, by aggregating firms' domestic output and exports, the total derivative of production for the industry as a whole with respect to qr_t is $dY_t/dqr_t = \Omega_D(dD_t/dqr_t)+\Omega_E(dE_t/dqr_t)$, where Ω_D and Ω_E respectively denote the partial derivative of composite production with respect to domestic output and exports for the industry as a whole, the latter two expressions can be rearranged as

$$\text{(2.31)} \qquad \frac{dy_t}{dqr_t} = \frac{\Omega_E}{n_t}\frac{dE_t}{dqr_t} - \frac{1}{n_t}(y_t - \Omega_D d_t)\frac{dn_t}{dqr_t} + \Omega_D\frac{dd_t}{dqr_t}.$$

With the elimination of the quota premium, the first term represents the positive impact of an export expansion for the industry as a whole. The second term denotes the negative impact of returns to scale, as a larger number of firms results in the less efficient exploitation of fixed inputs (note that $\Omega_D d_t < y_t$, if $\phi_{yd} < 1$, where ϕ_{yd} denotes the elasticity of composite production with respect to domestic output.).[17] Finally, the third term denotes the capability of firms to sell in the domestic market after new entry has occurred. I expect it to be negative, since given the domestic demand, a larger number of firms implies a fall in per firm domestic production. Hence, despite the benefits from export expansion, the size of incumbent firms might not expand.

PROPOSITION 2.4: *The elimination of a VER raises the size of incumbent firms if, and only if, export expansion outweighs the negative effects of both inefficiently exploiting economies of scale and of trading in the domestic market.*

---

[17] Note that $\Omega_D d_t < y_t$ implies $\Omega_d/(y_t/d_t) < 1$.

On the basis of the results on average cost, number of firms, price cost margin and firm size, which are summarised by the first four propositions, incumbent firms will lobby the government or industry associations to keep signing VERs agreements.[18]

[2.3.5] The impact on the cost of primary and intermediate inputs

The lower price cost margin in the export market is obtainable only if the marginal cost increase is larger than the rise in the producer price of exports (2.12). Since the model assumes the factor inputs to be homogenous among sectors, the impact on factor returns should not be large. This implies that the rise in the marginal cost is mainly due to the substantial rise in the intermediate inputs costs. This finding is very important when I will analyse the VER implication on welfare in section [2.3.7].

PROPOSITION 2.5: *The elimination of a VER raises slightly the cost of primary factor inputs, and substantially the cost of intermediate inputs. The intermediate inputs cost rise might be larger than the rise in the export producer price.*

To prove Proposition 2.5, it is necessary to subgroup the marginal cost into two components: the marginal cost related to the primary factor inputs (v_t) and the marginal cost related to intermediate inputs (int_t). Rearranging (2.10),

(2.32) $$v_t + \text{int}_t = pe_t\left\{1 - 1/|\delta_t|\right\}.$$

From Proposition 2.6, $dY_t/dqr_t < 0$, which implies that $dL_t/dqr_t < 0$ and $dK_t/dqr_t < 0$, where $L_t = n_t l_t$, and $K_t = n_t k_t$. Consequently, $dv_t/dqr_t < 0$. By using the chain rule, $d\delta_t/dqr_t < (d\delta_t/dn_t)(dn_t/dqr_t)$. Since $dn_t/dqr_t < 0$ (from Proposition

[18] One might ask why incumbent firms would accept VERs in the first place, if some of them would exit the market. It could be argued that if export quotas in the first place are at, or close to, the free market equilibrium, incumbent firms would rationally welcome them.

2.2) and $d\delta_i/dn_i < 0$, then $d\delta_i/dqr_i > 0$. The latter finding, plus the fact that $dpe_i/dqr_i < 0$, imply that $dc_i/dqr_i < 0$. Consequently, if primary factor inputs are homogenous among sectors and the reduction of qr_i just slightly varies v_i, then $d\,\text{int}_i/dqr_i < 0$. In addition, the total differential of (2.32) with respect to qr_i is

$$(2.33) \qquad \frac{dv_i}{dqr_i} + \frac{d\,\text{int}_i}{dqr_i} = \left\{1 - 1/|\delta_i|\right\}\frac{dpe_i}{dqr_i} + \left\{pe_i|\delta_i|^{-2}\right\}\frac{d|\delta_i|}{dqr_i}.$$

The latter expression can be rearranged as

$$(2.34) \qquad \frac{dv_i}{dqr_i} + \frac{d\,\text{int}_i}{dqr_i} = \frac{(pe_i - c_i)}{qr_i}\left[\frac{qr_i}{|\delta_i|}\frac{d|\delta_i|}{dqr_i} - \frac{qr_i}{pe_i}\frac{dpe_i}{dqr_i}\right] + \frac{dpe_i}{dqr_i}.$$

Since $dpe_i/dqr_i < 0$ and $d|\delta_i|/dqr_i < 0$, then the first term on the right is positive, if the export producer price elasticity with respect to qr_i is in absolute value larger that the elasticity of the inverse of the price cost margin in the export market with respect to qr_i. If $\frac{dv_i}{dqr_i} < \frac{(pe_i - c_i)}{qr_i}\left[\frac{qr_i}{|\delta_i|}\frac{d|\delta_i|}{dqr_i} - \frac{qr_i}{pe_i}\frac{dpe_i}{dqr_i}\right]$, then $d\,\text{int}_i/dqr_i > dpe_i/dqr_i$. In other words, if the cost of primary factor inputs is just slightly affected, and the fall in the price cost margin in the export market is smaller than the rise in the producer price of exports, the rise in the intermediate inputs cost would be larger than the rise in the producer price of exports.

[2.3.6] The impact on output and trade volume

Given the characteristics of the transformation function (2.2), at industry level

$$(2.35) \qquad \frac{dY_i}{dqr_i} = \Omega_D\frac{dD_i}{dqr_i} + \Omega_E\frac{dE_i}{dqr_i}.$$

The first term represents the effect on domestic demand, and the second term the effect on exports. Given the secondary effect on D_i, and since $dE_i/dqr_i < 0$, then $dY_i/dqr_i < 0$.

The trade balance can be written as

$$\sum_i pwe_i E_i + \sum_{crs} \overline{pe}_{crs} E_{crs} = \sum_j \overline{pwm}_j M_j \,. \tag{2.36}$$

The derivative of (2.36) with respect to qr_i yields

$$\sum_i pwe_i \, dE_i / dqr_i + \sum_i E_i \, dpwe_i / dqr_i + \sum_{crs} \overline{pe}_{crs} \, dE_{crs} / dqr_i = \sum_j \overline{pwm}_j \, dM_j / dqr_i \,, \tag{2.37}$$

where, with the elimination of VERs, the first term denotes the positive quantity effect due to export expansion, the second term denotes the negative terms of trade effect, the third term represents the negative effect of other sectoral exports, as resources are reallocated, and the last term denotes the impact on imports.

PROPOSITION 2.6: *The elimination of a VER leads to the growth of a previously restrained industry. The impact on trade volume is positive if, and only if, the quantity effect dominates the negative terms of trade effect and the negative effects on other industrial exports.*

These latter two results, easily obtainable with models facing constant returns to scale, are consistent with the general thinking about the effects of the elimination of a VER on an exporting country.

[2.3.7] The impact on welfare

The sign of the welfare change can be measured by the ratio between the change in indirect utility function and the marginal utility of income, which is equal to the difference between the change in income (dHR) and the change in the consumer price index ($\sum_j Q_j dp_j$).[19]

If the numeraire of the model is the Laspeyre's price index of domestic goods, the total differential of household income, under the zero profit condition, yields:

$$
\begin{aligned}
dHR = {} & \sum_{crs}\left(pd_{crs} dD_{crs} + \overline{pe}_{crs} dE_{crs} - \sum_j p_j dx_{jcrs} \right) + \sum_i n_i \left(pd_i dd_i + pe_i de_i - \sum_j p_j dx_{ji} \right) + \\
& \sum_i \left(pd_i d_i + pe_i e_i - \sum_j p_j x_{ji} \right) dn_i + \sum_i E_i dpe_i - \sum_j X_j dp_j + \sum_i n_i dver_i + \sum_i ver_i dn_i
\end{aligned}
\tag{2.38}
$$

The sum of the first three terms yields the *global efficiency* effect. The first term denotes the negative production effect in the unrestricted sectors, as resources are reallocated to their detriment; the second term denotes the firm's value added effect. This is indeterminate, since, from Proposition 2.4, the impact on firm output is ambiguous. The third term denotes the market structure effect, which has a twofold effect on welfare: (i) a negative effect arises if economies of scale are exploited less efficiently; (ii) a positive effect arises if a firm, by perceiving a more elastic domestic demand curve, decreases the price of the ith domestic commodities, resulting in an expansion of domestic consumer surplus. Hence, the *global efficiency* effect is indeterminate. The fourth term represents the gain from an increase in the producer price of exports, as described by Proposition 2.1, which generates a positive income effect (*export producer price* effect). The fifth term represents the loss from an increase in the cost of intermediate inputs, as described by Proposition 2.5 (*increased intermediate inputs cost* effect). The sixth term represents the loss from the annulment of the economic rent (*rent loss* effect). The last term represents the gains from variety,

[19] $V[p_j, HR]$ is the household's indirect utility function, where p_j is the price vector of consumption goods. The total differential of $V[p_j, HR]$ is $dV[p_j, HR] = (\partial V/\partial HR)dHR + \sum_j (\partial V/\partial p_j)dp_j$. Using the Roy's identity, the latter expression can be written as $dV[p_j, HR] = (\partial V/\partial HR)\left[dHR - \sum_j Q_j dp_j \right]$, where Q_j is the quantity demanded.

as domestic firms enter in pursuit of positive profits, in accordance with Proposition 2.2 (*variety* effect). Hence, the net gain on aggregate welfare is analytically indeterminate. It is important to stress that the literature on VERs focuses only on the *rent loss* effect and, to a certain extent, on the *export producer price* effect. The *variety* effect, the *increased intermediate inputs cost* effect and the indeterminate *global efficiency* effect have been neglected. The *consumer price* effect is negligible, as the Laspeyre's price index of domestic goods is assumed constant and the world price of imports is not affected by the trade policy. In summary, the impact of the elimination of VERs on welfare is indeterminate, regardless of the size of the country.

[2.4] An AGE model for Turkey

This section seeks to answer three main questions: Do the qualitative effects identified in the previous section [2.3] lead to quantitative aspects of significant magnitude? Can the analytical ambiguity of the policy effect on some of the variables, in particular welfare and firm size, be numerically resolved? Is the impact of the elimination of a VER sensitive to the type of competition employed? To answer these fundamental questions, I use an AGE model with the same features of the analytical model applied to Turkey. This country is a good test case for two main reasons. Firstly, as a consequence of the recent customs union agreement with the EU, VERs on Turkish textiles and apparel have been abolished. Secondly, since the Turkish government does not officially recognise any quota restriction, VER agreements could only be made with Turkish industry associations (GATT, 1994). Thus, the rents from VERs accrued to the exporting firms which were able to obtain the export quota documents for deliveries to the EU.

The model contains two categories of industries: those where perfect competition and constant return to scale are assumed to prevail (18 sectors), and those which are characterised by increasing returns to scale (textiles and apparel).[20] The production function has a two stage nested CES structure. At the first stage, I assume a Leontief function among primary factors of production and intermediate inputs, which are in turn assumed to be complements. At the second stage, the value added is characterised by constant returns variable costs with nonsunk setup costs. The elasticity of substitution among the mobile labour and the mobile capital is assumed to be positive and to vary across industries. The production possibility frontier has a two stage constant elasticity of transformation (CET) specification. At the first stage, producers allocate their production in the domestic market and abroad.[21] At the second stage, exports are allocated in the restricted EU market and in the unrestricted rest of the world (RoW) market. On the demand side, at the first stage, the representative household's demand and the intermediate demand are satisfied by composite commodities.[22] At the second stage, buyers choose among imports and domestic goods. At the third and fourth stages, buyers first choose among a variety of domestically produced goods and a variety of composite imports, and then among imports from the EU and imports from the RoW, according to the Armington specification, which states that goods competing in the same market are imperfect substitutes. The *small country* assumption is postulated for all traded commodities, with the exception of textiles and apparel exports to the EU for which an iso-elastic demand curve is supposed.

[2.4.1] Benchmark and calibration

The theoretical model outlined above and applied to Turkey requires a benchmark data set to calibrate unknown parameters, such that the observed value of endogenous

[20] The structure of the AGE model is reported in Appendix 2.B.
[21] One property of the CET specification is that the condition $\Omega_D d_i < y_i$ [see footnote (17)] is valid for any value of the elasticity of transformation.
[22] At the first stage, the utility function is taken to be Cobb-Douglas. This assumption, plus (2.9) imply that χ_i is equal to the ratio between final demand and aggregate demand.

variables constitutes an equilibrium of the numerical model. The main bulk of the data comes from a 1990 Social Accounting Matrix (SAM) for Turkey (De Santis and Ozhan, 1995 and 1997), which has been compiled by using the official 1990 Input-Output Table for Turkey (SIS, 1994).[23] The SAM has been adjusted in order to extract the rents on exports subject to VERs accruing to the companies and, then, to households. The activities and commodities are disaggregated into 20 different types and classified according to the I-O table classification. Table 2.1 shows the statistics related to Turkish production, cost structure and composition of the demand. According to these official data, the value of production of Turkish textiles and apparel is 5.5% of total output value, whilst textiles and apparel export sales comprise 18.5% of total exports. These two sectors are relatively efficient in Turkey, as the average productivity of labour and capital is almost double than that recorded by the economy as a whole.

As far as the demand side is concerned, textiles and apparel intermediate demand comprises 4.6% of total intermediate demand, whilst the budget share of the representative consumer is equal to 5.6% of his disposable income.

The accounts for imports and exports are disaggregated to model the relations with the EU and the RoW. The share of imports and exports have been derived from a recent unpublished statistical source of the Turkish State Institute of Statistics (Table 2.2).[24] The export volume of textiles and apparel to the European market is estimated to be 16.4% of total exports. These summary statistics indicate that the elimination of VERs in textiles and apparel might have an important impact on the reallocation of resources within the economy.

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[23] Appendix 2.C reports the 1990 SAM for Turkey.

[24] The EU is composed of 15 countries: 12 members existing in 1990, plus the new members Finland, Austria and Sweden.

Table 2.1: Production, cost structure and composition of demand in Turkey, 1990

Sectors	D_j	E_j	M_j	$\frac{L_j}{D_j+E_j}$	$\frac{K_j}{D_j+E_j}$	$\frac{X_j}{D_j+E_j}$	$\frac{X_j}{D_j+M_j}$	$\frac{C_j}{D_j+M_j}$	$\frac{E_j}{D_j+E_j}$	$\frac{M_j}{D_j+M_j}$
Agriculture,	93760	2513	3079	0.069	0.609	0.322	0.413	0.553	0.026	0.032
Mining	7005	510	11276	0.266	0.504	0.230	0.843	0.063	0.068	0.603
Food processed products	31663	4561	3264	0.073	0.142	0.785	0.358	0.596	0.126	0.093
Beverages and tobacco	8009	526	2068	0.223	0.328	0.449	0.110	0.856	0.062	0.204
Textiles	20798	6214	2414	0.071	0.240	0.689	0.547	0.401	0.230	0.100
Wearing apparel	5706	4814	587	0.062	0.225	0.713	0.028	0.809	0.458	0.090
Leather and fur products	1941	399	501	0.022	0.339	0.639	0.761	0.130	0.171	0.200
Footwear	1569	87	65	0.075	0.197	0.728	0.057	0.709	0.053	0.038
Wood and wood products	18060	295	1374	0.075	0.255	0.670	0.628	0.338	0.016	0.069
Chemical products	16658	1592	10524	0.100	0.262	0.638	0.599	0.398	0.087	0.385
Petroleum and coal products	16769	763	3652	0.021	0.263	0.716	0.895	0.228	0.044	0.135
Non-metallic mineral products	17117	1047	1960	0.127	0.294	0.579	0.761	0.252	0.058	0.101
Metal products	17221	3304	10313	0.096	0.124	0.780	0.907	0.000	0.161	0.369
Machinery	26146	1656	17850	0.107	0.272	0.622	0.285	0.282	0.060	0.400
Transport equipment	15660	939	9403	0.158	0.164	0.678	0.309	0.317	0.057	0.369
Electricity, gas and waterworks	11920	115	15	0.267	0.427	0.306	0.762	0.175	0.010	0.001
Construction	56015	0	0	0.229	0.187	0.584	0.000	0.000	0.000	0.000
Trade, restaurants and hotels	84208	8938	1220	0.175	0.544	0.281	0.320	0.573	0.096	0.014
Transport and communication	69366	12534	2205	0.079	0.548	0.372	0.396	0.522	0.153	0.030
Other services	76610	1255	662	0.500	0.336	0.164	0.325	0.271	0.016	0.008
Total or Average	596201	52062	82432	0.165	0.386	0.449	0.417	0.375	0.080	0.118

Source: Data elaboration from SIS (1994).

D_j, E_j and M_j are evaluated in billions of Turkish lira. So, in this Table, they indicate the volumes of domestic sales, exports and imports gross of tariffs, respectively.

Table 2.2: Share of Turkish imports and exports with the EU, elasticities' values

Sectors	$\frac{M_j^{EU}}{M_j^{EU}+M_j^{RoW}}$ (%)	$\frac{E_j^{EU}}{E_j^{EU}+E_j^{RoW}}$ (%)	σ_i	ε_j	μ_j	ρ_j	ϖ_j
Agriculture,	0.265	0.464	0.945	2.000	5	2.9	5
Mining	0.016	0.871	0.426	0.500	5	2.9	5
Food processed products	0.465	0.534	0.945	1.050	5	2.9	5
Beverages and tobacco	0.069	0.032	0.886	1.840	5	2.9	5
Textiles	0.401	0.963	0.927	2.000	5	2.9	5
Wearing apparel	0.033	0.831	0.927	3.400	5	2.9	5
Leather and fur products	0.524	0.243	0.927	3.400	5	2.9	5
Footwear	0.369	0.287	0.927	3.400	5	2.9	5
Wood and wood products	0.641	0.193	0.899	2.000	5	2.9	5
Chemical products	0.644	0.434	1.009	1.762	5	2.9	5
Petroleum and coal products	0.240	0.700	0.374	0.400	5	2.9	5
Non-metallic mineral products	0.642	0.792	0.964	1.169	5	2.9	5
Metal products	0.312	0.330	0.911	0.762	5	2.9	5
Machinery	0.688	0.758	1.105	0.839	5	2.9	5
Transport equipment	0.598	0.321	1.670	1.511	5	2.9	5
Electricity, gas and waterworks	0.467	0.017	1.884	2.000	5	2.9	5
Construction	0.000	0.000	1.988	-	-	-	-
Trade, restaurants and hotels	0.486	0.440	1.557	2.000	5	2.9	5
Transport and communication	0.487	0.440	1.890	2.000	5	2.9	5
Other services	0.486	0.440	2.010	2.000	5	2.9	5

σ_j : elasticity of substitution among primary factors of production; ε_j : elasticity of substitution between imported and domestically produced goods; μ_j : elasticity of substitution among imports from different regions; ρ_j : elasticity of transformation between production for exports and the domestic market; ϖ_j : elasticity of transformation among exports to different regions.

Most of the elasticity values have been selected from the existing literature: the factor substitution elasticities, the Armington trade elasticities, the elasticities of substitution between imports coming from different regions and the production possibility frontier's elasticities have been selected from Harrison, *et al.* (1992), and some of them in relation to the sectors facing constant returns to scale have been adjusted for differences in the aggregation of sectoral output; whereas the smaller export demand elasticities for the sectors facing increasing returns to scale (see Table 2.3) have been chosen from Dervis, *et al.* (1982). The elasticity of substitution between domestic brands and brands to be exported have been chosen exogenously, such that they are respectively larger than the elasticity of substitution between domestic goods and imports, and the export demand elasticity. The fact that the calibrated price elasticity of aggregate demand are less than one in both sectors implies that $\varsigma_i > \varepsilon_i > \chi_i$. As a result, the individual producer will face a more elastic demand curve with entry. The *ad valorem* quota premium have been selected from Trela and Whalley (1990). The economic rents from VERs are equal to 0.5% of total household's revenues.

In order to calibrate the variables of sectors facing increasing returns to scale, the algebraic structure of the model required further information on price-cost margins, fixed costs and the number of symmetric firms at sectoral level. These data are not easily collectable. However, the 1990 SAM for Turkey classifies labour in 8 different labour categories. I assume that three categories, represented by "professional workers", "administrative and managerial workers", and "clerical workers" comprise the fixed amount of labour required to have the plant open. According to the SAM's estimates, the fixed labour cost in textiles and apparel is almost 20% of total labour force. With regard to the capital stock, the Istanbul Chamber of Industry (1991) published some statistical information on the largest 500 industries in Turkey.

Table 2.3 Data for the imperfectly competitive sectors

SECTORS	*Textiles*	*Apparel*
Elasticity of substitutions among domestic brands	8	8
Elasticity of substitutions among export brands	8	8
Export demand elasticity (small)	2	2
Export demand elasticity (high)	5	5
Price elasticity of aggregate demand	0.401	0.809
Number of firms	20	20
Ad valorem quota premium	0.150	0.300
Fixed labour cost (1)	0.197	0.196
Fixed capital cost (2)	0.150	0.150
Price cost margin for domestic goods (Bertrand)	0.131	0.131
Price cost margin for exports (Bertrand - $\eta_i = 2$)	0.130	0.130
Price cost margin for exports (Bertrand - $\eta_i = 5$)	0.127	0.127
Price cost margin for domestic goods (Cournot)	0.230	0.175
Price cost margin for exports (Cournot - $\eta_i = 2$)	0.144	0.144
Price cost margin for exports (Cournot - $\eta_i = 5$)	0.129	0.129

(1) The fixed labour cost is a share of the total labour cost.
(2) The fixed capital cost is a share of total sales.

Using this statistical source, the fixed capital stock, represented by capital depreciation, interest payments and rents, has been estimated to be equal to 15% of total sales in both textiles and apparel. The number of firms has been chosen exogenously; whereas the price cost margins in both domestic and foreign markets have been calibrated within the model, with their value depending upon the adopted conjectures. The price cost margin in the Bertrand case is smaller, because Bertrand conjectures are inherently more competitive (see Table 2.3).

Table 2.3 shows that the additional data needed to calibrate equations with imperfect competitive features are assumed to be similar in both sectors. This assumption is not a fallacy of the numerical model. On the contrary, since the *ad valorem* quota premium in apparel is double that in textiles, the empirical findings will help us in understanding the relation between the impact on sectoral variables and the size of the binding quota.

As the analytical model, the AGE model assumes free entry/exit. Hence, the benchmark generates a long run reference equilibrium by setting pure profits to zero. This reference equilibrium is then the basis for comparison in counterfactual trade policy analysis.[25]

[2.4.2] The elimination of VERs scenarios

[2.4.2.1] The impact on Turkish industry and incumbent firms' variables

The equilibrium concepts employed in this chapter are Nash equilibria in prices (i.e. Bertrand competition) or quantities (i.e. Cournot competition). Tables 2.4-2.5 report the numerical results of the elimination of VERs on Turkish textiles and apparel respectively under Cournot and Bertrand conjectures in two different cases, assuming the price elasticity of the export demand in these two sectors to be equal to 2 and 5. In this way, the sectoral results of the policy scenarios can be compared under alternative Nash equilibria, and under different hypothesis regarding the size of the country and the size of the quota premium.

[25] The calibration procedure and the GAMS code of the entire model are reported in Appendix 2.D.

Table 2.4: Elimination of VERs in textiles and apparel (Cournot)
(Base year = 100)

	$\eta_i = 2$		$\eta_i = 5$	
Turkey's social welfare	99.4		98.9	
Aggregate output in real terms	100.7		101.4	
Trade volume	100.4		100.7	
Consumer price index	100.0		100.0	
Intermediate inputs cost index	100.8		103.3	
	Textiles	*Apparel*	*Textiles*	*Apparel*
- At sectoral level				
Exports to the EU	124.3	148.4	135.0	193.6
Output	107.1	112.2	119.5	124.6
Number of firms	107.3	106.0	113.1	104.1
Domestic sales	106.2	99.6	111.9	99.0
Export sales to the EU	128.2	158.4	146.2	220.5
Export sales to the RoW	91.8	96.2	63.4	91.9
Price elasticity of domestic demand	94.3	100.0	89.6	100.2
- At firm level				
Output	99.9	105.8	96.8	119.7
Domestic output	95.9	88.2	91.4	83.7
Exports to the EU	115.9	140.0	119.4	186.0
Exports to the RoW	85.6	90.8	56.0	88.3
- Prices and costs				
Producer price of exports to the EU	103.2	106.7	108.3	113.9
Average cost	102.7	104.9	107.4	109.1
Marginal cost	103.3	106.9	108.3	113.9
Primary factor inputs cost	100.5	100.6	100.5	100.7
Intermediate inputs cost	103.8	107.3	109.7	114.9
Price cost margin in the domestic market (1)	99.6	98.4	99.7	98.8
Price cost margin in the EU market (2)	99.1	99.3	99.7	99.9
Price cost margin ratio: (1) / (2)	100.5	99.1	100.0	98.9

Table 2.5: Elimination of VERs in textiles and apparel (Bertrand)
(Base year = 100)

	$\eta_t = 2$		$\eta_t = 5$	
Turkey's social welfare	99.4		99.0	
Aggregate output in real terms	100.6		101.4	
Trade volume	100.9		101.0	
Consumer price index	100.0		100.0	
Intermediate inputs cost index	101.0		102.0	
	Textiles	*Apparel*	*Textiles*	*Apparel*
- At sectoral level				
Exports to the EU	123.5	144.8	136.6	195.0
Output	106.7	111.8	110.5	125.9
Number of firms	108.3	107.1	115.2	106.0
Domestic sales	106.1	99.8	112.2	99.1
Export sales to the EU	127.8	158.0	147.6	221.8
Export sales to the RoW	94.3	96.3	87.9	90.0
Price elasticity of domestic demand	97.1	102.5	94.7	105.0
- At firm level				
Output	98.5	104.4	95.9	117.9
Domestic output	94.7	87.0	90.2	82.2
Exports to the EU	114.0	138.0	118.6	184.0
Exports to the RoW	87.6	89.9	76.3	85.0
- Prices and costs				
Producer price of exports to the EU	103.5	106.9	108.0	113.7
Average cost	103.3	105.6	107.7	110.1
Marginal cost	103.5	107.0	108.1	113.8
Primary factor inputs cost	100.4	100.3	100.4	100.2
Intermediate inputs cost	104.1	107.5	109.4	114.7
Price cost margin in the domestic market (1)	99.6	99.6	99.3	99.6
Price cost margin in the EU market (2)	99.7	99.7	99.7	99.9
Price cost margin ratio: (1) / (2)	99.9	99.8	99.6	99.7

It is clear that the numerical results are fully consistent with those analytical findings which are unambiguous. The elimination of VERs brings about a large increase of sectoral exports to the EU, both in terms of total exports and exports per firm. The large impact on textiles and apparel exports to the EU raises output in both industries quite remarkably in accordance with Proposition 2.6, and expands trade volume under both forms of competition. The producer price of exports to the EU is also positively affected in accordance with Proposition 2.1. The possibility of making profits allows less efficient firms to break even in accordance with Proposition 2.2. The number of firms increases by 7.3% (13.1%) in textiles and 6% (4.1%) in apparel in the Cournot case, and by 8.3% (15.2%) in textiles and 7.1% (6%) in apparel in the Bertrand case. The zero profit condition is once again restored if the average cost rises in accordance with Proposition 2.1. In the Cournot case, the average cost rises by 2.7% (7.4%) in textiles and 4.9% (9.1%) in apparel. Whereas in the Bertrand case, it rises by 3.3% (7.7%) in textiles and 5.6% (10.1%) in apparel.

It is interesting to note that although, in accordance with Proposition 2.1, there is a unique positive relation between size of quota premium, or size of the country, and average cost, a similar relation between size of quota premium, or size of the country, and number of firms does not occur. This is because the impact on the number of firms is also a function of domestic sales and of the price elasticity of domestic demand [(see (2.28)]. In fact, Tables 2.4 and 2.5 show that although the quota premium in textiles is half that in apparel, new entry is larger in textiles, because the VERs abrogation reduces the price elasticity of domestic demand and has a positive impact on domestic sales. I should stress that the impact on the export sales to the RoW does not affect the number of firms, because the RoW faces an infinitely elastic demand function. A similar conclusion can be drawn with respect to the size of the country.

As far as the form of competition is concerned, the impact on both average cost and new entry is larger under Bertrand conjectures, as they are inherently more competitive. Similarly, the ex-post size of firms is smaller under Bertrand competition. This implies that incumbent firms will prefer the *status quo* especially under a price setting oligopoly. However, it must be stressed that the difference between the numerical results obtained under Bertrand and Cournot conjectures is small. So despite the significance of the quantitative results, they are less sensitive to equilibrium concepts, as already described by Venables (1994) for the case of an import tariff and an export tax. This is because as the number of firms rises, the price cost margins in the domestic and export markets converge towards the same value (that is, the inverse of the elasticity of substitution among brands) under both conjectures.

Entry leads to a modest decline of the price cost margin in both markets. Another important empirical result is in relation to the ratio between the price cost margins in the domestic and export markets. Given the elasticity of substitution among exported brands, the smaller the country, the greater the loss of monopoly power in the domestic market with respect to the export market [see (2.29) and (2.30)] in accordance with Proposition 2.3.

The full employment assumption of factor inputs implies a reallocation of resources among sectors. Thus, despite the increase of factor inputs demand in textiles and apparel, wage and rental rates characterising the whole of the economy are only slightly affected in accordance with Proposition 2.5. Hence, if the cost of primary factor inputs rises slightly, and the fall in the price cost margin in the export market is smaller that the rise in the producer price of exports, then the cost of intermediate inputs has to increase substantially, and at a higher rate than the rise in the producer price of exports to the EU, for the price cost margin in the export market to decline [see (2.34)] in accordance with Proposition 2.5.

Despite output growth, output per firm might expand or decline in accordance with Proposition 2.4, depending positively on the size of export expansion, which is obviously larger in apparel, and negatively on both the number of new entrants, which is larger in textiles, and the domestic output fall, which is larger in apparel.

A further important empirical result is in relation to the impact on firms' domestic output. All scenarios show that despite the large spillovers of exports from the RoW, firms record a domestic output contraction, which is larger, the smaller the country.

These numerical results support the hypothesis that a VER is a good instrument to prevent entry and to protect the monopoly power of incumbent firms in both the domestic and the export markets, either in a quantity-setting or in a price-setting oligopoly.

[2.4.2.2] The impact on Turkey's social welfare

The measure of the welfare change in AGE literature is the Hicksian equivalent variation. To be consistent with the analytical model, the representative household faces a convex indifference curve *a la* Dixit-Stiglitz, which is taken to be Cobb-Douglas at the first stage, and CES form at the second, third and fourth stages. Income distribution issues are neglected, hence the representative consumer's utility function can be regarded as representing the Samuelsonian social indifference curves, which takes the following form:

(2.39) $$W = \prod_{crs}\left[C_{crs}{}^{\vartheta_{crs}}\right]\prod_{i}\left[I_i{}^{\vartheta_i}\right], \qquad \sum_{crs}\vartheta_{crs} + \sum_{i}\vartheta_i = 1,$$

where ϑ_i represents the household's consumption shares, C_{crs} denotes the individual's consumption of commodities produced by industries facing constant returns to scale, and I_i can be regarded as the Dixit-Stiglitz quantity index of aggregate consumption of the industry output of differentiated products. C_{crs} is derived by maximising the subutility function subject to the money income spent on commodities produced by the industries facing constant returns to scale.

Given the assumption that domestic production and imports satisfies both household consumption and the intermediate demand of the industry [see (2.9)], I_i takes the form,

(2.40) $$I_i = \chi_i\left[\varphi_i D_i^{(\varepsilon_i-1)/\varepsilon_i} + (1-\varphi_i)M_i^{(\varepsilon_i-1)/\varepsilon_i}\right]^{\varepsilon_i/(\varepsilon_i-1)},$$

where χ_i, the price elasticity of aggregate demand, is equal to the share of household consumption in the total demand of goods produced by industries facing increasing returns to scale.

Given the symmetry assumption among firms, the utility gained from the consumption of domestic goods and imported products can be written as:

(2.41) $$D_i = n_i^{\varsigma_i/(\varsigma_i-1)}d_i,$$

(2.42) $$M_i = \bar{n}_i^{m\,\bar{\varsigma}_i/(\bar{\varsigma}_i-1)}\left[\iota_i m_i^{EU(\mu_i-1)/\mu_i} + (1-\iota_i)m_i^{RoW(\mu_i-1)/\mu_i}\right]^{\mu_i/(\mu_i-1)},$$

where $\bar{n}_i^m$ represents the fixed number of competing foreign brands, m_i^{EU} and m_i^{RoW} denote respectively the EU and the RoW representative firms' sale to the market of the exporting country, $\bar{\varsigma}_i$ is the elasticity of substitution among imported varieties, μ_i is the elasticity of substitution among imports from different regions, and ι_i is a share parameter of the import aggregation function. $\bar{n}_i^m$ should properly be treated as an endogenous variable. However, the model presented in this study is a single country open economy model. It is therefore difficult to model the product selection process in foreign industries.[26]

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[26] In examining the economic implications for Canada of the North-America free trade agreement, Harris (1984) assumes that the number of imported variety of a product is in a constant ratio to the number of domestically produced varieties. However, this assumption implies that as the number of domestic firms decreases with the elimination of tariffs, the number of competing foreign varieties is also reduced. In contrast, it is generally accepted that product variety rises with trade. Thus, the welfare gains of tariff liberalisation in the presence of product differentiation would be underestimated. As far as the effect of a VER on $\bar{n}_i^m$ is concerned, it can be argued that the *ad valorem* quota premium is equivalent to an *ad valorem* tariff rate for the importing country. Its elimination might produce the same results discussed in Harris (1984), where the elimination of tariffs imposes a downward pressure on price mark-ups in manufacturing industries and forces the

Tables 2.4 and 2.5 show that, as a consequence of the elimination of VERs, the impact on welfare, though small, is negative. Social welfare decreases by a factor of 0.6 (1-1.1) as a percentage of consumer income in 1990. Given the fact that the consumer price index is not affected, the social welfare loss indicates that the *rent loss* effect and the *increased intermediates input cost* effect dominate the positive effects from trade. It also seems that the smaller the country, the larger the welfare loss of the elimination of VERs, although the efficiency gains (represented by the rise of aggregate output in real terms), the gains from variety, and from the rise in the export producer price, are much larger. Thus, since the loss of the economic rent and the consumer price index are equal in all scenarios, it is reasonable to suggest that the *increased intermediate inputs cost* effect is an important negative effect, which might determine the size of the welfare loss in the exporting country. In fact, the computed estimates show that the intermediate inputs cost index rises quite remarkably, when the country faces a more elastic foreign demand curve.

In summary, if policy-makers of exporting countries might accept VERs agreements in order to improve the welfare of their nations, industry associations voluntarily agree to restrain their level of exports in order to limit entry of other potential firms. This allows incumbent firms to better exploit economies of scale, capture rents and protect their monopoly power in both domestic and export market.

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less efficient firms to exit in response to losses. Thus, fixing $\bar{n}_i^m$ exogenously might overestimate the welfare effect of the elimination of a VER. It is likely that only a multiregional model might attempt to explicitly model both domestic and foreign brands, and in this way examine the welfare effect of trade policies in the presence of product differentiation. In this study, $\bar{n}_i^m$ is assumed to be equal to the benchmark value of n_i, and $\bar{\varsigma}_i$ is assumed to be equal to ς_i.

[2.5] Conclusions

This paper analyses the possible consequences of VERs on an exporting country when firms facing increasing returns to scale behave either in a Cournot fashion or with Bertrand conjectures. I show that the elimination of a VER raises the average cost to produce one unit of output, and this effect is larger, the smaller the country. It decreases the concentration of the industry and the price cost margins in the export market. The impact on firm size is ambiguous. In addition, I show that the smaller the country, the greater the possibility of a relative lower price cost margin in the domestic market, as a result of a VER abrogation. This implies that incumbent firms have an interest in renewing VERs in order also to protect their monopoly power in the domestic market. The analytical effect on social welfare is indeterminate: the positive effect comes from the increased product diversity, as the number of symmetric firms rises (*variety* effect), and from the increase of the producer price of exports, as foreign consumers are more sensitive to price changes rather than to *ad valorem* quota premium variation (*export producer price* effect); the negative effect comes from the loss of the economic rent (*rent loss* effect), and from the rise in the intermediate inputs cost (*increased intermediate inputs cost* effect); whilst the indeterminate effect comes from the impact on production (*global efficiency* effect) and on the cost of living (*consumer price* effect). The *increased intermediate inputs cost* effect is very important, as a fall in the price cost margin in the export market can be achieved only if the cost of purchasing intermediate inputs rises substantially.

An AGE model with increasing returns to scale, segmented markets and free entry/exit, applied to the Turkish textiles and apparel industries, indicates that the analytical results are quantitatively interesting, under both Bertrand and Cournot competition, and seems to support the hypothesis that an exporting country is better off under a VER, as the *rent loss* effect and the *increased intermediate inputs cost* effect dominate the positive effects from trade and the *global efficiency* effect, which the numerical analysis has shown to be positive. The numerical model indicates that the smaller the exporting country, the larger the welfare loss. Given the facts that the consumer price index is not affected, and the loss of economic rents is equal in both scenarios, and since the *export producer price* effect, the *variety* effect and the *global efficiency* effect are negatively related to the size of the exporting country, it is reasonable to suggest that the *increased intermediate inputs cost* effect explains much of the welfare loss in an exporting country.

The numerical results also indicate that the contraction of firms' domestic output is large, whilst the impact on price cost margins is modest. In addition, they show that the rise in both the average cost and the number of new entrants is larger under Bertrand conjectures, as they are inherently more competitive. Similarly, the size of the firms is smaller. This implies that industries, especially characterised by more competitive conjectures, will lobby the government or industry associations to keep renewing VERs agreements. However, the quantitative difference of the impact of the elimination of VERs under Bertrand and Cournot conjectures is small, which implies that the impact of this policy is less sensitive to equilibrium concepts.

A possible loss in social welfare and the fall of monopoly power of incumbent firms, in both domestic and export markets, are the key elements to understanding why exporting countries voluntarily agree to restrain their level of exports.

CHAPTER 3

Optimal Export Taxes, Welfare, Industry Concentration and Firm Size: A General Equilibrium Analysis

[3.1] Introduction

After the seminal papers by Bickerdike (1906, 1907) on the optimal degree of trade restriction, the literature on optimal tariff, which developed in the nineteen thirties and forties, (Lerner, 1934; Kaldor, 1940; Scitovsky, 1941; Kahn, 1948-49; Graaff, 1949-50) argues that an optimal export tax is equal to the absolute value of the inverse elasticity of foreign export demand, if perfect competition prevails among domestic firms and foreign countries do not retaliate. More recently, this basic insight has been further elaborated in a PE framework in a context of an imperfect competitive domestic market, where an optimal export tax is positive and adjusted by firm size (Rodrik, 1989; Helpman and Krugman, 1989). The larger the firm's share, or the greater the conjectural variation parameter, the smaller the firm's specific optimal export tax. In the case of monopoly or collusion, the optimal export tax is nil. So RHK argue that an export tax is welfare improving in a context of a non-collusive oligopoly, which has international market power.

I use a GE model, with fixed (or sunk) costs and segmented markets, to show that an export tax does not necessarily have a positive impact on social welfare, as the efficiency effect from trade restriction is negative, and might outweigh the terms of trade benefits. Moreover, the efficiency loss from trade restriction would be larger if costs are sunk (i.e. developing marketing channels overseas, obtaining export licenses, foreign promotion and advertising). Thus, it is inappropriate to assume that the RHK formula could yield the optimal size of an export tax.

In addition, I show analytically that the simple method suggested by Rodrik (1989) to compute the uniform export tax is upwardly biased. This is because the size of Rodrik's export tax is also a negative function of its impact on the absolute value of the foreign demand elasticity and industry concentration. I show analytically that an export tax implies a more elastic foreign demand curve and a fall in export sales, if a hypothetical foreign industry produces an imperfect substitute good for the own market. Both these results lead to the exit of some domestic firms. So, under constant conjectures, the Rodrik formula is upwardly biased.

This paper also attempts to understand the impact of an export tax on firm size. I find that it is ambiguous, as it is negatively related to the effect of the trade policy on foreign demand, and positively to both the ability of firms to trade export excess supply in the domestic market, and to the capability of exploiting economies of scale.

I use an AGE model, which has the same features of the analytical model applied to Turkish textiles and apparel industries, to investigate how large and significant the above described findings are; and, in particular, to examine the impact of RHK export tax on welfare, as this is analytically ambiguous. I find that the computed RHK export tax is smaller than the rate calculated using the PE formula suggested by Rodrik (1989), where all variables are set exogenously. Under constant conjectures, the ratio between the PE estimate and the computed optimal export tax ranges between 1.034 and 1.089. So, as far as the Rodrik formula is concerned, despite the importance of the analytical result, the bias seems to be numerically small.

The numerical model also shows that the impact on firm size varies according to different scenarios.

The most important numerical result is related to social welfare. Despite the analytical indeterminacy, all numerical scenarios show that moving from free trade to the RHK export tax has a negative impact on the exporting country's welfare, which implies that the RHK export tax is not an optimal policy in a GE framework. The estimated welfare loss varies among the alternative scenarios. It ranges between - 0.3% and - 1.6% as a percentage of consumer income in the scenarios with fixed costs, and between - 1% and - 2.9% in the scenarios with sunk costs. The size of the welfare loss is also an interesting empirical finding, when it is compared to the static welfare gains from multisectoral trade liberalisation, which, in the AGE literature, are usually estimated to be equal to 1-2% of a country's GDP. Whereas, in this study, trade restriction is only imposed on two sectors, whose output comprised 5.8% of total Turkish production in the benchmark year.

The remaining sections of this Chapter have been organised as follows: Section 2 analyses the relation between optimal export tax, industry concentration, foreign demand elasticity and conjectural variation; Section 3 describes a GE model with increasing returns to scale, segmented markets, intraindustry trade and identical firms; Section 4 analyses the impact of the RHK export tax on firm size, industry concentration, foreign demand elasticity and welfare; Section 5 reports the numerical results obtained applying a GE model to the Turkish textiles and apparel industries; and the final section presents a summary and some conclusion.

[3.2] Optimal export tax and industry concentration

Assume that within an oligopolistic industry (i) there are firms (k) of different sizes. They export homogenous goods at price level, pwe_i. The industry has international market power. So, according to the PE literature, the government of an exporting country could enhance social welfare by restricting exports with differentiated export taxes (te^*_{ik}). More precisely, the government has to choose a vector te^*_{ik}, such that when a firm k maximises its profit function, the total amount of exports for the industry as a whole has to be equal to the export level E_i^M, which would have been chosen by a monopolist: $\sum_k e_{ik} = E_i^M$, where e_{ik} denotes the amount of the firm k's exports.

Fig. 3.1 The optimal export tax in a PE framework

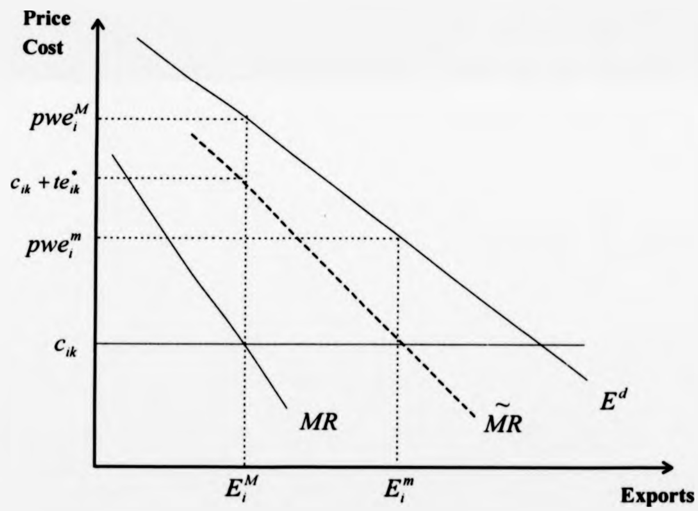

Figure 3.1 shows a PE graphical representation, used by Helpman and Krugman (1989, pg. 87), to determine the optimal size of an export tax. E^d denotes

the export demand schedule, MR the marginal revenue curve faced by a monopolist, $\widetilde{MR}$ the firm k's perceived marginal revenue curve, and c_{ik} the constant marginal cost curve. The equilibrium in autarchy is represented by the equilibrium price pwe_i^m and quantity E_i^m. The introduction of an export tax of a given size, te_{ik}^{*}, would shift the marginal cost curve upwardly, such that the intersection between the new cost curve (gross of the export tax) and $\widetilde{MR}$ would allow firms to set prices and quantities at their optimal level, pwe_i^M and E_i^M, respectively.

The diagrammatic analysis suggests that the optimal export tax vector can be calculated as a difference between the firm's perceived marginal revenue and the profit-maximising cartel marginal revenue, evaluated at the export level chosen by the domestic firms acting as a profit-maximising cartel (E_i^M). Using this definition, it can be shown that

$$te_{ik}^{*} = pwe_i\left\{\left[1 - s_{ik}\left(1 + \lambda_{ik}\right)\right]/\eta_i^e\right\}, \tag{3.1}$$

where s_{ik} denotes the kth firm's share in total exports, λ_{ik} the conjectural variation of firm k about the other firms in the export market, and η_i^e the absolute value of the export demand elasticity.[27] This is the same expression proposed by Rodrik (1989), to whom I refer for a complete analytical argument. te_{ik}^{*} ought necessarily be no negative. It is evident that a uniform optimal export tax is applicable only if firms are symmetric or if perfect competition prevails ($\lambda_{ik} = -1$). Typically, the optimal export tax is firm specific and is negatively related to firm size (Rodrik, 1989). In the limiting case of monopoly (or collusion), the optimal export tax is nil, since a profit-maximising monopolist (or cartel) already sets pwe_i at its optimal level, $pwe_i\left(E_i^M\right)$.

[27] te_{ik}^{*} can also be defined as the difference between the kth firm's perceived marginal revenue and its marginal cost (c_{ik}) evaluated at E_i^M: $te_{ik}^{*}\big|_{E_i=E_i^M} = pwe_i\left\{1 - s_{ik}\left[1+\lambda_{ik}\right]/\eta_i^e\right\} - c_{ik}$ (Helpman and Krugman, 1989).

Conversely, as the kth firm's export share becomes smaller, the optimal export tax converges towards the upper bound limit pwe_i/η_i^e.[28]

However, as the policy-maker chooses the vector $te_{ik}^{\bullet}$, all variables in equation (3.1) would be affected. Thus, the method suggested by Rodrik (1989) for calculating an optimal export tax by adjusting η_i^e for the Herfindahl index of concentration (H_i), when traders are symmetric and behave in a Cournot fashion, is only a simple approximation, because both η_i^e and H_i are treated exogenously.[29]

To better emphasise the point, let us make the simplifying assumption that firms are symmetric. In this case, the uniform *ad valorem* optimal export tax ($t_i^{\bullet}$) in equilibrium is

$$(3.2) \qquad t_i^{\bullet}\Big|_{E_i=E_i^M} = \frac{1}{\eta_i^e}\left(1 - \frac{1+\lambda_i}{n_i}\right),$$

where n_i denotes the number of identical firms. It is important to emphasise that all variables in (3.2) are endogenously determined. Thus, moving from free trade to an optimal export tax would hardly likely result in η_i^e, λ_i and n_i equating their initial values. This implies that the argument that an optimal export tax is negatively related to the ex-ante industry concentration ratio does not automatically hold in a GE framework. In fact, the total derivative of $t_i^{\bullet}$ yields

[28] In fact, $\lim\limits_{s_{ik}\to 1} te_{ik}^{\bullet} = 0$ (i.e. monopoly case); $\lim\limits_{\lambda_{ik}\to\left[(s_{ik})^{-1}-1\right]} te_{ik}^{\bullet} = 0$ (i.e. collusive case); $\lim\limits_{s_{ik}\to 0} te_{ik}^{\bullet} = pwe_i/\eta_i^e$ (i.e. large number of firms' case); and $\lim\limits_{\lambda_{ik}\to -1} te_{ik}^{\bullet} = pwe_i/\eta_i^e$ (i.e. competitive case). Similarly, $\lim\limits_{\eta_i^e\to 0} te_{ik}^{\bullet} = \infty$, which implies that foreigners would accept exports at any price; whereas $\lim\limits_{\eta_i^e\to\infty} te_{ik}^{\bullet} = 0$, and this result corresponds to the *small country* assumption.

[29] Under the symmetry assumption and Cournot conjecture, (3.1) takes the following form: $te_i^{\bullet}\Big|_{E=E_M} = \left(pwe_i/\eta_i^e\right)\left(1 - H_i\right)$, where $H_i = 1/n_i$; as proposed by Rodrik (1989).

$$(3.3)\qquad dt_i^{*}\Big|_{E_i=E_i^M} = \frac{1}{\eta_i^e n_i^2}\left[(1+\lambda_i)dn_i - n_i d\lambda_i\right] - \left(\frac{n_i - 1 - \lambda_i}{n_i \eta_i^{e^2}}\right) d\eta_i^e .$$

This expression shows that the *ad valorem* optimal export tax depends not only on the ex-ante η_i^e, λ_i and n_i, but also on its impact upon these variables, as it is also recognised by Rodrik (1989, note 4). In section 3.4, I will show that under constant conjectures, the Rodrik formula, which I have reported in footnote 30, is upwardly biased because the impact of an export tax raises η_i^e and decreases n_i.[30]

[3.3] A GE model with fixed (or sunk) costs and segmented markets

The model presented in this section is a GE model with fixed (or sunk) costs, segmented markets and identical firms used to study the impact of moving from free trade to the RHK export tax on the number of firms, firm size, foreign demand elasticity and welfare. Given the difficulty of modelling firms conjectures endogenously, I assume them constant. In order to study the impact of the RHK export tax on firm size, I assume that each firm produces two imperfect substitute goods, one traded within the domestic market and the other exported. An export tax leads to export contraction, but not necessarily to the decline of the firm size, as the remaining firms can increase their supply in the domestic market. So to model domestic and foreign trade, I assume that each firm employs factors and intermediate inputs to produce two imperfect substitute goods, one sold in the domestic market and the other exported; whereas the representative consumer gains utility from the consumption of domestically produced goods and their imperfect substitute imports. Also the sectoral intermediate demand is satisfied with the supply of domestic goods and imports.

[30] In addition, in section 3.4.3., I prove that the impact of an export tax on welfare in ambiguous in a GE setting.

[3.3.1] Mark-up pricing

Assume that within an industry (i) firms face fixed (or sunk) costs, produce two differentiated commodities, one supplied in the domestic market and the other exported, and have constant conjectures, in the sense that the firms' choice on how to react to its rivals' choices is given *a priori* and is independent of the impact of trade policies.

The profit function of a representative firm (π_i) takes the following form:

$$(3.4) \qquad \pi_i = pd_i d_i + (pwe_i - te_i)e_i - c_i(d_i + e_i) - f_i,$$

where d_i and e_i denote domestic output and export, respectively; pd_i the price of domestic goods; f_i the fixed (or sunk) cost and c_i the marginal cost, which is indipendent of output. The first order conditions yield

$$(3.5) \qquad pd_i + d_i \frac{\partial pd_i}{\partial D_i}\frac{\partial D_i}{\partial d_i} = c_i, \qquad \frac{\partial pd_i}{\partial D_i} < 0$$

$$(3.6) \qquad pwe_i + e_i \frac{\partial pwe_i}{\partial E_i}\frac{\partial E_i}{\partial e_i} = c_i + te_i, \qquad \frac{\partial pwe_i}{\partial E_i} < 0$$

where D_i denotes domestic demand and E_i export demand.

[3.3.2] Technology and number of firms

The production function of a single representative firm, Θ, is additively separable in Φ_1 and Φ_2, and such that $\partial^2\Theta/(\partial\Phi_1\partial\Phi_2) > 0$:

$$(3.7) \qquad \begin{aligned} y_i &= \Theta[\Phi_1(x_{ji}), \Phi_2(l_i, k_i)] \\ &= 0 \text{ if } l_i < l_i^f \text{ or } k_i < k_i^f \end{aligned}$$

where y_i represents composite production of domestic goods and exports; x_{ji} denote intermediate inputs, assumed for simplicity to be net complements ($j = i \cup crs$, where *crs* indicates the sectors facing perfect competition and constant returns to scale); l_i and k_i represent labour and capital inputs; and l_i^f and k_i^f the factor inputs employed in fixed proportion. This implies that the production sets are not convex. Φ_2 is locally assumed to be twice differentiable, so that $\Phi_2^{'} > 0$ and $\Phi_2^{''} < 0$.

The production possibility frontier of the representative firm is represented by

(3.8) $$y_i = \Omega(d_i, e_i), \qquad \Omega_d > 0,\ \Omega_e > 0,\ \partial^2\Omega/(\partial d_i \partial e_i) < 0,$$

which locally is a linear homogenous, separable, differentiable transformation curve of domestic goods and exports. The transformation curve is locally assumed to be twice differentiable with respect to d_i and e_i, such that $\partial^2\Omega/\partial d_i^2 < 0$ and $\partial^2\Omega/\partial e_i^2 < 0$.

The fixed factor inputs, multiplied by their respective returns, determine the firm's fixed (or sunk) cost. It is important to emphasise the benefits for each firm of raising production, as each firm would bear a reduced fixed cost element per unit of output. The total cost faced by each firm is the sum of variable and fixed (or sunk) costs. So the average cost to produce one unit of output net of export taxes (ac_i) takes the following form:

(3.9) $$ac_i = \left(wl_i + rk_i + \sum_j p_j x_{ji} \right) \Big/ y_i,$$

where p_j represents the price vector of final and intermediate goods. The factor demands of each firm and the marginal cost equation can be derived by solving a standard dual problem.

The number of firms is endogenously determined by the long run zero profit condition:

(3.10) $$py_i = ac_i = \left[pd_i d_i + (pwe_i - te_i)e_i \right] / y_i,$$

where py_i is the composite producer price.

The tax-free sectors are assumed to face perfect competition and constant returns to scale. This allows me to restrict the analysis of the impact of the RHK tax on these industries only on their production level, as it is relevant for welfare analysis. So the production function and the transformation curve of the tax-free sectors take respectively the following form:

(3.11) $$Y_{crs} = \Theta^{crs}\left[\Phi_1^{crs}\left(x_{jcrs}\right), \Phi_2^{crs}\left(L_{crs}, K_{crs}\right)\right]$$

(3.12) $$Y_{crs} = \Omega^{crs}\left(D_{crs}, E_{crs}\right),$$

where Y_{crs} denotes composite output, D_{crs} domestic output, E_{crs} exports, L_{crs} labour, and K_{crs} capital for the industry as a whole. Θ^{crs} is globally linear homogenous, additively separable in Φ_1^{crs} and Φ_2^{crs}, and such that $\partial^2\Theta^{crs}/\left(\partial\Phi_1^{crs}\partial\Phi_2^{crs}\right) > 0$. Φ_2^{crs} is twice differentiable. Ω^{crs} is globally linear homogenous, separable, differentiable and concave.

[3.3.3] Domestic and foreign demand functions

The demand for domestic goods (D_i) and imports (M_i) is a function of a consumer's final demand and industries' intermediate demand (X_i):

(3.13) $$D_i = f\left(HR, pd_i, \overline{pwm_i}, X_i\right), \qquad D_{HR} > 0,\ D_X > 0,\ D_{pd/\overline{pwm}} < 0,$$

(3.14) $$M_i = f\left(HR, pd_i, \overline{pwm_i}, X_i\right), \qquad D_{HR} > 0,\ D_X > 0,\ D_{pd/\overline{pwm}} > 0,$$

where HR denotes the representative consumer income, $\overline{pwm_i}$ the exogenous world price of imports treated as substitutes for domestic goods, and $X_i = \sum_j a_{ji} Y_j$.

The export demand function of the taxed industry (E_i) is derived by assuming that a hypothetical foreign consumer gains utility by purchasing their own domestic goods (D_i^*) priced at pd_i^*, and their imperfect substitute imports, which are exported by the country under analysis. The two-stage utility maximisation problem faced by the foreign consumer takes the following form

$$\max_{D_i^*, E_i} \left\{ U^* = \Pi\left[Q_i^* \Gamma\left(D_i^*, E_i \right) \right] \right\}$$

$$\text{s.t. } \sum_i \left(pd_i^* D_i^* + pwe_i E_i \right) = HR^*,$$

where HR^* represents the income of the representative foreign consumer, Q_i^* the vector of composite commodities, Π and Γ the upper level and the lower level utility functions, respectively. The solution of the problem yields

$$(3.15) \qquad E_i = \Gamma\left(pd_i^*, pwe_i, HR^* \right), \qquad \Gamma_{pd_i^*} > 0,\ \Gamma_{pwe_i} < 0,\ \Gamma_{HR^*} > 0.$$

For simplicity, the sectors which are not subject to an export tax (free-tax sectors) are assumed to face an infinitely elastic export demand function and an infinitely elastic import supply function. Domestic goods and imports are treated as imperfect substitutes.

The trade balance is always in equilibrium. Thus,

$$(3.16) \qquad \sum_i pwe_i E_i + \sum_{crs} \overline{pwe}_{crs} E_{crs} - \sum_j \overline{pwm}_j M_j = 0,$$

where $\overline{pwe}_{crs}$ denotes the world price of exports produced by the free-tax sectors.

[3.3.4] Representative household income

The sources of household domestic income are value added and export tax revenues received in the form of a lump-sum transfer:

$$(3.17) \qquad HR = wL + rK + \sum_i te_i E_i,$$

where L and K denote labour and capital endowments, respectively; while w and r their respective returns. L and K are fully employed, although if costs are sunk, their endowment would decline with firms' exit.

[3.4] Analytical results

[3.4.1] The impact of RHK export tax on foreign demand elasticity and industry concentration

η_i^e can be obtained from (3.15). Assume that the upper level utility function of the hypothetical foreign consumer is a Cobb-Douglas and that Γ is a function with constant elasticity of substitution, $\chi_i > 1$. Then, (3.15) can be rewritten as

$$(3.18) \qquad E_i = \vartheta_i^* HR^* \frac{\tau_i^{\chi_i} pwe_i^{-\chi_i}}{\tau_i^{\chi_i} pwe_i^{(1-\chi_i)} + (1-\tau_i)^{\chi_i} pd_i^{*(1-\chi_i)}},$$

where τ_i is the CES share parameter and ϑ_i^* the foreign household's constant budget share. Then,[31]

$$(3.19) \qquad \eta_i^e = -\frac{\partial E_i}{\partial pwe_i}\frac{pwe_i}{E_i} = \chi_i + \frac{(1-\chi_i)}{(\tau_i^{-1}-1)^{\chi_i} pd_i^{*(1-\chi_i)} pwe_i^{(\chi_i-1)} + 1}.$$

By using the chain rule, then $\partial\eta_i^e/\partial te_i = (\partial\eta_i^e/\partial pwe_i)(\partial pwe_i/\partial te_i)$. The sign of this expression depends only on the sign of $\partial\eta_i^e/\partial pwe_i$, as moving from free trade to an export tax the world price of exports rises. The derivative of (3.19) with respect to the price of exports is

$$(3.20) \qquad \frac{\partial\eta_i^e}{\partial pwe_i} = \frac{(1-\chi_i)^2(\tau_i^{-1}-1)^{\chi_i} pd_i^{*(1-\chi_i)} pwe_i^{(\chi_i-2)}}{\left[(\tau_i^{-1}-1)^{\chi_i} pd_i^{*(1-\chi_i)} pwe_i^{(\chi_i-1)}+1\right]^2} > 0.$$

Then, $d\eta_i^e/dte_i > 0$.

An export tax does have an impact on industry concentration, as it affects sectoral aggregate output and demand price elasticities. Given (3.5), (3.6), (3.10) and

[31] This approach has been already adopted by Devarajan and Rodrik (1989, 1991) on the domestic side in examining the procompetitive gains from trade. They calibrate the price elasticity of domestic demand endogenously as a positive function of the ratio between the price of imports and the price of domestic goods.

the symmetry assumption, the equality between the combined-market marginal revenue curve and marginal cost is

$$py_i + \theta_i^D d_i \frac{\partial pd_i}{\partial D_i}\frac{\partial D_i}{\partial d_i} + \theta_i^E e_i \frac{\partial pwe_i}{\partial E_i}\frac{\partial E_i}{\partial e_i} = c_i\left(\theta_i^D + \theta_i^E\right), \tag{3.21}$$

where $\theta_i^D = D_i/Y_i$ and $\theta_i^E = E_i/Y_i$. The latter expression can be rearranged as

$$n_i = \left[\frac{(1+\lambda_i)}{f_i}\left(\frac{pd_iD_i}{\eta_i^d} + \frac{pwe_iE_i}{\eta_i^e}\right)\right]^{1/2}, \tag{3.22}$$

where η_i^d is the price elasticity of domestic demand. For simplicity, the conjectural variation is assumed to be equal in both markets.[32] The total derivative of n_i with respect to an export tax is

$$\frac{dn_i}{dte_i} = \frac{1}{2}\left[\frac{f_i}{(1+\lambda_i)}\left(\frac{pd_iD_i}{\eta_i^d} + \frac{pwe_iE_i}{\eta_i^e}\right)\right]^{-1/2}\left[\frac{1}{\eta_i^d}\frac{d(pd_iD_i)}{dte_i} - \frac{pd_iD_i}{\eta_i^{d2}}\frac{d\eta_i^d}{dte_i} + \frac{1}{\eta_i^e}\frac{d(pwe_iE_i)}{dte_i} - \frac{pwe_iE_i}{\eta_i^{e2}}\frac{d\eta_i^e}{dte_i}\right]. \tag{3.23}$$

Since an export tax has a secondary effect on sectoral domestic production and domestic consumption decisions, the analysis of the impact on n_i can be confined to the analysis of the impact on η_i^e, which is shown to be positive, and on export sales. The impact of an export tax on export sales can be examined by using (3.18) and the chain rule as follows,

$$\frac{d(pwe_iE_i)}{dte_i} = E_i \frac{(1-\chi_i)(1-\tau_i)^{\chi_i} pd_i^{*(1-\chi_i)}}{\tau_i^{\chi_i} pwe_i^{(1-\chi_i)} + (1-\tau_i)^{\chi_i} pd_i^{*(1-\chi_i)}}\frac{dpwe_i}{dte_i}. \tag{3.24}$$

Since $dpwe_i/dte_i > 0$ and $\chi_i > 1$, then $d(pwe_iE_i)/dte_i < 0$. The findings that $d(pwe_iE_i)/dte_i < 0$ and $d\eta_i^e/dte_i > 0$, plus the consideration that the trade policy has an indirect effect on domestic sales and domestic demand price elasticity, imply that an export tax leads to the exit of firms: $dn_i/dte_i < 0$.[33] In summary:

[32] For an interpretation of (3.22), see section [2.3.2] in the previous chapter.

[33] I have indirectly shown that entry always occurs if total output (Y_i) expands. It is interesting to note that the conventional wisdom suggests $dY_i/dn_i > 0$ (see Seade, 1980).

PROPOSITION 3.1. *Under constant conjectures, Rodrik's PE formula to compute an optimal export tax is upwardly biased; when moving from free trade, both the foreign demand elasticity (in absolute value) and industry concentration raise.*

In fact, (3.3) unequivocally shows that, under constant conjectures, the lower the ex-post number of firms and the larger the ex-post absolute value of the foreign demand elasticity, the lower the optimal size of the export tax. This result might be easily extended, if we assume that λ_i is a function of n_i. The existence of few firms may facilitate collusion among firms, which implies that $d\lambda_i/dn_i < 0$ (Seade, 1980). Since an export tax raises the industry concentration ratio, the effect of increased collusion implies $d\lambda_i/dte_i > 0$ and, as a consequence, a further lower export tax rate in equilibrium.

[3.4.2] The impact of RHK export tax on firm size

The impact on firm size is ambiguous. Since $dY_i/dte_i = y_i(dn_i/dte_i) + n_i(dy_i/dte_i)$, and since, by aggregating firms' domestic output and exports, the total differential of Y_i with respect to te_i can be also written as $dY_i/dte_i = \Omega_D(dD_i/dte_i) + \Omega_E(dE_i/dte_i)$, where Ω_D and Ω_E denote the partial derivatives of the transformation curve with respect to D_i and E_i, respectively; the latter two expressions can be rearranged as

$$\text{(3.25)} \qquad \frac{dy_i}{dte_i} = \frac{\Omega_E}{n_i}\frac{dE_i}{dte_i} + \frac{1}{n_i}(\Omega_D d_i - y_i)\frac{dn_i}{dte_i} + \Omega_D\frac{dd_i}{dte_i}.$$

The first term represents the negative impact of a fall in real exports for the industry as a whole. The second term denotes the positive impact of returns to scale, as a lower number of firms allows a better exploitation of fixed inputs (note that $\Omega_D d_i < y_i$, if $\phi_{yd} < 1$, where ϕ_{yd} denotes the elasticity of composite production with respect to domestic output.).[34] Finally, the third term denotes the capability of firms to sell excess supply in the domestic market. I expect it to be positive, since given the domestic demand, a lower number of firms implies a rise in per firm domestic production. Hence, despite the benefits from better exploiting economies of scale, and despite the rise in domestic production, the impact of an export tax on y_i is indeterminate.

PROPOSITION 3.2. *Moving from free trade to RHK export tax has an ambiguous impact on firm size. It depends positively upon the firm's capability of exploiting economies of scale and of trading excess export supply in the domestic market, and negatively to the magnitude of export contraction.*

[3.4.3] The impact on welfare

Assume the indirect utility function of the representative consumer to be the measure of social welfare. As already shown in the previous chapter, the incremental welfare can be measured by the ratio between the change in the indirect utility function and the marginal utility of income. This ratio (v) is equal to the difference between the total derivative of the consumer income and the consumer price change. Equation (3.17) can be also written as $HR = \sum_j \left[pd_j D_j + (pwe_j - te_j)E_j - \sum_j a_{ij} p_j Y_j \right] + \sum_i te_i E_i$, where the first term in the bracket represents the value of production minus the cost of intermediate inputs, with a_{ij} representing the Leontief intermediate inputs coefficients, and the second term denotes export tax revenues. If the Laspeyre's price

[34] Note that $\Omega_D d_i < y_i$ implies $\Omega_d / (y_i / d_i) < 1$.

index of domestic goods is the numeraire of the model, by total differentiating HR, v can be written as

$$\begin{aligned} v = & \sum_{crs}\left[pd_{crs}dD_{crs} + pwe_{crs}dE_{crs} - \sum_{j} a_{jcrs}p_j dY_{crs}\right] + \sum_{i}\left[pd_i dd_i + pwe_i de_i - \sum_{j} a_{ji}p_j dy_i\right]n_i + \\ & \sum_{i}\left[pd_i d_i + pwe_i e_i - \sum_{j} a_{ji}p_j y_i\right]dn_i + \sum_{i} E_i dpwe_i - \sum_{j}\sum_{j} a_{ij}Y_j dp_j - \sum_{j} Q_j dp_j \end{aligned} \tag{3.26}$$

where Q_j denotes total sectoral demand of final and intermediate goods, which is a composite of domestically produced goods and imports.

Equation (3.26) is a general expression for the analysis of the impact on welfare, when export taxes are collected and devoted to households in the form of a lump-sum transfer. Here, I focus the analysis when an export tax is levied on sectors facing IRS. The sum of the first three terms yields the *global efficiency* effect. The first term denotes the production effect in the tax-free sectors, which is indeterminate as it depends upon: (i) the positive reallocation of primary factor inputs in their favour; (ii) the interdependency among sectors via the intermediate inputs flows (the greater the interdependency among the taxed sectors and the non-taxed sectors, the larger the negative impact on the non-taxed sectors). The second term denotes the firm's value added effect. It is indeterminate, since, from Proposition 3.2, the impact on firm output is ambiguous. The third term denotes the market structure effect, which has a twofold effect on welfare: (i) a positive effect originates if economies of scale are better exploited; (ii) a negative effect results if a firm, by perceiving a less elastic domestic demand curve [see (3.5)], raises the price of the ith domestic commodities and, as a result, a contraction of the domestic consumer surplus occurs. Since the first three terms are ambiguous, the *global efficiency* effect is indeterminate. Obviously, a possible efficiency loss would be larger in the presence of sunk costs, as a lower factor endowment would be available in the economy with firms' exit. The fourth term represents the positive *terms of trade* effect. The fifth and the last term indicate the *intermediate inputs cost* effect and the *consumer price* effect, respectively. Since the Laspeyre's price index of domestic goods is the numeraire of the model, and since the world prices of imports are exogenous, the welfare impact of the latter two effects, in particular of the *consumer price* effect, should be negligible. Then,

PROPOSITION 3.3. *The RHK export tax is not optimal in a GE framework if a possible efficiency loss outweighs the terms of trade benefits.*

[3.5] Numerical results

In order to understand quantitatively the relation among optimal export tax, firm size, industry concentration and welfare, an AGE model has been constructed having the same features of the analytical model presented in the previous two sections. It has been applied to Turkey because, as a consequence of the customs union agreement with the EU, the export restriction in the form of VERs on Turkish textiles and apparel have been abrogated. In addition, Turkey is one of the countries signing the MFA arrangement, which also might be abolished in the near future. If Turkish textiles and apparel industries have market power within the international markets, the regional agreement with the EU and the abrogation of the MFA scheme would imply a deterioration of the Turkey's terms of trade. Hence, the Turkish government might still wish to rely on the positive terms of trade effect by introducing an optimal export tax.

[3.5.1] The AGE model for Turkey

As in the analytical model, the AGE model contains two categories of industries: those where perfect competition and constant return to scale are assumed to prevail (18 sectors), and those which are characterised by increasing returns to scale (textiles and apparel).[35] The production function has a two stage nested CES structure. At the first stage, I assume a Leontief function among primary factors of production and intermediate inputs, which are in turn assumed to be net complements. At the second stage, the elasticity of substitution among the mobile labour and the mobile capital is assumed to be positive and to vary across industries. The production possibility frontier of firms and of industries facing perfect competition and constant returns to scale is a CET specification of domestic products and exports, treated as imperfect substitutes.[36] On the demand side, the representative household demand and the intermediate demand are satisfied by a composite of domestic and imported goods, according to the Armington specification, which states that goods competing in the same market are imperfect substitutes. For simplicity, the price elasticity of domestic demand is assumed constant. The country is assumed to be a price taker for the commodities traded internationally, with the exception of textiles and apparel exports, for which a downward sloping export demand curve has been derived by assuming that a hypothetical foreign consumer purchases both Turkish exports and their imperfect substitute domestically produced goods. The world price of imports in textiles and apparel is also assumed exogenous. The trade balance is always in equilibrium.

[3.5.2] The benchmark data set

The benchmark data set employed to calibrate the relevant variables and parameters of the model is based on the benchmark used in the previous chapter.[37]

In order to calibrate the export demand function in textiles and apparel, I employed OECD data (OECD, 1995) for the year 1990. In particular, I use the value of production, exports and imports relative to 18 OECD countries to which Turkey

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[35] The structure of the AGE model is reported in Appendix 3.A.
[36] See footnote (21) in the previous chapter and footnote (34).
[37] The calibration and the GAMS model is reported in Appendix 3.B.

ships almost all textiles and apparel exports (see Appendix 3.C). The elasticities of substitution between Turkish exports and foreign production faced by the hypothetical foreign consumer have been chosen from Huff, *et al.* (1997): in their global GE trade model, the Armington elasticities are equal to 2.2 in textiles and 4.4 in apparel. Given that the share of Turkish textiles and apparel exports is small with respect to OECD production, η_i^e is computed to be very close to Huff's trade elasticities.

[3.5.3] Scenarios

Tables 3.1-3.3 report the results of several policy scenarios, which differ in: (i) the initial value of the conjectural parameter; (ii) the initial value of the number of firms; (iii) the treatment of primary factor inputs as fixed or sunk costs. The conjectural parameter is assumed to be zero or two, in order to examine the impact of RHK export tax when firms compete *a la* Cournot, as in the Rodrik's study, or act in a more collusive behaviour. The benchmark value of the number of firms is hypothesised to equal 15, 20 or 25, in order to compare the results when alternative ex-ante industry concentration ratios are postulated. In all scenarios, labour is always assumed to be fully employed. So the proportion of labour employed by firms in fixed amount always constitutes a component of fixed costs. Consequently, the scenarios with sunk costs assume that only a proportion of capital is sunk. The simple reason behind this assumption is that labour can be reallocated, while capital easily depreciates.

The experiments consist of computing endogenously the RHK export tax vector for textiles and apparel in a GE setting, where all variables are directly or indirectly affected. It must be stressed that, with the exemption of aggregate output and welfare, the results produced under the alternative hypotheses of fixed and sunk costs are similar. In particular, the computed RHK export tax vector is equal in both categories of scenarios.

Table 3.1 Computation of the RHK export tax

SCENARIO 1: Cournot case (Benchmark value: $\lambda_t = 0$).
SCENARIO 2: More collusive case (Benchmark value: $\lambda_t = 2$).

	Sectors	Number of firms (Base year)	*Ad valorem* export tax (1)	Rodrik's formula (2)	(2) / (1)
SCENARIO 1	*Textiles*	n = 15	0.411	0.426	1.036
	Textiles	n = 20	0.419	0.434	1.034
	Textiles	n = 25	0.424	0.438	1.034
	Apparel	n = 15	0.198	0.214	1.078
	Apparel	n = 20	0.202	0.217	1.077
	Apparel	n = 25	0.205	0.220	1.072
SCENARIO 2	*Textiles*	n = 15	0.348	0.365	1.050
	Textiles	n = 20	0.375	0.388	1.050
	Textiles	n = 25	0.395	0.411	1.039
	Apparel	n = 15	0.168	0.183	1.089
	Apparel	n = 20	0.178	0.195	1.089
	Apparel	n = 25	0.190	0.206	1.082

Table 3.1 shows the computed RHK export tax and the PE Rodrik's formula. This results suggest that the PE formula is upwardly biased, although by a small amount.

This bias is larger, the greater the benchmark value of λ_t. The Rodrik's formula is above the computed export tax by a factor ranging between 1.034 and 1.089. This is because the number of firms declines and the price elasticity of foreign demand rises (see Table 3.2). However, if the foreign demand elasticity is slightly affected, the number of firms contracts enormously. Hence, Proposition 3.1 is corroborated.

Table 3.2 The impact of the RHK export tax on production, number of firms and export demand elasticity (percentage variation)

	SCENARIO 1 ($\lambda_i = 0$)						SCENARIO 2 ($\lambda_i = 2$)					
	n = 15		n = 20		n = 25		n = 15		n = 20		n = 25	
	Textiles	*Apparel*	*Textiles*	*Apparel*	*Textiles*	*Apparel*	*Textiles*	*Apparel*	*Textiles*	*Apparel*	*Textiles*	*Apparel*
Exports	- 68.5	- 51.0	- 68.3	- 50.3	- 68.4	- 48.2	- 64.9	- 49.7	- 66.8	- 52.7	- 68.1	- 51.8
	(-69.0)	(- 50.7)	(-69.6)	(- 50.1)	(-60.9)	(-49.2)	(-65.0)	(-49.2)	(-67.0)	(-51.7)	(-67.7)	(-51.7)
Output	- 19.9	- 17.7	- 18.8	- 17.0	- 18.2	- 15.3	- 20.5	- 18.8	- 21.1	- 20.1	- 20.8	- 18.7
	(-20.6)	(-17.5)	(-20.5)	(-16.8)	(-20.2)	(-16.1)	(-20.8)	(-18.5)	(-21.2)	(-19.4)	(-21.1)	(-19.0)
Output per firm	16.6	62.7	29.7	91.6	43.3	115.7	- 5.9	6.9	- 2.9	16.2	4.5	34.5
	(16.0)	(62.2)	(28.6)	(91.2)	(42.2)	(119.5)	(-6.0)	(7.1)	(-2.9)	(16.0)	(0.7)	(25.1)
Domestic output per firm	34.6	111.6	49.8	148.8	65.7	178.0	7.7	37.3	11.5	51.3	20.5	75.1
	(34.1)	(119.7)	(48.9)	(146.1)	(64.7)	(184.1)	(7.6)	(37.3)	(11.6)	(50.6)	(16.0)	(62.7)
Export per firm	- 54.2	- 3.2	- 49.4	14.7	- 44.7	32.1	- 58.5	- 33.7	- 59.2	- 31.2	- 57.9	- 20.2
	(-54.7)	(-3.1)	(-50.9)	(14.8)	(-46.3)	(32.9)	(-58.5)	(-33.3)	(-59.4)	(-30.4)	(-58.8)	(-25.4)
Number of firms	- 31.6	- 49.4	- 37.4	- 56.7	- 42.9	- 60.7	- 15.5	- 24.0	- 18.7	- 31.2	- 24.2	- 39.6
	(-31.8)	(-49.1)	(-38.2)	(-56.5)	(-43.9)	(-61.8)	(-15.7)	(-23.9)	(-18.8)	(-30.6)	(-21.6)	(-35.2)
Export demand elasticity	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3
	(0.2)	(0.3)	(0.2)	(0.3)	(0.2)	(0.3)	(0.2)	(0.3)	(0.2)	(0.3)	(0.2)	(0.3)

The results of the scenarios with sunk costs are reported in bracket.

Table 3.3 The impact of the RHK export tax on welfare (percentage variation)

		FIXED COSTS					SUNK COSTS				
		Welfare	Terms of Trade	Aggregate Output	Consumer price index	Interm. inputs cost index	Welfare	Terms of Trade	Aggregate Output	Consumer price index	Interm. inputs cost index
SCENARIO 1	n = 15	- 0.6	8.8	- 1.3	- 0.4	- 1.4	- 2.0	8.9	- 2.3	- 0.6	0.3
	n = 20	- 1.1	8.6	- 1.7	- 0.6	- 0.7	- 2.2	9.0	- 2.5	- 0.6	0.1
	n = 25	- 1.6	8.5	- 1.7	- 0.7	- 0.1	- 2.9	9.0	- 2.7	- 0.7	1.0
SCENARIO 2	n = 15	- 0.4	8.2	- 1.3	- 0.3	- 1.1	- 1.1	8.3	- 1.4	- 0.4	- 1.2
	n = 20	- 0.3	8.7	- 1.6	- 0.2	- 1.6	- 1.0	8.7	- 1.6	- 0.3	- 0.6
	n = 25	- 0.7	8.8	- 1.3	- 0.3	- 1.8	- 1.2	8.8	- 2.1	- 0.2	- 0.3

Fixed costs: A proportion of labour and a proportion of capital are treated as fixed costs.
Sunk costs: A proportion of capital is a sunk cost. A proportion of labour is treated as a fixed cost.

The numerical results support the conventional wisdom that the smaller the ex-ante concentration ratio, the larger the RHK export tax rate; and in addition, the smaller the bias. It is also interesting to note that when firms cooperate to a certain extent ($\lambda_i = 2$), exit is remarkably smaller.

The second finding is in relation to Proposition 3.2: the impact of an export tax on firm size is not predictable. In general, despite the possibility of better exploiting economies of scale and despite the greater amount of domestic production both due to firms' exit, output per firm might decline because of the large export fall for the industry as a whole [see (3.25)].

The last finding is in connection with social welfare (Table 3.3). Despite the impact on welfare being analytically ambiguous, the Hicksian equivalent variation index, which is widely used in AGE analysis as an aggregate measure of welfare, is found to be negative in all scenarios. This implies that the RHK formula is not optimal in a GE framework. The welfare loss is due to the negative impact of the tax on global efficiency. In fact, the global resource allocation effect, measured by real aggregate output, ranges between - 0.3% and - 1.6% in the scenarios with fixed costs, and between - 1% and - 2.9% in the scenarios with sunk costs. With regard to the other partial effects on welfare [(see (3.26)], the most important is the impact on terms of trade, which ranges between 8.2% and 9% in both categories of scenarios; whereas the impact on intermediate inputs cost index and on the consumer price index is generally small.

Table 3.3 shows that, although the impact on terms of trade is similar in both categories of scenarios, the negative impact of the RHK export tax on aggregate output in the scenarios with sunk costs is around 50% larger, than the negative impact in the scenarios with fixed costs. This is because, in the scenarios with sunk costs, as a consequence of trade restriction, firms' exit leads to a contraction of the capital endowment. Consequently, since the negative global efficiency effect is greater in absolute value, the welfare loss is much larger when a proportion of factor inputs is sunk. In particular, when the benchmark is characterised by 25 homogenous firms, the welfare loss is estimated to be very large (- 2.9% as a percentage of consumer income). It is also interesting to note that when firms cooperate to a certain extent ($\lambda_t = 2$), the welfare loss is smaller and this due to the fact that, as a consequence of the smaller exit, the negative impact on aggregate output is attenuated. So in conclusion, these results clearly indicate that the RHK formula to determine an optimal export tax in a PE framework is not optimal in a GE setting.

[3.6] Conclusions

This chapter employs a GE model with increasing returns to scale and segmented markets to show that the positive optimal export tax, suggested by Rodrik (1989), Helpman and Krugman (1989) in a PE framework, might be sub-optimal in a GE setting. Under the symmetry assumption, I show that Rodrik's formula is upwardly biased, because the impact on industry concentration, foreign demand elasticity and conjectural variation is not taken into account. I show that the foreign demand elasticity (in absolute value) is positively related to the export price. Thus, an export tax, raising the export price, brings about a rise in the foreign demand elasticity. I also show that the number of competing firms is positively related to output and negatively to the foreign demand elasticity. Thus, as a result of export contraction and higher foreign demand elasticity, an export tax leads to firms' exit. Both these effects drive down the Rodrik's export tax. Obviously, this result would be larger if firms' conjectures about the reaction of other firms were a positive function of the industry concentration ratio. In addition, I show that the impact on firm size is indeterminate. It depends upon three factors: the size of the export contraction, the degree of exploiting fixed inputs and the capability of trading in the domestic market.

A GE model applied to Turkish textiles and apparel shows that Rodrik's export tax formula is upwardly biased by a small factor ranging between 1.034 and 1.089 under constant conjectures. It supports the view that the smaller the ex-ante industry concentration ratio, the larger the RHK export tax, and the smaller the bias. The numerical results also indicate that the impact on firm output is highly indeterminate. As far as social welfare is concerned, despite its analytical indeterminacy, all scenarios show that welfare decreases with the introduction of the RHK export tax. The welfare loss would be larger in the presence of sunk costs. This numerical finding is very important from the policy-makers point of view, as this can explain why developed countries do not impose positive export taxes. RHK suggests that an export tax should be positive in the presence of a large industry (within the international market), a domestic oligopoly and no retaliation. However, the numerical finding indicates that it is not optimal, because the negative impact on output causes a global efficiency loss, which offsets the welfare gains, mainly coming from incremental terms of trade.

CHAPTER 4

The Impact of a Customs Union with the EU on Turkey's Welfare, Employment and Income Distribution: An AGE Analysis

[4.1] Introduction

In December 1995, the European Parliament ratified the customs union (CU) agreement with Turkey for mining and industrial products, with the exception of the commodities subject to the Common Agricultural Policy (CAP). This preferential trade arrangement came into force in January 1996. Despite this, very few attempts have been made to analyse the economic implications of this agreement on Turkey (Harrison, *et al.* 1993, 1997;[38] Mercenier and Yeldan, 1997[39]), and none of them has examined the impact on employment, and the distribution of income.

[38] By using a representative consumer AGE model, Harrison, *et al.* (1997) estimate that Turkey's welfare gain of the CU agreement with the EU is equal to 1.1% of 1990 Turkish GDP (2,861 Billions of 1990 Turkish lira). However, this result has been obtained under the assumption that the Turkish terms of trade for non-agricultural products with third countries rises by 4.2%. Harrison, *et al.* claim that, by the year 2001, Turkey will negotiate preferential trade agreements with third countries, with whom the EU has negotiated Association and Free Trade agreements. This assumption plays a key role in the estimate of the aggregate welfare gain. As Harrison, *et al.* (1997, pp. 866-867) put it: "Improved access to these markets results in a gain in Turkish welfare of 0.5%, which is the largest gain of all the components." However, the improved access has been extended to all non-member countries, whilst Turkish exports with the countries, which negotiated preferential access agreements with the EU, are less than one third of Turkish exports to all non-member states (United Nations, 1997).

Trade and income distribution, and trade and employment have become two important issues among economists, as some of the recent studies argue that trade with poor countries is the main source of both the decline in employment (Katz and Murphy, 1992; Sachs and Shatz, 1994; Wood, 1994) and the increase in wage inequality (MacPherson and Stewart, 1990; Borjas, Freeman and Katz, 1991; Murphy and Welch, 1991; Borjas and Ramey, 1994; Wood, 1994; Sachs and Shatz, 1996) in industrialised regions.[40] The latter studies employ PE techniques to show that trade liberalisation widens the gap between the wage of the skilled worker (the abundant factor) and the wage of the unskilled worker (the scarce factor).[41] Similar results are obtained by McDougall and Tyers (1997), who use a multiregional AGE model to explore the impact of world trade "opening up" on factor price inequality within the developed countries. They also found that the wage-rental ratio declines in the developed countries, in accordance with the Stolper-Samuelson theorem, which states that with trade, aggregate welfare gains are accompanied by an income redistribution effect in favour of the factor which is intensively used in the production of the exportable good. However, it is generally accepted that a trade policy satisfies the Pareto criterion of optimality, if those who gain from the policy *can* fully compensate those who lose.

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[39] Mercenier and Yeldan (1997) use a representative agent multiregional intertemporal AGE model, with increasing returns to scale and imperfect competition, to show that the CU agreement with the EU is detrimental to Turkish welfare. They argue that this regional agreement would generate welfare gains to Turkish consumers if, and only if, full integration of the commodity market with nontariff barriers is achieved.

[40] It must be stressed that other economists, such as Lawrence and Slaughter (1993), Krugman and Lawrence (1993) and Bound and Johnson (1992), argue that trade is not an important contributor of the increasingly unequal distribution of wages, and plays a minor role in the contraction of U.S. manufacturing output and employment registered in the eighties. They believe that technological change is the cause of these trends in U.S. economy. In contrast, Wood (1994) argues that technology is only a further plausible force to explain the rise in relative demand of skilled labour in developed countries, in particular in U.S.. In this study, technological change is not modelled.

[41] As MacPherson and Stewart (1990) pointed out, the immediate policy impact of this finding would be a request for trade protection by trade unions. The same concern is shared by Bhagwati and Dehejia (1994).

Turkey is a middle income developing country abundant of both basic educated workers (basic skilled workers) and workers with virtually no schooling, who are unemployable in the manufacturing sector (no-skilled workers).[42] Since Turkey levies very high sectoral tariffs on goods imported from both the EU and the non member states, and since the European CAP is not part of the CU protocol, this preferential trading arrangement with the EU might favour a wage rise of the basic skilled workers relative to both the skilled workers, who are richer, and the no-skilled workers, who are poorer. As a result, the impact on inequality is ambiguous. In addition, the Stolper-Samuelson theorem enables one to determine the relationship which may exist between foreign trade and functional income distribution, but it cannot predict the effects on the size distribution of income, which depend upon the combined ownership structure of primary factors of production.[43] In a recent study on the theory of income distribution, Atkinson (1996, p. 20) says:

"Statements about the distribution of national income between wages and profits, or about the relative wages of skilled and unskilled workers, do not tell us directly how the share of the top 20 per cent or the bottom 20 per cent is likely to have changed. The factor distribution is certainly part of the story, but it is only part, and the other links in the chain need to receive more attention."

Nowadays, households receive their income from different sources, including capital, in the form of interest and dividends. In this study, each household income group engages its own members in eight different labour activities, owns two different shares of capital factor of production, and is a recipient of part of the quota rents which originate from the VER agreements with the EU.[44] As a result, the finding that trade

[42] In this study, 8 labour categories are distinguished in 3 skilled workers and 5 unskilled workers. In turn, the latter group is distinguished in 4 basic skilled workers and 1 no-skilled workers. The no-skilled workers are farmers, who are unemployable in modern manufacturing. Migration issues are not taken into account.

[43] Adelman and Robinson (1989) provide a substantive discussion on these concepts.

[44] The European Commission and the Istanbul Textiles and Clothing Exporters Association (ITKIB) have agreed quantitative restrictions and price mechanisms for Turkish textiles in 1982 and for clothing categories in 1986. Since then, the VERs arrangements have been regularly renewed (GATT,

widens (reduces) the wage gap between skilled and basic skilled workers in developed (developing) countries cannot be used to predict the impact on overall inequality. It seems that the issue of international trade and the size distribution of income has been neglected by trade theory mainly because it requires a general equilibrium framework where sectoral output, trade flows, prices, factor returns, factor inputs and households' income are all simultaneously determined. So I have built a single country AGE model which is able to trace such effects in a multi-sector, multi-labour, multi-household framework, to quantify in a GE setting the effects of the CU agreement with the EU upon the welfare of Turkish rural and urban households, and the functional and the size distribution of income in Turkey.[45]

As I have mentioned above, with regard to the issue of trade and employment, several studies show that the trade liberalisation process is the cause of the decline (increase) in manufacturing employment in industrialised (developing) countries (Wood, 1994). So it is important to examine what might be the impact of the CU agreement on Turkish employment. The technique employed follows Krugman's model of global trade, employment and wages (Krugman, 1995). Krugman uses a stylised numerical GE two-country model with two productive inputs, skilled labour and

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1994). The elimination of the VER on Turkish textiles and apparel exports is an important issue of the preferential trade arrangement agreed with the EU. The Turkish production of textiles and apparel comprises 13% of Turkey's industrial production, and their exports represent 38% of merchandise exports. Most of them are exported to the European market. Hence, the elimination of the VERs could have an important impact on the Turkish economy. Certainly, the quota rents on textiles and apparel accruing to the exporting firms, and transferred to households, would be annulled; although the output of these sectors would expand, affecting sectoral factor mobility, welfare and, as a consequence, the distribution of income. Also Harrison, *et al.* (1997) assume that Turkish exporters obtain improved access in textiles and apparel, which consists of an exogenous increase of the prices received by Turkish exporters to the EU on these goods. However, the quota rents are not annulled. Hence, they over-estimate the computed welfare gains.

[45] The analysis of economic policies on income distribution with AGE models has a long tradition. Adelman and Robinson (1978) were pioneering in this regard, as they examined the impact of various policies affecting income distribution in Korea. Their model identifies 15 different categories of income recipients, classified according to their skills. However, the impact on the size distribution of income has been derived indirectly, by using the calculation on factor incomes and by assuming that the size distribution of income within each occupational group is represented by a lognormal distribution.

unskilled labour, and two goods, one exportable and one importable, to study the impact of trade on employment of an industrialised country in the case of rigid real wages. His model predicts a fairly large negative employment effect, in relation to the labour input used intensively in producing the importable good. Following Krugman (1995), the employment implications of the CU agreement on the Turkish economy have been examined under the assumption that real wages are constant. Since Turkish industries employ unskilled workers intensively in manufacturing exportable goods, the CU leads to a rise in Turkish employment, as one would expect from the Krugman model applied to a developing country. I estimate that the number of new jobs created is equal to almost 148000. As Turkish manufacturing industries expand, the demand of basic skilled production workers rises substantially, comprising 75% of the new jobs created.

The second important finding is that although, in terms of changes in real income, the owners of basic skilled labour (the abundant factor) are better off than both the owners of skilled labour and the owners of capital (the scarce factors), the impact on inequality in Turkey is ambiguous: it increases in the scenario with fixed wages and declines in the scenario with flexible wages. This is due to the fall (rise) in both agricultural capital income and farmers' earnings in the scenario with fixed (flexible) wages, which brings about a substantial rise (decline) of inequality between urban and rural household groups. This suggests that the analysis of trade impact on the distribution of income, only carried out with models which define household groups according to their functional role and under the full employment assumption, such as the Stolper-Samuelson model, might be misleading.

To measure the impact on welfare, I use the Hicksian equivalent variation, which is widely used in AGE literature. The results indicate that although Turkey's welfare gain is in aggregate equal to 1226-2750 billions of 1990 Turkish lira (470-1054 million US dollars), the welfare impact on most of individual households depends hugely on the assumption made for the labour market. In particular, several urban groups would suffer large welfare losses in the case of flexible wages.

The static single country AGE model for the Turkish economy presented in this study specifies 20 urban household groups and 19 rural household groups, disaggregated by income class. Factor inputs (8 different labour categories and 1 capital) are fully mobile among sectors. In addition, unlike the Krugman model where traded goods are homogenous, it is assumed that domestic products, imports and exports are imperfect substitutes, in order to capture the *cross-hauling* phenomenon. The model assumes perfect competition and constant returns to scale, and this is because the literature on trade liberalisation and income distribution, which I hope to contribute to, makes these assumptions. The intra-industry trade model used for this study adopts the consumption tax base definition of the VAT, as the effective VAT rates in Turkey are not uniform among commodities. The multiregional relations have been described in the form of two trade flows, one with the EU and one with the Rest of the World (RoW). To measure inequality, the income received by household members, adjusted by the households' "true" cost of living index, has been employed as a unit of measure.

The study also consists of a further four sections. Section 2 defines the algebraic specification of the model, and the measures of welfare and income inequality. Section 3 describes the benchmark. Section 4 explores the effects of the policy simulations, and the final section provides some conclusions.

[4.2] Model Specification

The trade model presented in this study is a standard static multi-sector, multi-labour, multi-household AGE model for Turkey with perfect competition and constant returns to scale. It is characterised by intra-industry trade as each tradeable commodity is exchanged in five different markets: the domestic market; the markets for imports from the EU, and the RoW; and the markets for export to the EU, and the RoW. This implies that although Turkey is assumed to be a price taker of international goods, domestic prices are endogenously determined. To simplify the presentation, the specification of the model is divided into five components: production technology and factor demand, treatment of traded goods and foreign sector closure, household revenues and consumption, government revenues and consumption, and treatment of savings and investment decisions. In addition, the welfare and the income distribution measures have been reported. The complete algebraic formulation of the model is shown in Appendix 4.A.

[4.2.1] Technology and factor demand

The production technology is described by a three stage nested separable CES function. At the first stage, sectoral production is generated as a Leontief function between raw-material inputs, which are assumed to be strictly complementary, and the value added, which is, at the second stage, a CES combination of three factor inputs, such as composite skilled labour, composite unskilled labour and capital. At the final stage, composite skilled labour and composite unskilled labour are respectively a CES aggregation of different skilled occupational categories and of different unskilled occupational categories.

The demand for factor inputs is derived by solving a two stage dual problem. Firstly, the minimisation of the skilled (unskilled) labour cost function subject to the skilled (unskilled) labour aggregation function yields the demand of labour for different skilled (unskilled) occupational categories. Secondly, the minimisation of the total cost function subject to the production technology yields the demand for composite skilled labour, for composite unskilled labour and for capital. In other words, producers behave competitively and the factor returns equal their marginal revenue product.

It is assumed that factor inputs are mobile between sectors. Total labour demand of each category is equal to exogenous labour supply of each category only when wages are flexible, whereas total capital demand always equates exogenous aggregate capital. In addition, since Turkish farmers are virtually without schooling, they are unemployable in manufacturing. Or to put it in another way, since 95% of employed persons in Turkish agriculture are self-employed or unpaid family labour (Bulutay, 1995), it is assumed that any effect of the trade policy is perceived on farmers' wages.

[4.2.2] Treatment of traded goods and foreign sector closure

[4.2.2.1] Imports

As far as the imports are concerned, on the supply side, the *small country* assumption is postulated with respect to both regions. Hence, the import supply functions are represented by the import price equations for the EU (pm_j^{EU}) and the RoW (pm_j^{RoW}) commodities:

(4.1) $$pm_j^{EU} = \overline{pwm}_j^{EU}\left(1 + tm_j^{EU}\right),$$

(4.2) $$pm_j^{RoW} = \overline{pwm}_j^{RoW}\left(1 + tm_j^{RoW}\right),$$

where $\overline{pwm}_j^{EU}$ and $\overline{pwm}_j^{RoW}$ are the fixed world prices of similar imports produced by the EU and the RoW, respectively; and tm_j^{EU} and tm_j^{RoW} are the effective *ad valorem* regional import tariff rates, gross of the effective *ad valorem* Mass Housing Fund levies on EU and RoW commodities evaluated in terms of tariff equivalent.[46]

[46] Turkey has levied this surcharge on imports since 1984, the year of the Housing Fund law approved by the Turkish Parliament to finance the government's low cost housing scheme for poor and middle-class income households. The Mass Housing Fund duty will be phased out in 1998 (GATT, 1994).

On the import demand side, a two stage nested separable CES function is employed. Thus, it is assumed that buyers first decide between domestically produced goods and the composite imported commodities, and then choose between imports from the EU (M_j^{EU}) and imports from the RoW (M_j^{RoW}) with elasticity of substitution μ_j, according to the Armington specification (Armington, 1969), which states that products of different countries competing in the same market are imperfect substitutes:

$$M_j^{EU} = \mathrm{A}_j^{\mu_j - 1} \alpha_j^{\mu_j} \left(\frac{pm_j^{EU}}{pm_j^C} \right)^{-\mu_j} M_j^C, \tag{4.3}$$

$$M_j^{RoW} = \mathrm{A}_j^{\mu_j - 1} \left(1 - \alpha_j\right)^{\mu_j} \left(\frac{pm_j^{RoW}}{pm_j^C} \right)^{-\mu_j} M_j^C, \tag{4.4}$$

where M_j^C denotes the composite imports, pm_j^C is the composite domestic price of imports, A_j and α_j are the shift and the share parameters of the CES import aggregation function.

[4.2.2.2] Exports and VERs

With regard to exports, on the demand side, the *small country* assumption implies the export demand functions to both regions to be infinitely elastic. Hence, the Turkish export production is totally absorbed by foreign trade partners at world prices. However, for goods subject to VERs, the domestic supply price of exports (pe_i^{EU}) is endogenously determined by the amount of output which is agreed to be exported. Hence,

$$pe_i^{EU} = \frac{\overline{pwe_i}^{EU}}{1 + qr_i^{EU}}, \tag{4.5}$$

where $\overline{pwe_i}^{EU}$ is the fixed price of exports prevailing in the EU market, and qr_i^{EU} represents the *ad valorem* export quota premium parameter on Turkish textiles and apparel. When qr_i^{EU} is zero, the domestic supply price of exports to the EU is equal to the price prevailing in the EU market.

On the supply side, the export supply functions to the EU (E_i^{EU}) and the RoW (E_i^{RoW}) are derived by maximising total export sale revenues subject to the export possibility frontier (E_i^C), which is defined by a constant elasticity of transformation (CET) function. Hence,

(4.6) $$E_i^{EU} = \mathrm{B}_i^{-1}\left[\beta_i + \beta_i^{\eta_i+1}(1-\beta_i)^{-\eta_i}\left(\frac{pe_i^{EU}}{\overline{pwe}_i^{RoW}}\right)^{-(\eta_i+1)}\right]^{-\left(\frac{\eta_i}{\eta_i+1}\right)} E_i^C,$$

(4.7) $$E_i^{RoW} = \mathrm{B}_i^{-1}\left[(1-\beta_i) + \beta_i^{-\eta_i}(1-\beta_i)^{\eta_i+1}\left(\frac{\overline{pwe}_i^{RoW}}{pe_i^{EU}}\right)^{-(\eta_i+1)}\right]^{-\left(\frac{\eta_i}{\eta_i+1}\right)} E_i^C,$$

where $\overline{pwe}_i^{RoW}$ is the fixed price of exports prevailing in the RoW market, η_i the elasticity of transformation, B_i and β_i the shift and the share parameters of the CET export aggregation function. The composite export, E_i^C, is in turn derived by maximising total sales (domestic sales, plus export sales) subject to the production possibility frontier, which is a transformation function of the domestic good and the composite export with constant elasticity.

The rents from VERs (VER_i^{EU}), which are allocated to the Turkish exporting sectors,[47] and then transferred to households, are proportional to the agreed quota premium and the level of exports:

(4.8) $$VER_i^{EU} = qr_i^{EU} pe_i^{EU} E_i^{EU}.$$

When qr_i^{EU} is zero, quota rents disappear.

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[47] Since the Turkish government does not officially recognise any quota restriction, VERs agreements could only be made with Turkish industry associations (GATT, 1994). Thus, the rents from VERs accrued to the exporting firms which were able to obtain the export quota documents for deliveries to the EU.

[4.2.2.3] Foreign sector closure

The current account deficit, $\overline{CA}$, is exogenously specified. Thus, the equilibrium in the balance of payments is:

$$(4.9)\qquad \sum_i \overline{pwe}_i^{EU} E_i^{EU} + \sum_i \overline{pwe}_i^{RoW} E_i^{RoW} + \overline{CA} = \sum_j \overline{pwm}_j^{EU} M_j^{EU} + \sum_j \overline{pwm}_j^{RoW} M_j^{RoW}.$$

[4.2.3] Households' revenues and consumption

[4.2.3.1] Households' revenues

The household sector comprises 20 urban and 19 rural household groups classified according to their income size. This disaggregation allows one to identify the losers and the gainers of the CU agreement between Turkey and the EU. The source of private income (HR_h) originates from wage payments, returns to capital, plus rents from VERs:

$$(4.10)\qquad HR_h = \sum_c \zeta_{hc}^L \sum_i w_c L_{ic} + \zeta_h^{agr} \sum_{agr} rAK_{agr} + \zeta_h^{nagr} \left(\sum_{nagr} rAK_{nagr} + \sum_i VER_i^{EU} \right),$$

where $i = agr \cup nagr$, AK_{agr} and AK_{nagr} denote the net capital factor in agricultural and non-agricultural activities, respectively; L_{ic} represents the different labour categories employed in sector i; r and w_c are the returns on capital and labours of different skills' categories, respectively; ζ_{hc}^l represents the distributive share parameters of labour income to households; and ζ_h^{agr} and ζ_h^{nagr} represent the distributive share parameters of agricultural and non-agricultural capital incomes to households, respectively. Since the Turkish government did not take part in the VERs arrangements with the EU, the rents accrued directly to the private companies, which then distributed them back to shareholders in the form of dividends, and therefore in proportion to ζ_h^{nagr}.

[4.2.3.2] Households' consumption

Since the model is static, the households' utility functions are defined only over composite commodities. The households' consumption behaviour is obtained by maximising their utility functions, subject to their disposable income after deduction of savings, which are simply measured by the product between the average propensity to save and households' disposable income. Because of lack of data on the values of the elasticity of substitution among commodities for each household group, consumers' preferences have been described simply by Cobb-Douglas utility functions.[48]

[4.2.4] Government revenues and expenditure

The government levies various taxes in order to finance its expenditures: a direct tax on household income; duties on imported goods; and indirect taxes on goods and services. Despite the VAT system only being introduced in Turkey in 1985, VAT has become the main component of indirect tax revenues. AGE modellers usually levy the VAT rates on wage payments, plus the return to capital net of depreciation, thus assuming a proportionate tax on the value added by the firm (income tax base definition of the VAT).[49] However, by definition, VAT applies to commodities' sales net of all intermediate goods purchases (consumption tax base definition of the VAT). The consumption tax base definition of VAT is an equivalent concept of the income tax base definition only if the tax rate is uniform among commodities. However, the

[48] Harrison, *et al.* (1997) employs a CES utility function for their model with a representative consumer. The elasticity of substitution is also assumed *ad hoc*, and equal to 1.5.
[49] Harrison, *et al.* (1997) for example employ the VAT, defined on the income side, as a replacement tax to examine the impact of the CU agreement on Turkey's welfare.

effective VAT rates in Turkey are commodity specific.[50] Hence, the consumption tax base definition of the indirect taxes has been employed as replacement tax to perform a revenue neutral tariff reform. A fuel consumption tax is also considered.

With regard to the apportionment of customs' revenues to Turkey, it is assumed that these revenues are distributed to the members of the EU in proportion to their imports from the RoW (Corden, 1984). Thus, the duties on RoW imports collected by Turkey continue to be considered revenues of the Turkish government after the CU agreement.

Public expenditure is simply treated as exogenous transfers to households and foreign institutions, and exogenous consumption of public goods and services in real terms. Thus, the government is a separate consuming agent; however its consumption decisions are not affected by price changes.

[4.2.5] Savings and investment decisions

Since the purpose of the model is to measure the static effects of the preferential trade arrangements with the EU, savings and investment decisions have been treated in a simple fashion. Households' savings are a constant proportion of disposable income; foreign savings, given by the current account deficit, are set exogenously; the budget deficit is exogenously specified as a difference between public revenues and exogenous public expenditure; capital depreciation is also assumed to be exogenous. Aggregate savings always equates aggregate investment, set exogenously in the model. Investment spending in each sector is held constant in real terms.

[50] The VAT system has been introduced in Turkey in 1985. As has been reported by the OECD (1992, 1995), the tax administration is still inadequate in the face of a large underground economy. Hence, despite the general VAT rate being 12% in 1990, the effective VAT rate is not uniform among commodities.

[4.2.6] Welfare and inequality measures

Two main indices are constructed to measure welfare changes in AGE literature: the equivalent variation and the compensating variation. Since they are very similar concepts, I use the Hicksian equivalent variation to study the impact of the partial trade liberalisation policy on each household income group. The welfare of urban and rural household income groups, and of the Turkish nation as a whole, is an additive aggregation of the welfare of each household income group.[51]

As far as the measurement of inequality is concerned, the study focuses on the inequality between urban and rural household members. The number of members within each household group varies substantially, and many of them are concentrated around the bottom and middle of the income distribution. This implies that considerable information would be lost if the income received by household income groups is used as a unit to measure inequality.[52] Since the data source does not provide any additional information concerning the income redistribution among household members in each income class group, the arithmetic mean income across household members in each income class group (hr_h) has been employed to examine the CU impact on the size distribution of income. However, income does not capture directly the price effect as tariffs fall. Thus, the ratio between hr_h and the 'true' cost

[51] Although this procedure is widely used in cost-benefit analysis, it presents problems related to interpersonal utility comparisons, which are described in Boadway (1974). However, if one accepts the Pareto criterion of optimality, the aggregation is admissible. A more general discussion can be found in Hammond (1991).

[52] Assume that there are two households groups (1 urban household group and 1 rural household group), each earning the same income. Obviously, income is equally distributed among household groups. Assume now that the urban household group has one member and that the rural household group is composed of k members. In this case, income would be unequally distributed among household members. This implies that the use of the income received by household groups as a unit of measure of inequality would be imprecise.

of living index, $P_h = \prod_j (p_j / \vartheta_{jh})^{\vartheta_{jh}}$ where ϑ_{jh} denotes the household budget share for good j, (that is, the indirect utility function) is used as a basis to measure inequality.[53]

A set of general entropy indices for discrete distributions (GE_θ) has been employed to measure inequality. Given the assumption that, within each income class group, members receive the same income, GE_θ can be written as:

$$(4.11) \qquad GE_\theta = \frac{1}{\theta^2 - \theta}\left[\frac{1}{K}\sum_{h=1}^{H}\left(\frac{k_h\, hr_h / P_h}{hr^m}\right)^\theta - 1\right], \qquad K = \sum_{h=1}^{H} k_h ,$$

where k_h represents the number of household members in each household income group h; K the total number of members; hr^m the arithmetic mean income across household members for the entire population in real terms; H the number of households income groups, which is 39 (i.e. 20 urban and 19 rural household income groups); and θ an arbitrary parameter which in principle can assume any real value, although particular values generate known inequality measures as specific cases. The generalised entropy index measures the average distance between each person's real actual income and the real income he would receive in a perfectly equal society. The advantage of this is that one can derive the inequality measure directly, without postulating the existence of a social welfare function, and discussing its desired properties (Cowell, 1995). The generalised entropy index has also been chosen as an indicator of income inequality because it has three main important properties: it satisfies the strong principle of transfer, according to which the change in inequality depends only on the "distance" between individual income shares, no matter which individuals one chooses; it is additively decomposable by population subgroups; and it encompasses all other measures that are ordinally equivalent: the entire subfamily of Atkinson indices ($\theta < 1$), the Theil index ($\theta = 1$) and half of the square of the

[53] It must be stressed that household income does not adjust for differences in needs between households (so called *equivalisation* process), but only for the number of individuals (so called *reweighting* process). A fuller discussion on these issues can be found in Cowell (1984), Danziger and Taussig (1979), and Glewwe (1991).

coefficient of variation ($\theta = 2$).[54] The additive decomposability property is very important for this study because one can compare the inter group income inequality among rural and urban areas and the inter group income inequalities among household members partitioned according to their geographical location.[55]

4.3. Features and properties of the benchmark

The benchmark for this study is mainly based upon the SAM for Turkey constructed for the year 1990 by the author in collaboration with Ozhan (De Santis and Ozhan, 1995).[56] This SAM does not provide information regarding regional trade data disaggregation. Thus, further sources have been used, such as a recent unpublished document of the State Institute of Statistics of Turkey (SIS), which shows the Turkish trade flows with the EU for the year 1990, and a recent unpublished dissertation by Kose (1995), who reports the import duties and the Mass Housing Fund duties, both disaggregated at regional level and consistent with the aggregate data published in the official Input-Output table for Turkey (SIS, 1994).

The SAM defines the cost of labour in terms of wages and salaries in line with the official Input-Output table for Turkey. In other words, it includes only the cost of employees. This implies that sectors, such as agriculture, dominated by self-employed and unpaid family labour, would be characterised by an underestimated ratio between labour and capital. Since self-employed and unpaid family labour comprise almost 95% of the employed persons in Turkish agriculture (Bulutay, 1995), and since this might effect the computation of the impact of the CU agreement on the size and the functional distribution of income, I have calculated the total farmers' earnings in

[54] For proof and further discussion see Bourguignon (1979), Cowell (1980), Cowell and Kuga (1981a, 1981b), Shorrocks (1980).
[55] Appendix 4.B describes the measurement of inequality in more detail.
[56] Some of the data have been already reported in Table 2.1 and Appendix 2.C.

Turkish agriculture for the year 1990, by using as a basis the average nominal wage in agriculture estimated by Bulutay for the year 1989 (Bulutay, 1995).[57] According to my estimates for agriculture, the ratio between farmers' earnings and value added is 45.01%, and the ratio between total labour cost and value added is 48.09%. In the SAM, these two ratios are respectively equal to 7.06% and 10.13%.

Table 4.1 shows a schematic representation of a SAM used for this study. Its main features are that firstly, the trade flows of Turkey are distinguished in two geographical directions: one with the EU and one with the RoW; and secondly, the rents on exports subject to the VERs are an income source of the factors of production accruing to the exporting firms. These aggregate accounts are disaggregated as follows: factor labour is disaggregated into 8 different types of labour categories;[58] households are disaggregated according to their income size and to their geographical regions (20 rural and 19 urban households); activities and commodities are disaggregated into 20 different types and classified according to the I-O table classification.[59] The accounts for imports and exports are disaggregated to model the relations with the EU and the RoW.[60]

Table 4.2 shows the source of income of urban and rural households, disaggregated by their income size and split in twentieth percentiles. Each income class group contains a large number of household members.

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[57] I have also considered the fact that the index of prices received by farmers increased by 62.8% from 1989 to 1990 (SPO, 1996), and that the full time equivalent work in agriculture is 41% of the entire time, as it has been estimated for similar European countries, such as Greece (EC, 1996).

[58] Partly following Wood (1994), I classify professional workers, managerial workers and clerical workers as the skilled labour group, with post-basic education; sales workers, service workers, non-agricultural workers and other workers as the unskilled labour group, with basic education; and the agricultural workers as the no skilled labour group, with virtually no schooling.

[59] The disaggregated 1990 SAM for Turkey comprises 54 sectors. Since the formation of CU between Turkey and the EU involves only mining and manufacturing commodities, the author has mainly aggregated the sectors subject to the CAP, mining and services. Mining has been aggregated mainly because it is a very small sector in terms of share in the GDP, labour force employed and volume of trade.

[60] The EU is composed of 15 countries: 12 members existing in 1990, plus the new members Finland, Austria and Sweden. See Table 2.1 in Chapter 2.

Table 4.1 Schematic representation of a SAM for Turkey 1990

	Factors	*Households*	*Government*	*Activities*	*Cmp-Com*	*Imports EU*	*Imports RoW*	*Exports EU*	*Exports RoW*	*Cap-Acc*	*Foreign Institutions*	*Total*
Factors (1)				Gross Value Added				Rents from VERs				*Gross Factor Income*
Households (2)	Factor Income											*Household Income*
Government (3)		Direct Taxes			Indirect Taxes	Import Duties	Import Duties					*Government Income*
Activities (4)					Domestic Sales			Exports to the EU	Exports to the RoW			*Production Revenues*
Cmp-Com (5)		Consumption	Consumption	Intermediate Inputs						Investment		*Total Income*
Imports EU (6)					Gross Imports from the EU							*Supply of Imports from the EU*
Imports RoW (7)					Gross Imports from the RoW							*Supply of Imports from the RoW*
Exports EU (8)											Exports to the EU and rents from VERs	*Supply of Exports to the EU*
Exports RoW (9)											Exports to the RoW	*Supply of Exports to the RoW*
Cap-Acc (10)	Capital Depreciation	Savings	Budget Surplus								Current Account Deficit	*Aggregate Savings*
Foreign Institutions (11)						Net Imports from the EU	Net Imports from the RoW					*Current Payments Abroad*
Total	*Gross Factor Payments*	*Households Expenditure*	*Government Expenditure*	*Production Costs*	*Total Absorption*	*Expenditure on Imports from the EU*	*Expenditure on Imports from the RoW*	*Expenditure on Exports to the EU*	*Expenditure on Exports to the RoW*	*Aggregate Investment*	*Net Foreign Exchange Receipts*	

Table 4.2 Household income in urban and rural areas (in billions of 1990 TL and %)

Geographical location	*Income groups*	*Household members*	*Professional workers*	*Managerial workers*	*Clerical workers*	*Sales workers*	*Service workers*	*Agricultural workers*	*Production workers*	*Other workers*	*Agricultural Capital*	*Non-agricultural Capital*
		Total income (*Billions of TL*)	*22,002*	*6,351*	*14,862*	*4,789*	*13,983*	*29,381*	*39,603*	*893*	*33,636*	*155,845*
	1st	191,797	0.18	-	0.63	0.44	1.58	0.20	2.15	1.12	0.00	0.03
	2nd	2,084,093	1.68	0.06	10.66	1.96	8.00	0.50	7.89	3.70	0.12	0.54
	3rd	3,929,142	7.99	0.58	13.62	2.55	11.99	0.61	10.16	9.63	0.31	1.42
	4th	3,844,072	6.90	1.15	10.54	3.72	9.68	0.65	9.76	13.44	0.40	2.38
	5th	3,065,584	6.10	1.73	7.69	4.57	5.56	0.65	7.43	7.84	0.50	3.27
U	6th	2,368,164	5.54	2.24	6.04	3.90	3.50	0.54	5.67	10.75	0.49	3.34
R	7th	2,013,527	4.78	2.47	6.16	4.36	3.16	0.48	4.74	11.53	0.53	4.11
B	8th	1,324,046	4.16	2.52	4.04	3.51	2.54	0.48	3.38	8.96	0.41	3.78
A	9th	1,137,946	3.57	2.47	3.42	4.61	1.58	0.33	2.68	5.94	0.42	3.60
N	10th	795,868	3.65	2.31	2.17	3.34	1.20	0.17	2.01	5.60	0.17	2.78
	11th	1,196,026	5.99	7.54	3.48	6.26	2.35	0.54	2.51	5.94	0.42	6.29
A	12th	837,296	5.04	5.09	2.11	4.76	2.40	0.50	1.90	1.90	0.64	5.35
R	13th	601,592	4.66	5.50	1.31	3.99	2.30	0.41	1.14	-	0.49	4.27
E	14th	373,861	4.45	4.61	0.11	3.28	0.82	0.39	1.22	-	0.23	3.43
A	15th	249,915	3.39	2.03	0.74	2.34	1.49	0.07	0.55	1.90	0.14	2.50
S	16th	598,479	7.90	11.48	1.71	6.37	1.39	0.69	2.07	-	0.81	8.07
	17th	193,393	2.80	5.78	-	3.34	0.53	0.15	0.64	-	0.31	4.11
	18th	185,608	5.66	13.89	-	5.18	1.92	0.15	0.73	-	0.39	9.00
	19th	30,698	-	11.45	-	1.23	-	0.20	0.41	-	0.19	3.12
	20th	10,733	-	2.00	-	0.75	-	-	-	-	-	1.95
	Sub-Total	*25,031,840*	*84.43*	*84.90*	*74.42*	*70.47*	*61.98*	*7.70*	*67.05*	*88.24*	*6.98*	*73.32*
	1st	891,853	0.30	0.03	0.28	0.29	1.44	1.78	1.60	0.34	0.53	0.07
	2nd	2,927,443	1.45	0.09	3.42	0.63	6.38	5.42	4.39	1.12	2.90	0.56
	3rd	4,289,044	2.83	0.88	4.39	1.90	7.09	7.09	5.70	0.34	5.01	1.70
	4th	4,195,913	2.89	0.88	6.16	2.63	5.85	8.71	4.69	-	7.69	2.03
	5th	3,444,371	2.33	0.94	3.42	3.38	6.52	8.45	3.28	3.70	8.48	2.27
R	6th	2,469,112	1.03	0.71	3.88	1.59	3.98	7.07	3.26	1.46	8.26	1.75
U	7th	1,950,201	0.85	1.43	1.14	1.27	1.29	6.72	3.21	-	8.00	1.48
R	8th	1,508,911	0.47	0.71	1.25	1.00	0.62	7.54	1.36	-	6.93	1.77
A	9th	1,306,443	0.30	0.94	0.40	2.09	0.34	6.61	1.51	-	6.78	1.45
L	10th	867,520	0.15	0.27	1.08	0.96	0.29	2.69	0.67	-	5.04	0.68
	11th	1,512,805	0.20	1.09	0.17	1.34	1.54	9.45	1.43	1.12	11.00	2.01
A	12th	764,382	0.26	0.79	-	1.84	1.82	5.72	0.52	3.70	6.25	1.43
R	13th	448,989	0.30	0.27	-	2.23	0.62	2.51	0.29	-	2.75	1.35
E	14th	358,242	0.71	1.70	-	2.21	-	0.87	0.46	-	2.58	1.92
A	15th	216,019	0.35	0.50	-	1.55	-	1.08	0.32	-	1.55	0.85
S	16th	338,024	1.15	0.91	-	2.28	0.24	1.89	0.28	-	2.74	2.09
	17th	175,218	-	2.20	-	1.42	-	3.69	-	-	4.18	1.28
	18th	150,188	-	0.74	-	0.92	-	4.29	-	-	2.32	1.53
	19th	7,380	-	-	-	-	-	0.72	-	-	0.05	0.47
	Sub - Total	*27,822,058*	*15.57*	*15.10*	*25.58*	*29.53*	*38.02*	*92.30*	*32.95*	*11.76*	*93.02*	*26.68*

In aggregate, the geographical subgroups are composed of about 25 million urban household members and almost 28 million rural household members. It is evident that much of the urban and rural population is concentrated in the bottom-middle of the income distribution. In fact, 87.7% of urban household members (almost 22 millions) and 91.2% or rural household members (almost 25 millions) earn an income level below the eleventh percentile. In addition, 69.8% of labour income and 55.2% of capital income is allocated among urban household members, which represent only 47.4% of the population. This implies that intra group income inequality as well as inter group income inequality are important features of Turkey. It is also interesting to note, for the subsequent numerical analysis on income inequality, that the main income source of rural households is agricultural labour and capital incomes. A contraction (expansion) in agriculture would imply a fall (rise) in rural welfare and a rise (fall) in inter group income inequality.

Table 4.3 shows the *ad valorem* effective indirect tax rates on goods and services, the *ad valorem* effective duties levied on foreign imports, the quota premium and the European common external tariff. It is evident that the sectors which are much more protected by an effective tariff are beverages and tobacco, wearing apparel, footwear, wood and wood products, petroleum and coal products, non metallic mineral products and transport equipment. One might expect that these sectors are those which would be much more affected by the CU with the EU. The *ad valorem* effective net indirect tax rates (t_j) have been derived from De Santis and Ozhan (1995). The duties levied by the EU on Turkish commodities and the European common external tariff are published by the Commission of the European Communities on an annual base (CEC, 1990). The duties levied by the EU on Turkish goods are zero. Since the EU imports a large number of differentiated commodities from non-member countries, which are subject to a large range of different duties, the mode has been employed in this study as the average European common external tariff (cet_j^{RoW}).

Table 4.3 Indirect tax rate, tariff, quota premium, and common external tariff (%)

SECTORS	t_j	tm_j^{EU}	tm_j^{RoW}	qr_j^{EU}	cet_j^{RoW}
Agriculture	0.3	18.3	17.9	0.0	12.0
Mining	17.1	1.0	0.9	0.0	2.4
Food processed products	1.0	14.8	14.2	0.0	12.0
Beverages and tobacco	0.8	145.0	91.9	0.0	24.0
Textiles	8.4	14.5	16.5	5.0	9.0
Wearing apparel	4.0	61.2	0.7	15.0	13.0
Leather and fur products	12.4	4.3	3.2	0.0	3.1
Footwear	4.0	166.6	32.3	0.0	11.7
Wood and wood products	6.7	19.1	67.9	0.0	5.7
Chemical products	1.1	21.9	35.0	0.0	7.3
Petroleum and coal products	32.8	112.1	94.6	0.0	3.1
Non-metallic mineral products	7.6	35.8	56.1	0.0	5.2
Metal products	18.9	9.6	2.9	0.0	5.1
Machinery	2.1	17.4	29.8	0.0	5.0
Transport equipment	2.6	34.2	40.6	0.0	7.0
Electricity, gas and waterworks	0.5	0.0	14.3	0.0	0.0
Construction	2.7	-	-	-	-
Trade, restaurants and hotels	0.6	-	-	-	-
Transport and communication	3.5	-	-	-	-
Other services	11.8	-	-	-	-

With regard to the quota restriction on Turkish textiles and wearing apparel exports to the EU, the exogenous increase on the export price of these goods, used by Harrison, *et al.* (1997), is assumed to be the *ad valorem* quota premium on VERs (qr_j^{EU}).

It is important to note for the subsequent analysis on welfare that the European common external tariff rates are lower than the tariff rates levied on Turkish imports from the RoW, with the only exemption of mining, wearing apparel and metal products. This implies that the CU should not be trade diverting.

With regard to the elasticity values, the factor substitution elasticities, the Armington trade elasticities, and the elasticities of transformation have been selected from Harrison, *et al.* (1992), and some of them have been adjusted for differences in sectoral aggregation (see Table 2.2). In addition, because of the lack of data, the elasticities of substitution among skilled and unskilled labour categories are assumed to be equal to 2 and 5, respectively.

With regard to the calibration of all other parameter values, such as initial prices, direct tax rates on household income, marginal propensities to save, factor income distribution shares, shift and share parameters of different functional forms, the standard techniques widely used in AGE literature are employed (Mansur and Whalley, 1984).[61]

4.4. The revenue-neutral tariff reform scenarios

The preferential trading arrangement between Turkey and the EU is a regional economic integration agreement, signed in respect of the GATT's rules, according to which the member countries remove tariffs and quotas on mining and manufacturing commodities which circulate within the CU, and apply a common external tariff on these commodities from outside the CU. As a result, nominal protection rates on goods subject to the European CAP (that is, agricultural and food processed commodities) remain unchanged.

The indirect tax rate has been used as a policy instrument manoeuvrable by policy-makers to perform a revenue-neutral tariff reform. This experiment has been carried out under two different assumptions: firstly, real wages are assumed to be rigid (with the exception of farmers' wages), which implies that the effects of trade are

[61] The calibration procedure can be found in Appendix 4.C, which reports the GAMS code of the model.

manifested in changes in employment; and, secondly, real wages are assumed to be flexible and full employment is maintained.

Tables 4.4-4.6 report the economic impact of policy scenarios upon sectoral output, value added, and trade flows in Turkey. Tables 4.7-4.9 show the consequences on welfare and the distribution of income among Turkish urban and rural households. Finally, Table 4.10 shows the impact on Turkish employment.

Table 4.4 The impact on output and exports (Base year = 100)

	Fixed wages			Flexible wages		
Sectors	*Output*	*Exports EU*	*Exports RoW*	*Output*	*Exports EU*	*Exports RoW*
Agriculture	97.8	84.6	84.6	102.6	110.1	110.1
Mining	99.7	126.6	126.6	99.1	128.3	128.3
Food processed products	103.6	110.4	110.4	103.6	109.9	109.9
Beverages and tobacco	107.0	154.1	154.1	105.3	150.7	150.7
Textiles	115.0	148.2	116.1	98.8	102.6	80.4
Wearing apparel	94.3	108.7	54.0	121.5	162.7	80.9
Leather and fur products	138.1	222.3	222.3	175.6	317.2	317.2
Footwear	107.8	186.1	186.1	106.2	182.2	182.1
Wood and wood products	101.0	137.1	137.1	99.2	130.5	130.5
Chemical products	103.3	136.4	136.4	105.8	146.1	146.1
Petroleum and coal products	89.3	44.4	44.4	88.3	41.7	41.7
Non-metallic mineral products	103.9	146.1	146.1	101.8	135.2	135.2
Metal products	108.8	129.0	129.0	107.7	126.4	126.4
Machinery	101.3	122.5	122.5	100.6	121.4	121.4
Transport equipment	101.6	149.2	149.2	100.8	148.3	148.3
electricity gas	99.2	55.9	55.9	96.6	48.9	48.9
Construction	100.0	-	-	100.0	-	-
Trade, restaurants and hotels	100.2	98.1	98.1	97.3	89.2	89.2
Transport and communication	101.2	104.2	104.2	100.3	103.3	103.3
Other services	99.1	96.2	96.2	97.4	90.5	90.5
Leyspere Quantity Index	101.7	116.6	108.4	100.7	114.2	109.1

It is evident from Table 4.4 that the partial trade liberalisation policy favours a positive re-allocation of resources in Turkey: aggregate output, measured by the Leysperes quantity index, increases by 0.7%-1.7%. The major growing sectors are food processed products, beverages and tobacco, textiles (in the scenario with fixed wages), apparel (in the scenario with flexible wages), leather and fur products, footwear, chemical and non-metallic mineral products. These are the sectors where Turkey faces a comparative advantage and is in a position to compete with foreign countries, in particular with the European member states.[62] Despite the elimination of the VER in textiles towards the EU market, this sector might contract (i.e. scenario with flexible wages), if it is easy to switch sales from markets which are not constrained from VERs; and this has been postulated in this model by assuming a large elasticity of transformation among goods exported towards the EU and the RoW. In contrast, apparel rises in the flexible wages case, and contracts in the fixed wage case. The explanation used for textiles is also valid for apparel. However, apparel exports towards the previously restricted EU market expand to the detriment of exports to non EU countries for two further reasons: firstly, the European common external tariff rate in apparel is larger than the tariff rate levied on Turkish apparel imports from the non member states; and secondly, the domestic demand in apparel is now satisfied by a large increase of apparel imports from the EU, which were previously protected by a huge effective tariff. The commodities which are favoured by the trade policy are industrial products to the detriment of services. Agriculture might contract as it is still heavily protected.[63] In fact, the value added in industry increases by 4.1%-5.4%; whilst the value added in agriculture increases by 2.5% in the scenario with flexible wages, but decreases by 5.4% in the scenario with fixed wages (see Table 4.5). In aggregate,

[62] In support of this finding, it is important to consider a study by Celasun (1994), which measures the revealed comparative advantage (RCA) for 26 Turkish industries for the period 1987-89. This study shows that the sectors having a positive RCA value are textiles-clothing-shoes, furniture, ceramic-glass, food-beverage-tobacco, rubber-plastic, petrol refineries, and iron-steel.

[63] In the future, the liberalisation of the European CAP and the enlargement of the CU agreement to agricultural commodities might favour the expansion of Turkish agriculture.

GDP rises by 0.5%-0.9% in real terms. Hence, as a first finding, despite the aggregate impact on GDP being modest, the value added breakdown clearly shows that resources are reallocated favouring a remarkable expansion of the Turkish industrial sectors.

Table 4.5 The impact on the value added (Base year = 100)

	Fixed wages	Flexible wages
GDP in real terms	100.9	100.5
- Agriculture	94.6	102.5
- Industry	105.4	104.1
- Services	99.1	96.8

Table 4.6 reports the impact on trade flows. The partial trade liberalisation policy in favour of the EU increases the trade budget deficit with the EU by 5.1%-38%, and raises the aggregate trade volume with respect to the GDP by almost 10%. The impact of the CU on the import volume from the EU and the RoW is an indicator of the Vinerian trade creation and trade diversion effects. The volume of imports from both regions rises, and this implies that the CU agreement is not trade diverting. The latter outcome is due to the fact that Turkish tariffs levied on goods imported from non-member states are bigger than the European common external tariffs in most commodities (see Table 4.3).

Table 4.6 The impact on the trade flows (Base year = 100)

	Fixed wages	Flexible wages
Trade balance deficit	100.0	100.0
Trade balance deficit with the EU	105.1	138.0
Trade balance deficit with the RoW	99.5	95.9
Trade volume/GDP	110.2	109.7
Volume of exports	113.0	111.9
Volume of exports to the EU	116.6	114.2
Volume of exports to the RoW	108.4	109.1
Volume of imports	109.8	109.0
Volume of imports from the EU	116.0	115.5
Volume of imports from the RoW	104.8	103.8
Volume of exports in agriculture	84.6	110.1
Volume of exports in industry	125.8	125.1
Volume of exports in services	101.1	96.8
Volume of imports in agriculture	108.7	97.3
Volume of imports in industry	110.5	110.0
Volume of imports in services	100.1	100.7

Also the volume of exports is positively affected by the trade policy rising by 11.9%-13%. In particular, industrial exports increase by almost 25%, especially toward the EU, thanks to the elimination of VERs in textiles and wearing apparel. So, in summary, Tables 4.4-4.6 indicate that the regional agreement with the EU leads to an enormous re-allocation of resources in favour of manufacturing industries, expands trade volume and is not trade diverting.

Table 4.7 The impact on welfare

Region	Income class	Fixed wages		Flexible wages	
		Billions of 1990 TL	*Base year 100*	*Billions of 1990 TL*	*Base year 100*
Urban groups	1st group	16.3	101.3	2.8	100.2
	2nd group	215.5	102.9	103.0	101.4
	3rd group	180.5	101.4	- 0.2	100.0
	4th group	185.8	101.4	- 33.0	99.8
	5th group	166.3	101.3	- 66.6	99.5
	6th group	145.0	101.2	- 79.0	99.3
	7th group	114.2	100.9	- 142.5	98.8
	8th group	61.7	100.6	- 163-3	98.4
	9th group	106.0	101.1	- 107.8	98.8
	10th group	84.5	101.1	- 91.9	98.8
	11th group	111.8	100.7	- 278.8	98.1
	12th group	127.7	101.0	- 176.1	98.6
	13th group	13.2	100.1	- 242.6	97.5
	14th group	38.1	100.5	- 187.9	97.6
	15th group	33.1	100.6	- 132.9	97.7
	16th group	189.2	101.1	- 317.3	98.2
	17th group	161.7	101.9	- 95.7	98.9
	18th group	635.7	103.6	24.1	100.1
	19th group	31.4	100.5	- 155.7	97.4
	20th group	141.7	104.4	6.2	100.2
	Urban Areas	*2759.3*	*101.4*	*- 2135.2*	*99.1*
Rural groups	1st group	3.2	100.2	31.6	102.1
	2nd group	- 1.8	100.0	127.7	102.0
	3rd group	58.1	100.5	222.6	102.1
	4th group	29.7	100.2	311.2	102.4
	5th group	- 32.1	99.8	285.2	102.2
	6th group	- 22.7	99.8	302.2	102.7
	7th group	- 4.0	100.0	301.0	103.1
	8th group	- 38.1	99.5	232.7	102.8
	9th group	- 58.8	99.2	214.6	102.8
	10th group	- 38.7	99.2	162.0	103.4
	11th group	- 113.0	99.0	346.1	103.1
	12th group	- 43.8	99.4	206.9	102.9
	13th group	31.3	100.7	102.0	102.4
	14th group	76.0	101.5	98.5	101.9
	15th group	25.5	101.0	60.5	102.3
	16th group	38.6	100.6	98.6	101.6
	17th group	16.0	100.3	168.1	103.5
	18th group	50.8	101.1	97.3	102.0
	19th group	14.8	101.9	- 7.3	99.1
	Rural Areas	*- 9.1*	*100.0*	*3361.4*	*102.5*
	Turkey	**2750.3**	**100.8**	**1226.3**	**100.4**

Table 4.7 reports the Hicksian equivalent variation for urban and rural household income groups and the aggregate measures of welfare. The positive sign indicates an improvement for the household in question. The Hicksian equivalent variation indices are measured as a percentage of household income. It is clear that as a consequence of the CU agreement, aggregate welfare for the nation as a whole rises, supporting the view that the preferential trading agreement with the EU is not trade diverting. In aggregate, the static welfare gains in Turkey are modest, as are typically found in most of AGE models with perfect competition and constant returns to scale, dealing with trade liberalisation issues. As a percentage of household income, they range between 0.4% in the case of flexible wages and 0.8% in the case of fixed wages. Namely, they range between 1226 and 2750 billions of 1990 Turkish lira (470-1054 million US dollars).[64]

The results on welfare become more interesting when the welfare impact is decomposed among urban and rural household income groups. In the scenario with flexible wages, the urban household groups suffer an aggregate welfare loss of 2135 billions of 1990 Turkish lira, whereas rural households gain 3361 billions of 1990 Turkish lira. The opposite outcome is obtained in the scenario with fixed wages. However, in this case, rural household groups suffer a negligible welfare loss in aggregate. In summary, although the preferential trading agreement with the EU is not trade diverting, the welfare effects vary across the household groups, and according to the assumptions postulated for the labour market; the CU is potentially Pareto superior; and the welfare gains would be larger, and would benefit a greater number of household groups, if policy-makers encourage institutions to bargain a wage rate such that the real wages remain constant.

The impact on the size distribution of income, and the impact on the functional distribution of income, are shown in Tables 4.8 and 4.9. The first important finding is

[64] The average conversion factor for 1990 is an estimate of the IMF: 2608.6 Turkish Lira for 1 US dollar (IMF, 1995).

that the impact on overall inequality decreases in the full employment case in line with the Stolper-Samuelson theorem, but increases in the scenario with fixed wages. The second striking result is that that main source of inequality worsening (improving) is a large negative (positive) impact on the inter-group inequality among urban and rural household groups. It rises (decreases) by 6.5%-7.5% (10.3%-17.7%). These two different outcomes depend upon the performance of agricultural activities. In the scenario with fixed (flexible) wages, agriculture contracts (expands), thus reducing (increasing) agricultural capital and labour incomes (see Table 4.9), which are the main components of the private income in rural areas (see Table 4.2).

Table 4.8 The impact on the size distribution of income
(Base year = 100)

Generalised Entropy Index	Inequality	Fixed wages	Flexible wages
	Overall inequality	100.5	98.0
- 1	Within urban areas	99.9	98.2
	Within rural areas	99.7	100.7
	Between rural-urban areas	107.5	82.3
	Overall inequality	100.7	98.2
0	Within urban areas	100.3	98.8
	Within rural areas	100.1	100.4
	Between rural-urban areas	107.4	82.5
	Overall inequality	101.5	98.2
+ 1	Within urban areas	101.0	99.5
	Within rural areas	100.7	99.9
	Between rural urban areas	106.5	89.7
	Overall inequality	103.6	97.8
+ 2	Within urban areas	102.7	100.4
	Within rural areas	101.7	98.8
	Between rural-urban areas	107.3	82.7

It is important to emphasise the robustness of these results, which are independent of the choice upon the parameter θ used to estimate the generalised entropy indices. It must be stressed that measures with positive value of θ are particular sensitive to income differences at the top end of the income distribution, whilst measures with negative value of θ are more sensitive to very low income. This explains why the inequality within groups varies with θ.

Table 4.9 The impact on the functional distribution of income
(Base year = 100)

	Fixed wages	Flexible wages
A -Capital income	**100.7**	**99.1**
- Agricultural income	97.2	103.7
- Non-agricultural income	101.5	98.1
B - Labour income	**100.4**	**99.9**
B.1 - Skilled labour income	**100.6**	**98.2**
- Professional workers	100.3	97.9
- Managerial workers	101.5	99.0
- Clerical workers	100.6	98.2
B.2 - Basic skilled labour income	**101.8**	**99.5**
- Sales workers	101.2	98.5
- Service workers	100.2	99.0
- Non agricultural workers	102.4	99.7
- Other workers	102.1	99.4
B.3 - No-skilled labour income	**97.4**	**103.2**
- Agricultural workers	97.4	103.2
Basic skilled / Skilled labour income	*101.2*	*101.3*
No-skilled / Skilled labour income	*96.8*	*105.2*
Basic skilled labour / Capital income	*101.1*	*100.4*
No-skilled labour / Capital income	*96.7*	*104.2*

When the analysis on the income distribution effect is carried out by examining the impact on the functional distribution of income, the results clearly indicate that in the scenario with flexible wages, the four ratios between (i) basic skilled and skilled labour incomes, (ii) no-skilled and skilled labour incomes, (iii) basic skilled labour and capital incomes, (iv) no-skilled labour and capital incomes, increase in line with the Stolper-Samuelson theorem, thus favouring a more equal distribution of income (see Table 4.9). In contrast, in the scenario with fixed wages, agricultural workers are worse off, thus leading to a rise in inequality. From the policy making point of view, it is very important to know what the effects of trade policies on income distribution are. The computed data for Turkey indicate that, despite the validity of the Stolper-Samuelson theorem, overall income inequality might increase with trade. As a result, the analysis of the trade impact on income distribution based on simplified two-sector, two-factors models, which define household groups according to their functional role, and under the assumption of full employment, might be misleading.

Table 4.10 reports the results concerning the impact of the CU agreement on Turkish employment, when real wages are constant. The only exception is the treatment of the agricultural category. Since agriculture in Turkey is a family-based activity, it is assumed that any effect of the trade policy is perceived on wages. The rigid real wages lead to an expansion of the aggregate labour demand by 1%, which implies that almost 148000 new jobs are created, as a consequence of the CU agreement. In the rigid real wage case, efficiency gains are not absorbed by wage increases but rather by employment creation.[65] It is interesting to note that, as a consequence of the trade policy, 75% of new jobs concern basic skilled non-agricultural workers, who are demanded by the growing manufacturing industries.

[65] A similar result has been obtained by Mercenier (1995) in examining the impact of the European single market in 1992 on employment among the EU member states.

Table 4.10 The impact on employment

	Relative change (Base year = 100)	Number of new workers	Share
Labour Input	101.0	147505	1.000
- Professional workers	100.3	2827	0.019
- Managerial workers	101.5	4901	0.033
- Clerical workers	100.6	5255	0.036
- Sales workers	101.2	18606	0.126
- Service workers	100.2	3050	0.021
- Agricultural workers	100.0	0	0.000
- Non agricultural workers	102.4	110251	0.747
- Other workers	102.1	2615	0.018

This finding is in line with the Krugman (1995) model if applied to a developing country, and with Wood's results, according to which the cumulative demand for labour in manufacturing from 1985 to 1990 is increased by about 23 million in developing countries (Wood, 1994).

It is important to stress that, given the ex-ante large tariff rates (see Table 4.3), these results are obtained if the VAT rates used to perform a revenue-neutral tariff reform are uniformly increased by 55.8% in the case of fixed real wages, and by 57.6% in the case of flexible real wages. In other words, the standard VAT rate should rise from 12% (the prevailing rate in Turkey in 1990) to 18.7%-18.9%, which is reasonably close to the standard VAT rate applied in most of the European member states.

To evaluate the robustness of the above results, sensitivity analysis on the elasticity values has been carried out. All elasticities employed in this study have been divided by a factor of two in order to simulate the effects of the CU on a more rigid economy, and multiplied by a factor of two in order to consider the case of a more flexible economy. The results reported in Appendix 4.D clearly show that the direction of the variable changes is robust, however their precise size depends upon the value of the elasticities. Some variation in the individual sectoral impact also exists. In the case of flexible wages, Turkey's welfare gains range between 75 (less flexible economy) and 4124 (more flexible economy) billions of 1990 Turkish lira, and the change in income inequality between rural and urban groups measured by the Theil index ($\theta = 1$) ranges between - 8.5% (less flexible economy) and 0.6% (more flexible economy). In the case of fixed real wages, Turkey's welfare gains range between 1406 (less flexible economy) and 8433 (more flexible economy) billions of 1990 Turkish lira, and the change in inequality between groups ranges between 7.9% (less flexible economy) and 15.3% (more flexible economy). The impact on employment ranges between 86000 (less flexible economy) and 432000 (more flexible economy) new jobs. Similar gaps exist for all other statistics estimated in the previous tables.

In conclusion, the numerical results suggest that the CU agreement is not trade diverting; it raises welfare, output, GDP and trade volume in Turkey. Despite the higher demand of basic skilled labour, in line with the Stolper-Samuelson model, this trade agreement causes an increase in overall income inequality in the scenario with fixed wages, mainly due to the rising gap between rural and urban incomes as a consequence of the contraction of the agricultural sector still heavily protected by trade barriers. In addition, it seems that this trade policy, accompanied by a fixed real wage policy allowing the creation of new jobs, raises Turkey's welfare, GDP, and output greater than in the case of flexible wages.

[4.5] Conclusions

The aim of this study is to analyse the impact of the CU agreement between Turkey and the EU on the welfare and the size distribution of income among urban and rural Turkish households; and on Turkey's employment, sectoral output, GDP and trade flows. In order to examine the impact of the CU upon employment in Turkey, two main cases have been considered for the labour market: the standard case of flexible real wages with full employment, and the case of fixed real wages.

The numerical simulations show that the CU agreement with the EU is not trade diverting, raises the trade volume-GDP ratio and that resources are reallocated towards the industrial sector, which expands by 4.1%-5.4%. With regard to welfare, although aggregate gains are equal to 1226-2750 billions of 1990 Turkish lira, the impact on urban and rural households' welfare highly depends upon the assumption postulated for the labour market. In the scenario with fixed wages, urban households are better off and rural households are worse off; in the scenario with flexible wages, urban household are worse off and rural households are better off. However, in the fixed wage case, a large welfare gain in urban areas is accompanied by a negligible welfare loss among rural households.

The second important result is related to the issue of international trade and income inequality. Despite the owners of basic skilled labour being better off than both the owners of skilled labour and the owners of capital, in line with the Stolper-Samuelson theorem (as Turkey is a middle income developing country and, therefore, abundant of the basic skilled labour factor), overall income inequality measured by the size distribution of income might rise. In the scenario with fixed wages, the main source of income inequality is the inter-income inequality between urban and rural areas, which rises by almost 7%, due to an output fall in agriculture, a sector still protected and the principal income source of rural households. This result suggests that theoretical and applied analysis of trade impact on the distribution of income, carried out only with models which define household groups according to their functional role and under the full employment assumption, might be misleading.

As far as the issue of international trade and employment is concerned, if real wages are rigid, the preferential trading agreement with the EU leads to a rise in employment, as one would expect from the Krugman model applied to a developing country. The efficiency gains with trade, not being absorbed by a wage increase, generate the creation of 148000 new jobs (432000 in the case of a more flexible economy), mainly basic skilled non-agricultural workers.

Finally, the welfare gains and the incremental GDP would be larger, if policy-makers encourage institutions to bargain a wage rate, such that real wages remain constant. The sensitivity analysis on elasticities values confirm the overall conclusion that the preferential trading agreement with the EU, accompanied by a fixed real wage policy, creates new jobs in Turkey, raises Turkey's welfare, output and GDP far greater than in the case of flexible wages, but also increases income inequality.

CHAPTER 5

Summary and Concluding Remarks

Three trade policy issues have been examined in this thesis: export quotas in the form of VERs, endogenous export taxation and customs union. The CU between Turkey and the EU has been studied, applying a multi-labour, multi-household, multi-sector general equilibrium model with constant returns to scale and perfect competition to the Turkish economy; whereas export taxes and VERs have been analysed firstly, with an analytical model facing increasing returns to scale and imperfect competition, and secondly, with an AGE model applied to Turkey in order to examine the quantitative relevance of the analytical findings.

With regard to VERs, this study analytically shows that a VER serves as an institution to protect incumbent firms of an exporting country. A VER is an entry barrier in the export market. It favours the concentration of industry, and allows established firms to better exploit economies of scale by producing output at lower average cost. Since the break-even price for potential firms is the average cost, entry in the domestic market is also inhibited. A VER also allows the raising of the price cost margin in the export market. However, it is important to recognise that the smaller the country, the greater is the possibility of a larger monopoly power in the domestic market. From the social point of view, two conventional effects from the elimination of a VER are usually considered: the *rent loss* effect and the *export supply price* effect.

In this study, three further effects on welfare are examined: the *global efficiency* effect, the *increased intermediate inputs cost* effect and the *variety* effect. The global effect on welfare on an exporting country is analytically indeterminate. A general equilibrium model applied to Turkey supports the conjecture that with the elimination of a VER, a possible loss in social welfare, the higher average cost and the fall of monopoly power of incumbent firms, are the key elements in understanding the rationale behind VERs.

As far as the export tax issue is concerned, Rodrik (1989), Helpman and Krugman (1989) employ a PE framework to show that under Cournot conjectures an optimal export tax is positive and negatively related to both the foreign demand elasticity (in absolute value) and industry concentration. I show that the PE formula is upwardly biased and may not be optimal in a GE setting. In addition, I show that the RHK export tax has an ambiguous impact on firm size. I use an AGE model for the Turkish economy to numerically explore the empirical relevance of these findings. In the model, the export tax estimated with the PE formula is larger than the computed export tax by a small factor ranging between 1.034 and 1.112. Most importantly, the numerical results support the view that the RHK export tax leads to a social welfare loss, which is larger in a context of sunk costs.

The numerical results regarding the CU agreement between Turkey and the EU show that, as a result of this regional agreement, Turkish trade with the RoW would not be diverted, and that the aggregate welfare gains to Turkey are around 1226-2750 billions of 1990 Turkish lira. Most importantly, urban (rural) Turkish groups benefit from the trade policy in the scenario with fixed (flexible) wages, and this substantially raises (decrease) income inequality between urban and rural household members. Despite the owners of basic skilled labour (abundant factor) being better off than the owners of skilled labour and capital (scarce factors), overall income inequality rises in the scenario with fixed wages, as the returns to capital and labour in agriculture fall. This finding suggests that an analysis only based on the functional distribution of income and under the typical full employment assumption might be misleading. In the case of fixed real wages, the model predicts the creation of 148000 new jobs, as the efficiency gains due to the trade policy are not absorbed by a wage rise but rather by employment creation. Sensitivity analysis seems to support this overall conclusion.

The results from all three studies inevitably have some limitations and provide insights for future research. In fact, the numerical model employed to study the CU agreement between Turkey and the EU can be extended by introducing imperfect competition and increasing returns to scale. These modelling features might substantially affect the numerical results described in Chapter 4, especially with regard to the welfare impact of VERs described in Chapter 2. However, an AGE model, with imperfect competition and increasing returns to scale, which has the target of quantifying regional agreements, needs reliable data to calibrate variables and parameters of several imperfect competitive industries, and these are not yet available for the Turkish economy. This research might be extended by examining export taxes and quotas issues in a multi-regional framework, in order to allow the number of foreign firms to be treated endogenously and other countries to retaliate if they are worse off as a consequence of the trade policy adopted by the exporting country. In addition, one key assumption of Chapter 2 is represented by the fact that governments do not intervene in allocating export quota. An interesting extension might be the study of the economic implications of the elimination of VERs, when quota rents are allocated by governments, and firms are obliged to pay a premium in order to receive the documents for deliveries to the restrained markets.

Appendices

Appendix 2.A: Price elasticities in Bertrand and Cournot

[2.A.1] Derivation of firms' perceived elasticity of domestic demand

An industry i faces an aggregate demand function which is represented by (2.7). If domestic goods are produced by symmetric firms, they can be treated as imperfect substitutes. Thus, the aggregate domestic demand at the third stage of the demand tree can be written as

$$\text{(2.A1)} \qquad D_i = \left[\sum_{s=1}^{n} \tilde{\beta}_{is} \tilde{d}_{is}^{(\varsigma_i - 1)/\varsigma_i} \right]^{\varsigma_i/(\varsigma_i - 1)}, \qquad \varsigma_i > 1, \ \sum_{s=1}^{n} \tilde{\beta}_{is} = 1,$$

where ς_i, is the elasticity of substitution among n domestic varieties, $\tilde{d}_{is}$; and $\tilde{\beta}_{is}$ are demand parameters describing the consumer preferences for a brand s produced by sector i.

The solution of the dual problem yields

$$\text{(2.A2)} \qquad \tilde{d}_{is} = \tilde{\beta}_{is}^{\varsigma_i} D_i pd_i^{\varsigma_i} \tilde{pd}_{is}^{-\varsigma_i},$$

where $pd_i = \left[\sum_{s=1}^{n} \tilde{\beta}_{is}^{\varsigma_i} \tilde{pd}_{is}^{(1-\varsigma_i)} \right]^{1/(1-\varsigma_i)}$.

[2.A.1.1] Derivation of (2.15)

(2.A2) can be log-linearised as

(2.A3) $$\ln \tilde{d}_{is} = \varsigma_i \ln \tilde{\beta}_{is} + \ln D_i + \varsigma_i \ln pd_i - \varsigma_i \ln \tilde{pd}_{is}.$$

By definition the derivative of (2.A3) with respect to $\ln \tilde{pd}_{is}$ yields the firms' perceived price elasticity of domestic demand (τ_i):

(2.A4) $$\tau_i = \frac{d\ln D_i}{d\ln \tilde{pd}_{is}} + \varsigma_i \frac{d\ln pd_i}{d\ln \tilde{pd}_{is}} - \varsigma_i.$$

Since under Bertrand conjectures $\frac{\partial pd_i}{\partial \tilde{pd}_{is}} = \tilde{\beta}_{is}^{\varsigma_i}\, pd_i^{\varsigma_i}\, \tilde{pd}_{is}^{-\varsigma_i}$, and since from (2.A2) $\tilde{\beta}_{is}^{\varsigma_i}\, pd_i^{\varsigma_i}\, \tilde{pd}_{is}^{-\varsigma_i} = \tilde{d}_{is}/D_i$, then by using the chain rule

(2.A5) $$\frac{d\ln D_i}{d\ln \tilde{pd}_{is}} = \frac{\tilde{pd}_{is}}{D_i}\frac{\partial D_i}{\partial pd_i}\frac{\partial pd_i}{\partial \tilde{pd}_{is}} = \frac{\tilde{pd}_{is}\,\tilde{d}_{is}}{pd_i D_i}\frac{pd_i}{D_i}\frac{\partial D_i}{\partial pd_i},$$

and

(2.A6) $$\frac{d\ln pd_i}{d\ln \tilde{pd}_{is}} = \frac{\tilde{pd}_{is}\,\tilde{d}_{is}}{pd_i D_i}$$

Given the symmetry assumption, (2.A6) and (2.A5) into (2.A4) yield

(2.A7) $$\tau_i = \left[\varsigma_i + \frac{pd_i}{D_i}\frac{\partial D_i}{\partial pd_i}\right]\frac{1}{n_i} - \varsigma_i.$$

By applying similar steps at the second stage of the demand tree, then

(2.A8) $$\frac{pd_i}{D_i}\frac{\partial D_i}{\partial pd_i} = [\varepsilon_i - \chi_i]\Psi_i - \varepsilon_i.$$

where Ψ_i denotes the consumption share for domestic goods and χ_i the absolute value of the price elasticity of aggregate demand.

(2.A8) into (2.A7) yields (2.15).

[2.A.1.2] Derivation of (2.17)

The inverse demand function of (2.A2) is

(2.A9) $$\ln \tilde{pd}_{is} = \ln \tilde{\beta}_{is} + \frac{1}{\varsigma_i} \ln D_i - \frac{1}{\varsigma_i} \ln \tilde{d}_{is} + \ln pd_i .$$

By definition the derivative of (2.A9) with respect to $\ln \tilde{d}_{is}$ yields the inverse of τ_i:

(2.A10) $$\frac{1}{\tau_i} = \frac{1}{\varsigma_i} \frac{d \ln D_i}{d \ln \tilde{d}_{is}} - \frac{1}{\varsigma_i} + \frac{d \ln pd_i}{d \ln \tilde{d}_{is}} .$$

Since under Cournot conjectures $\frac{\partial D_i}{\partial \tilde{d}_{is}} = \tilde{\beta}_{is} D_i^{1/\varsigma_i} \tilde{d}_{is}^{-1/\varsigma_i}$, and since from (2.A2) $\tilde{\beta}_{is} D_i^{1/\varsigma_i} \tilde{d}_{is}^{-1/\varsigma_i} = \tilde{pd}_{is} / pd_i$, then by using the chain rule

(2.A11) $$\frac{d \ln D_i}{d \ln \tilde{d}_{is}} = \frac{\tilde{pd}_{is} \tilde{d}_{is}}{pd_i D_i} .$$

Since, by using the chain rule, $\frac{\partial pd_i}{\partial \tilde{d}_{is}} = \frac{\partial pd_i}{\partial D_i} \frac{\partial D_i}{\partial \tilde{d}_{is}}$, then

(2.A12) $$\frac{d \ln pd_i}{d \ln \tilde{d}_{is}} = \frac{\tilde{pd}_{is} \tilde{d}_{is}}{pd_i D_i} \frac{D_i}{pd_i} \frac{\partial pd_i}{\partial D_i} .$$

Given the symmetry assumption, (2.A12) and (2.A11) into (2.A10) yield

(2.A13) $$\frac{1}{\tau_i} = -\frac{1}{\varsigma_i} + \frac{1}{n_i} \left(\frac{1}{\varsigma_i} + \frac{D_i}{pd_i} \frac{\partial pd_i}{\partial D_i} \right) .$$

By applying similar steps at the second stage of the demand tree, then

(2.A14) $$\frac{D_i}{pd_i} \frac{\partial pd_i}{\partial D_i} = -\frac{1}{\varepsilon_i} + \Psi_i \left(\frac{1}{\varepsilon_i} - \frac{1}{\chi_i} \right) .$$

(2.A14) into (2.A13) yields (2.17).

[2.A.2] Derivation of firms' perceived elasticity of foreign demand

Assume that a representative foreign consumer gains utility by the following two stages utility function $U^* = g^*(E_i)$, where

$$E_i = \left[\sum_{s=1}^{n} \tilde{\gamma}_{is}\, \tilde{e}_{is}^{(\xi_i-1)/\xi_i}\right]^{\xi_i/(\xi_i-1)}, \qquad \xi_i > 1,\ \sum_{s=1}^{n} \tilde{\gamma}_{is} = 1. \tag{2.A15}$$

ξ_i is the elasticity of substitution among n exported brands, $\tilde{e}_{is}$; and $\tilde{\gamma}_{is}$ are demand parameters describing the preferences of the foreign consumer for a brand s exported by sector i.

The first order conditions yield the lower level demand:

$$e_{is} = \tilde{\gamma}_{is}^{\xi_i} E_i pwe_i^{\xi_i}\, \tilde{pwe}_{is}^{-\xi_i}, \tag{2.A16}$$

where $pwe_i = \left[\sum_{s=1}^{n} \tilde{\gamma}_{is}^{\xi_i}\, \tilde{pwe}_{is}^{(1-\xi_i)}\right]^{1/(1-\xi_i)}$.

[2.A.2.1] Derivation of (2.16)

By using (2.10), (2.A16) can be log-linearised as

$$\ln \tilde{e}_{is} = \xi_i \ln \tilde{\gamma}_{is} + \ln A_i + (\xi_i - \eta_i)\ln pwe_i - \xi_i \ln \tilde{pwe}_{is}, \qquad \xi_i > \eta_i. \tag{2.A17}$$

By definition the derivative of (2.A17) with respect to $\ln \tilde{pwe}_{is}$ yields the firms' perceived price elasticity of foreign demand (δ_i):

$$\delta_i = (\xi_i - \eta_i)\frac{d\ln pwe_i}{d\ln \tilde{pwe}_{is}} - \xi_i. \tag{2.A18}$$

Since under Bertrand conjectures $\partial pwe_i / \partial \tilde{pwe}_{is} = \left(\tilde{\gamma}_{is}\, pwe_i / \tilde{pwe}_{is}\right)^{\xi_i}$, then

(2.A19) $$\frac{d \ln pwe_i}{d \ln \tilde{pwe}_{is}} = \tilde{\gamma}_{is}^{\;\xi_i} \left(\frac{\tilde{pwe}_{is}}{pwe_i} \right)^{1-\xi_i}.$$

In addition, by using (2.10) and (2.A16), since $\tilde{pwe}_{is}\, \tilde{e}_{is} = \tilde{\gamma}_{is}^{\;\xi_i} A_i pwe_i^{\xi_i - \eta_i}\, \tilde{pwe}_{is}^{\;1-\xi_i}$, then

(2.A20) $$\left(\frac{\tilde{pwe}_{is}}{pwe_i} \right)^{1-\xi_i} = \frac{\tilde{pwe}_{is}\, \tilde{e}_{is}}{\sum_s \tilde{pwe}_{is}\, \tilde{e}_{is}}.$$

Given the symmetry assumption (2.A20) and (2.A19) into (2.A18) yields (2.16).

[2.A.2.2] Derivation of (2.18)

By using (2.10), (2.A16) can be log-linearised as

(2.A21) $$\ln \tilde{pwe}_{is} = \ln \tilde{\gamma}_{is} + \left(\frac{1}{\xi_i} - \frac{1}{\eta_i} \right) \ln E_i - \frac{1}{\xi_i} \ln \tilde{e}_{is}.$$

By definition, the derivative of (2.A21) with respect to $\ln \tilde{e}_{is}$ yields the inverse of δ_i:

(2.A22) $$\frac{1}{\delta_i} = \left(\frac{1}{\xi_i} - \frac{1}{\eta_i} \right) \frac{d \ln E_i}{d \ln \tilde{e}_{is}} - \frac{1}{\xi_i}.$$

Since under Cournot conjectures $\partial E_i / \partial \tilde{e}_{is} = \tilde{\gamma}_{is} \left(E_i / \tilde{e}_{is} \right)^{1/\xi_i}$, then

(2.A23) $$\frac{d \ln E_i}{d \ln \tilde{e}_{is}} = \tilde{\gamma}_{is} \left(\frac{\tilde{e}_{is}}{E_i} \right)^{1-1/\xi_i}.$$

In addition, by using (2.10) and (2.A16), since $\widetilde{pwe}_{is}\,\tilde{e}_{is} = \tilde{\gamma}_{is}\,A_i^{1/\eta_i}\,E_i^{1/\xi_i - 1/\eta_i}\,\tilde{e}_{is}^{\,1-1/\xi_i}$, then

(2.A24) $$\tilde{\gamma}_{is}\left(\frac{\tilde{e}_{is}}{E_i}\right)^{1-1/\xi_i} = \frac{\widetilde{pwe}_{is}\,\tilde{e}_{is}}{\sum_s \widetilde{pwe}_{is}\,\tilde{e}_{is}}.$$

Given the symmetry assumption, (2.A24) and (2.A23) into (2.A22) yields (2.18).

Appendix 2.B: Numerical model: the case of VERs

This appendix reports the algebraic formulation of the numerical model employed to study the economic impact of the elimination of the VERs in Turkish textiles and apparel. The appendix has been split into six sections: (i) equations related to prices and costs; (ii) equations related to production and factor demand; (iii) equations related to domestic and foreign trade; (iv) equations related to income; (v) equations related to final demand and intermediate demand; (vi) equations related to the market clearing conditions.

[2.B.1] Price and cost equations

(2.B1) $$p_j = \Delta_j^{-1}\left[\varphi_j^{\varepsilon_j} pm_j^{1-\varepsilon_j} + (1-\varphi_j)^{\varepsilon_j} pd_j^{1-\varepsilon_j}\right]^{1/(1-\varepsilon_j)}$$

(2.B2) $$py_i y_i = pd_i\, D_i / n_i + pe_i\, E_i / n_i$$

(2.B3) $$py_{crs} = \Omega_{crs}^{-1}\left[\beta_{crs}^{\rho_{crs}} pd_{crs}^{1-\rho_{crs}} + (1-\beta_{crs})^{\rho_{crs}} pe_{crs}^{1-\rho_{crs}}\right]^{1/(1-\rho_{crs})}$$

(2.B4) $$pm_j M_j = \overline{pwm}_j^{EU} M_j^{EU} + \overline{pwm}_j^{RoW} M_j^{RoW}$$

(2.B5) $$pe_i E_i = pe_i^{EU} E_i^{EU} + \overline{pwe}_i^{RoW} E_i^{RoW}$$

(2.B6) $$pe_{crs} E_{crs} = \overline{pwe}_{crs}^{EU} E_{crs}^{EU} + \overline{pwe}_{crs}^{RoW} E_{crs}^{RoW}$$

(2.B7) $$pe_i^{EU}\left(1 - \frac{1}{|\delta_i|}\right) = c_i$$

(2.B8) $$pwe_i^{EU} = pe_i^{EU}(1 + qr_i)$$

(2.B9) $$pd_i\left(1-\frac{1}{|\tau_i|}\right)=c_i$$

(2.B10) $$pv_j=\Theta_j^{-1}\left[\gamma_j^{\sigma_j}w^{1-\sigma_j}+(1-\gamma_j)^{\sigma_j}r^{1-\sigma_j}\right]^{1/(1-\sigma_j)}$$

(2.B11) $$c_i=pv_i+\sum_j a_{ji}p_j$$

(2.B12) $$ac_i=\left[w(l_i+l_i^f)+r(k_i+k_i^f)+\sum_j p_j a_{ji}y_i\right]\Big/y_i$$

(2.B13) $$\tau_i=-\frac{1}{n_i}[(1-\Psi_i)\varepsilon_i+\Psi_i\chi_i]-\left(1-\frac{1}{n_i}\right)\varsigma_i$$ under Bertrand

(2.B13a) $$\frac{1}{\tau_i}=-\frac{1}{\varsigma_i}-\frac{1}{n_i}\left[\frac{(\varsigma_i-\varepsilon_i)}{\varsigma_i\varepsilon_i}+\Psi_i\left(\frac{\varepsilon_i-\chi_i}{\chi_i\varepsilon_i}\right)\right]$$ under Cournot

(2.B14) $$\delta_i=-\xi_i\left(1-\frac{1}{n_i}\right)-\frac{\eta_i}{n_i}$$ under Bertrand

(2.B14a) $$\frac{1}{\delta_i}=-\frac{1}{\xi_i}-\frac{1}{n_i}\frac{(\xi_i-\eta_i)}{\xi_i\eta_i}$$ under Cournot

(2.B15) $$\overline{\Lambda}=\frac{\sum_j pd_j\overline{D}_j}{\sum_j \overline{pd}_j\overline{D}_j}$$

[2.B.2] Production and factor demand equations

(2.B16) $$Y_{crs}=\Theta_{crs}\left[\gamma_{crs}AL_{crs}{}^{(\sigma_{crs}-1)/\sigma_{crs}}+(1-\gamma_{crs})AK_{crs}{}^{(\sigma_{crs}-1)/\sigma_{crs}}\right]^{\sigma_{crs}/(\sigma_{crs}-1)}$$

(2.B17) $$AL_{crs}=\Theta_{crs}^{(\sigma_{crs}-1)}\gamma_{crs}^{\sigma_{crs}}w^{-\sigma_{crs}}pv_{crs}^{\sigma_{crs}}Y_{crs}$$

(2.B18) $$AK_{crs}=\Theta_{crs}^{(\sigma_{crs}-1)}(1-\gamma_{crs})^{\sigma_{crs}}r^{-\sigma_{crs}}pv_{crs}^{\sigma_{crs}}Y_{crs}$$

(2.B19) $$l_i = \Theta_i^{(\sigma_i-1)}\gamma_i^{\sigma_i} w^{-\sigma_i} pv_i^{\sigma_i} y_i$$

(2.B20) $$k_i = \Theta_i^{(\sigma_i-1)}(1-\gamma_i)^{\sigma_i} r^{-\sigma_i} pv_i^{\sigma_i} y_i$$

[2.B.3] Trade equations

(2.B21) $$Q_j = \Delta_j\left[\varphi_j M_j^{(\varepsilon_j-1)} + (1-\varphi_j)D_j^{(\varepsilon_j-1)}\right]^{\varepsilon_j/(\varepsilon_j-1)}$$

(2.B22) $$\frac{M_j}{D_j} = \left(\frac{1-\varphi_j}{\varphi_j}\right)^{-\varepsilon_j}\left(\frac{pd_j}{\overline{pwm}_j}\right)^{\varepsilon_j}$$

(2.B23) $$M_j^{EU} = A_j^{\mu_j-1}\iota_j^{\mu_j}\left(\frac{\overline{pwm}_j^{EU}}{pm_j}\right)^{-\mu_j} M_j$$

(2.B24) $$M_j^{RoW} = A_j^{\mu_j-1}(1-\iota_j)^{\mu_j}\left(\frac{\overline{pwm}_j^{RoW}}{pm_j}\right)^{-\mu_j} M_j$$

(2.B25) $$Y_{crs} = \Omega_{crs}\left[\beta_{crs} D_{crs}^{(\rho_{crs}+1)/\rho_{crs}} + (1-\beta_{crs})E_{crs}^{(\rho_{crs}+1)/\rho_{crs}}\right]^{\rho_{crs}/(\rho_{crs}+1)}$$

(2.B26) $$y_i = \frac{\Omega_i}{n_i}\left[\beta_i D_i^{(\rho_i+1)/\rho_i} + (1-\beta_i)E_i^{(\rho_i+1)/\rho_i}\right]^{\rho_i/(\rho_i+1)}$$

(2.B27) $$\frac{D_{crs}}{E_{crs}} = \left(\frac{\beta_{crs}}{1-\beta_{crs}}\right)^{-\rho_{crs}}\left(\frac{pd_{crs}}{\overline{pwe}_{crs}}\right)^{\rho_{crs}}$$

(2.B28) $$E_j = \Gamma_j\left[\alpha_j E_j^{EU(\varpi_{crs}+1)/\varpi_{crs}} + (1-\alpha_j)E_j^{RoW(\varpi_{crs}+1)/\varpi_{crs}}\right]^{\varpi_{crs}/(\varpi_{crs}+1)}$$

(2.B29) $$\frac{E_{crs}^{EU}}{E_{crs}^{RoW}} = \left(\frac{\alpha_{crs}}{1-\alpha_{crs}}\right)^{-\varpi_{crs}}\left(\frac{\overline{pwe}_{crs}^{EU}}{\overline{pwe}_{crs}^{RoW}}\right)^{\varpi_{crs}}$$

(2.B30) $$E_i^{EU} = \overline{E}_i^{EU}\left(\frac{\overline{\chi}_i}{pwe_i}\right)^{\eta_i}$$

[2.B.4] Income equations

(2.B31) $$\pi_i = (py_i - ac_i)y_i$$

(2.B32) $$ver_i^{EU} = qr_i pe_i^{EU} E_i^{EU}$$

(2.B33) $$HR = w\overline{LAB} + r\overline{CAP} + \sum_i n_i\pi_i + \sum_i ver_i^{EU}$$

[2.B.5] Intermediate and final demand equations

(2.B34) $$X_j = \sum_{crs} a_{jcrs} Y_{crs} + \sum_i a_{ji} n_i y_i$$

(2.B35) $$C_j = \vartheta_j \frac{HR}{p_j}$$

[2.B.6] Market clearing conditions

(2.B36) $$Q_j = C_j + X_j$$

(2.B37) $$\sum_j \overline{pwe}_j^{RoW} E_j^{RoW} + \sum_j pwe_j^{EU} E_j^{EU} = \sum_j \overline{pwm}_j^{EU} M_j^{EU} + \sum_j \overline{pwm}_j^{RoW} M_j^{RoW}$$

(2.B38) $$\overline{LAB} = \sum_{crs} AL_{crs} + \sum_i n_i\left(l_i + l_i^f\right)$$

(2.B39) $$\overline{CAP} = \sum_{crs} AK_{crs} + \sum_i n_i\left(k_i + k_i^f\right)$$

(2.B40) $$py_i = ac_i$$

Variables (*):

ac_i	Average cost
AL_{crs}	Labour
AK_{crs}	Capital
c_i	Marginal cost
C_j	Private demand of goods
$\overline{CAP}$	Aggregate capital stock
D_j	Demand for domestic commodity
$\overline{D}_j$	Domestic commodities demanded in the base year
E_j	Exports
E_j^{EU}	Exports to the EU
$\overline{E}_i^{EU}$	Exports to the EU in the base year
E_j^{RoW}	Exports to the RoW
HR	Household revenues
k_i	Capital per firm
l_i	Labour per firm
$\overline{LAB}$	Aggregate labour
M_j	Imports
M_j^{EU}	Imports from the EU
M_j^{RoW}	Imports from the RoW
n_i	Number of firms
p_j	Price of the final and the intermediate good
$\overline{pd}_j$	Price of the domestic good in the base year

pd_j	Price of domestically produced commodity
pv_j	Value added price
py_j	Aggregate producer price
$\overline{pwe}_i^{EU}$	Price of exports to the EU
pwe_i^{EU}	Price of exports to the EU
$\overline{pwe}_j^{RoW}$	Price of exports to the RoW
$\overline{pwm}_j^{EU}$	Price of imports from the EU
$\overline{pwm}_j^{RoW}$	Price of imports from the RoW
Q_j	Composite commodity
r	Return to capital
X_j	Intermediate demand
y_i	Output per domestic firm
Y_{crs}	Output by the industry
w	Wage
χ_i	Price elasticity of aggregate demand
$\overline{\chi}_i$	World price of similar exported goods
π_i	Profit per firm
$\overline{\Lambda}$	Numeraire
Ψ_i	Share of consumption of domestic goods in total consumption

Parameters (*):

a_{ij}	Leontief input-output coefficients.
k_i^f	Fixed amount of capital per firm

l_i^f	Fixed amount of labour per firm
ν_i	Conjectural variation shift parameter
α_j	Share parameter in the second nest CET function
β_j	Share parameter in the CET aggregation function
δ_i	Firm perceived elasticity in the export market
ε_j	Elasticity of substitution between imported and domestic goods
φ_j	Share parameter in the Armington trade aggregation function
γ_j	Share parameter in the CES production function
ι_j	Share parameter in the second nest Armington function
η_i	Price elasticity of export demand
ϖ_j	Elasticity in the second nest CET function
ϑ_j	Household budget shares
ρ_j	Elasticity in the CET aggregation function
σ_j	Elasticity of substitution among primary factors of production
τ_i	Firm perceived elasticity in the domestic market
ξ_i	Elasticity of substitution among exported brands
ζ_i	Elasticity of substitution among domestic brands
A_j	Shift parameter in the second nest Armington function
Δ_j	Shift parameter in the Armington trade aggregation function
Γ_j	Shift parameter in the second nest CET function
Θ_j	Shift parameter in the CES production function
Ω_j	Shift parameter in the CET aggregation function

(*) Parameter and variables with a bar are set exogenously. *crs* and *i* denote sectors facing constant and increasing returns to scale, respectively ($j = crs \cup i$).

Appendix 2.C: A Social Accounting Matrix for Turkey

[2.C.1] Introduction[66]

A SAM is an economy-wide data system in the form of a matrix, which describes, on the one hand, data on production and income generation, and on the other hand, the flows between the accounts of a nation at a specific point in time. The construction of a SAM is based on the following two features, as well as other fundamental properties: (i) the payments for a transaction by one account represent the receipts for the same transaction by another account; (ii) total income is always equal to total expenditure. Hence, as an accounting system, a SAM is fully articulated and its estimates are internally consistent. For these reasons, a SAM provides a useful statistical framework for addressing many development issues and to help assemble and calibrate AGE models.

Although Turkey has a long tradition of planning, no official attempt has been made to compile a SAM for Turkey. To my knowledge, there have been three main previous attempts to construct a SAM for Turkey. Senesen (1991) presented a SAM for 1973. Her study, which was actually carried out some years prior to eventual publication, is a straightforward enlargement of the 1973 I-O table. Dervis, *et al.* (1982) compiled a 1973 SAM for Turkey, which was designed to reflect an open economy general equilibrium model to study the resource allocation effects of some trade policy in Turkey. However, this SAM does not have a income distribution dimension. In a subsequent study, Ozhan (1988) constructed a SAM for 1983 using a framework developed by Richard Stone in the early 1960s. This SAM was also published in detail by the Turkish State Planning Organisation (Ozhan, 1989) and has

[66] This section, written in collaboration with Gazi Ozhan, has been published in *Economic System Research* (De Santis and Ozhan, 1997).

already proved to be very useful for analysing the income distribution effects of stabilisation policies employed in Turkey during the 1980s (De Santis, 1996). However, the SAM constructed by Ozhan classifies imports and indirect taxes by users, rather than by type. This classification, conforming to the structure of the I-O tables, is not consistent with SAMs. In addition, some data sets have been constructed by modellers to study particular aspects of the Turkish economy (Adelman, *et al.* 1989; Celasun, 1986; Harrison, *et al.* 1993; Yeldan 1989) and these may be regarded as "implicit" SAMs. However, none of the SAMs, explicit or implicit, have yet incorporated household survey information and hence have an income distribution dimension.

This study represents the first comprehensive and detailed 1990 SAM for Turkey. The design of this SAM is conditioned by AGE modelling perspectives. Hence, in the production accounts, a distinction is made between "activities" and "commodities". This permits the domestic demand to be considered as a composite demand of imported and domestically-produced goods, and the supply to be a composite of domestic supply and export supply. This treatment of imported and domestically-produced commodities enables one to adopt the widely used Armington specification in AGE modelling literature, which assumes that products of different countries competing in the same market are imperfect substitutes. Whereas the treatment of domestic and exported goods as imperfect substitutes allows modellers to employ the constant elasticity of transformation specification.[67]

The first stage to compile this SAM is to construct a macro SAM using available published macroeconomic data. The main statistical sources used to achieve this task are the Input-Output (I-O) table for 1990, the Statistical Yearbook of Turkey, the Balance of Payments Statistics and the Annual Program published by the State Planning Organisation. The main statistical sources to compile the disaggregated SAM

[67] This SAM has already proved to be very useful to calibrate a AGE model with trade features (Harrison, *et al*, 1996, 1997).

are the Household Income and Consumption Expenditures Survey for 1987, the Manufacturing Industry Statistics, the Household Labour Survey and the Census of Population for 1990. Thanks to a good deal of compatibility between the different official statistical sources, a highly disaggregated SAM has been compiled containing 226 accounts: (i) factors are disaggregated into 8 different types of labour categories and 5 different types of capital (i.e. operating surplus); (ii) households are disaggregated according to their income size (20 classes) and to their geographical regions (rural/urban); (iii) companies are disaggregated into State Economic Enterprises and three private enterprises (i.e. non-agricultural production, trade and services); (iv) activities and commodities are each disaggregated according to the I-O table 1990 classification, hence comprising 54 accounts in each case; (v) the capital account is disaggregated into private gross fixed capital formation, public gross fixed capital formation and changes in stocks.

Households have been disaggregated according to income classes because it may allow modellers to analyse the effects on the personal distribution of income through income inequality indices. In contrast, if modellers are interested in examining the effects of their policy scenarios on the functional distribution of income, the analysis of income changes of the eight different labour categories may be more appropriate.

Most of the sub-matrices of the SAM, such as the disaggregation of gross value added to factors of production, the distribution of factor incomes to households, the disaggregation of private consumption, the disaggregation of net factor income from the rest of the world, the disaggregation of tariffs and direct taxes, and the input-output structure, have all been compiled with precision using official published data.

In general, the disaggregated SAM has been compiled using rational criteria and by comparing the actual estimates with those produced by different official statistical sources.

A first major area of difficulty concerned the disaggregation of the household consumption matrix. Since the private final consumption vector reported in the 1990 I-O table is obtained residually, the household consumption survey for 1987 has been employed to disaggregate private expenditures among households. Unfortunately, although the data are collected by income and commodity groups, the coverage of the commodity groups does not conform to the I-O classification. Sometimes the definition of commodities is not clear at all. Hence, firstly, the original 64 production sectors of the 1990 I-O table have been reduced to 54, and secondly, for some commodities personal judgements have been exercised to complete the estimates of this matrix. At a final stage, RAS has been applied to the household consumption expenditure matrix before inclusion in the disaggregated SAM.

A second area of difficulty concerned the disaggregation of net indirect taxes by type of domestic commodities. I-O tables usually report the net indirect taxes collected from domestic sectors. This classification by users is not appropriate if the main source of indirect tax revenues is VAT, as it is in the case of Turkey. Hence, the I-O classification by user has been transformed to a classification by type of commodities. An unpublished document of the Turkish Ministry of Finance and Custom has been used for this purpose.

A third area of difficulty regarded the allocation of the value added to the eight different labour categories. The Household Labour Survey, the Census of Population and the Manufacturing Industry Statistics have been employed in a such way that the estimates for the wage and the labour force matrices would be consistent too. The RAS method has been employed to adjust the labour revenue matrix to accord with the data reported in the I-O table.

A fourth area of difficulty concerned the computation of the dividends and retained earnings of the private enterprises. This distinction is very important as retained earnings constitute a component of the capital account. Given the level of investment, an under- or overestimation of the retained earnings would directly affect other forms of savings, in particular private and foreign savings. A Capital Market Board rule has been adopted for this purpose, which states that at least 50%, and no more than 70% of the super normal profits, has to be distributed between shareholders.

Finally, household savings have been calculated as residuals after allowing for consumer expenditure and direct taxes. Our estimates indicate that the marginal propensity to save is 17.08% for Turkey as a whole, 10.12% for the urban areas and 27.44% for the rural areas. It is important to note that according to the income distribution survey, the marginal propensity to save is 21.57% for Turkey as a whole, 13.78% for the urban areas and 32.86% for the rural areas. Several Turkish economists and statisticians are not completely satisfied by the official estimates. They argue that the consumption level, in particular in the rural areas, has been under-estimated. In addition, the State Institute of Statistics (SIS) of Turkey has re-estimated private final consumption for Turkey. The new computation clearly implies that a lower marginal propensity to save with respect to that estimated by the household survey is likely to be more appropriate for the Turkish economy.

In summary, most of the transaction values have been estimated using different official statistical sources. The data employed, especially those published by the SIS, are qualitatively good and comprehensive. Only in the case of the Household Consumption Expenditures Survey was there a need for extensive effort to adapt it to SAM, and as a consequence of that a contraction of the production activity classification from the I-O table's 64 sectors to the SAM's 54 sectors has been deemed necessary. The RAS method has been used only to compute a sequence of residual balance entries, and it has been applied only to the household consumption matrix and the labour revenue matrix.

[2.C.2] The aggregate SAM

The aggregate SAM for Turkey for 1990 is shown in Table 2.C1.

Table 2.C1 An Aggregate SAM for Turkey 1990 (Billions of TL)

		1	2	3	4	5	6	7	8	9	10	
		Factors	Households	Companies	Government	Activities	Composite Commodities	Imported Commodities	Capital Account	ROW Cur. Account	ROW Cap. Account	Total
1	Factors					357014						357014
2	Households	174486		146866	4699					8786		334837
3	Companies	156287			18247					4381		178915
4	Government		18609	7829			20514	13397				60349
5	Activities						596200			52062		648262
6	Composite Commodities		262206		43083	291248			102608			699145
7	Imported Commodities						82431					82431
8	Capital Account	26241	54022	21445	-11955						16311	106064
9	Row Cur. Account			2775	6275			69034				78084
10	Row Cap. Account								3456	12855		16311
	Total	357014	334837	178915	60349	648262	699145	82431	106064	78084	16311	

The value added (357014 billions of TL) is allocated to various factors of production. However, in the aggregate SAM these factors are consolidated into a single account.

The factor income to households (174486 billions of TL) comprises the total compensation of employees (107103 billions of TL) and the operating surplus originating from the primary sector, that is agriculture, animal husbandry, forestry and fisheries, and from the ownership of dwellings (67383 billions of TL). The rationale behind the allocation of the operating surplus of the primary sector to households is that according to the 1991 General Agricultural Census, 99% of agricultural holdings holds 83% of the agricultural land, whose size is less than 50 hectares. Thus, most of the agricultural output is produced by small household-based farms. Similarly, animal husbandry and fisheries are household-based activities. We also distribute the forestry operating surplus to households in order to treat all the primary sectors in the same way.

As far as the ownership of dwellings is concerned, this activity consists mainly of actual and imputed rents on houses, which are usually collected directly by households.

The dividends distributed by companies to households (146866 billions of TL) are calculated by subtracting the corporation tax, the interest paid by the SEE, the retained earnings and the dividends paid abroad from the total enterprise income. However, this will be explained in detail when the criteria used to estimate the retained earnings in the private sector are discussed.

The government transfers to households (4699 billions of TL) are calculated as residuals. The transfers from the ROW to households (8786 billions of TL) are estimated using the data reported by the Central Bank of the Republic of Turkey. According to this official data source, the net remittances are equal to 3325 million of US dollars in 1990. The exchange rate used to convert into Turkish lira the transactions expressed in dollars has been calculated by dividing the net factor income from ROW expressed in TL (4117 billions of TL) to that expressed in US dollars (1558 million US dollars). So 1 US dollar is on average exchanged for 2642.5 TL. This estimate is approximately equal to the official average value which is equal to 2607.6 TL for 1990.

The factor income to companies (156287 billions of TL) consists of the operating surplus originating from mining, manufacturing activities and services net of the ownership of dwellings.

The government transfers to private enterprises (16990 billions of TL) are calculated as residuals, while those to SEE are equal to 1257 billions of TL.

The transfers from the ROW to enterprises comprise profits (741 million US dollars) and payments of interest (917 million of US dollars) converted into domestic currency.

The taxes on income paid by households are equal to 18609 billions of TL. The corporation tax is equal to 4637 billions of TL, while the interest payment of the SEE to the government (3192 billions of TL) are calculated as residuals.

The indirect taxes on composite commodities (20514 billions of TL), the import duties (13397 billions of TL), the consumption of fixed capital (26241 billions of TL) and all transactions relating to the activity and the commodity accounts are derived from the I-O table for 1990.

Household savings (54022 billions of TL) are calculated as residuals after allowing for consumer expenditure and direct taxes.

The retained earnings of the SEE (7902 billions of TL) are calculated as residuals, while those of the private enterprises (13543 billions of TL) are estimated using a survey published by the Istanbul Chamber of Industry for 1990. The sum of the private retained earnings, plus those of the SEE, is reported in Table C.1.

The government budget deficit (11955 billions of TL) has been calculated as the sum of the consolidated budget deficit (11782 billions of TL) and the municipalities deficit (501 billions of TL), minus the local government surplus (328 billions of TL).

The capital transfers net of reserves (16311 billions of TL) are calculated by summing up the change in official reserves and the current account of transactions with the ROW.

The sources of income for the rest of the world current account comprise dividends (161 million US dollars) and interest payments (890 million US dollars) from enterprises paid overseas, government transfers in the form of interest payments of the foreign debt (2375 million US dollars) and net imports, converted into domestic currency.

The change in official reserves is derived by converting the actual change (1308 million US dollars) in domestic currency, while the current account deficit is derived residually. Unfortunately, the current account deficit is over-estimated. This is because the trade transactions evaluated with the national accounting system are quite different from the exports and imports which characterise the balance of payments. As a consequence, this estimate also affects the transaction value of the net capital activities.

According to the Turkish Ministry of Finance and Customs, the total government transfers are equal to 25020 billions of TL in 1990. 13966 billions of TL are used to pay the interest on the domestic (9613 billions of TL) and foreign (4353 billions of TL) debts, while the remaining part is distributed to the SEE and to other accounts which cannot be classified by institutions. Once the public transfers to the SEE and to the ROW current account have been allocated, the remaining transfers are allocated to private enterprises and households as residuals. Also the SPO provides an estimate for the government transfers equal to 27126 billions of TL. However, it does not collect data concerning the distribution of public transfers to institutions.

It is important to stress that most of the transaction values estimated as residuals, such as the government transfers to households and private companies, the interest payment and the retained earnings of the SEE, are usually considered exogeneously to the system of the equations in a modelling context. Hence, these ad hoc estimations will not materially affect the policy simulations.

[2.C.3] The disaggregated SAM

The aggregated accounts have been disaggregated in the following way:

1 factors are disaggregated into 8 different types of labour and 5 different types of capital (i.e. operating surplus);
2 households are disaggregated according to their income size (20 classes) and to their geographical regions (rural/urban);
3 companies are disaggregated into SEE and three private enterprises (i.e. non-agricultural production, trade and services);
4 activities and commodities are each disaggregated according to the I-O table 1990 classification, hence comprising 54 accounts in each case;
5 the capital account is disaggregated into private gross fixed capital formation, public gross fixed capital formation and changes in stocks.

The disaggregation of the gross value added to factors of production has been achieved by employing the I-O table for 1990, the Household Labour Surveys for 1990 and 1992, the Census of Population and the Manufacturing Industry Statistics for 1990.

The capital factor has been defined as operating surplus. Hence, the I-O table is an ample statistical source.

As far as the labour force is concerned, the Household Labour Survey distinguishes eight types of labour employed by nine main economic activities, such as agriculture, mining, manufacturing, trade and services. As the definition of occupational placement of workers has been changed in 1992, the Household Labour Survey for 1992 has been employed to disaggregate the relevant data for 1990. To further disaggregate the labour force by activities, the Census of Population and the Manufacturing Industry Statistics data sets have been employed. The Census of

Population provides data on the population according to occupation and economic activity, while the Manufacturing Industry Statistics indicates the number of people engaged in each manufacturing sector. The labour revenue matrix has been obtained by multiplying each element of the labour force matrix to the wage vector given by the Household Income Distribution Survey. The RAS method has been employed to adjust the matrix to accord with the data reported in the I-O table.

The income distribution survey for 1987 has been employed in order to disaggregate labour and capital income, government transfers and foreign remittances paid to households.

Factor income to enterprises is allocated to the SEE and three private companies. According to the Prime Ministry High Control Committee, 8.2% of the Turkish GDP at factor costs is produced by the SEE in 1990. In order to obtain the SEE operating surplus related to the non-agricultural activity (6176 billions of TL), trade (2163 billions of TL) and services (2482 billions of TL), the compensation of employees has been subtracted from the value added in each sector.

As far as the private enterprises are concerned, their operating surplus in each sector is calculated by subtracting the SEE operating surplus from the aggregate reported into the I-O table.

The government transfers to private enterprises are disaggregated according to the share of the operating surplus of each company.

The transfers of the rest of the world current account to private and public enterprises are composed of 2423 billions of TL in the form of interest and 1958 billions of TL in the form of capital income. The interest has been disaggregated according to the credit volume of the private (31639 billions of TL) and public (36120 billions of TL) banks, while the capital income has been disaggregated according to the share of the operating surplus of each company.

The income tax paid by households is disaggregated using the direct tax rates for 1990. The taxable income comprises rent, labour and entrepreneurial incomes, with the exclusion of agricultural income, which is tax-exempt. It is assumed that the average income of each household group is equal to the midpoint of the income class interval. Since the tax rates were unchanged between 1987 and 1990, and the class interval width for the households income classes increased by a scale factor equal to the inflation rate, the households income classes for 1990 have been calculated by multiplying those for 1987 by the scale factor 2.667. The tax burden on urban and rural household taxable incomes is 7.22% and 6.71%, respectively. While the tax burden on urban and rural household total incomes is 6.73% and 3.85%, respectively.

The corporation tax paid by the SEE is equal to 1196 billions of TL. The corporation tax paid by the private enterprises is disaggregated according to the magnitude of the enterprise income net of the interest payments abroad.

As far as indirect taxes net of subsidies are concerned, the I-O table 1990 reports the net indirect taxes collected from domestic sectors. This classification is not appropriate within a modelling context. Hence, the I-O classification by user has been transformed to a classification by type in order to allow modellers to apply the Armington specification. Unfortunately, the only official source which shows any disaggregation of the value added tax by type of commodities is an unpublished document of the Turkish Ministry of Finance and Custom.

The disaggregation of the import duties, the consumption of the fixed capital and all the transactions relating to the activity and the commodity accounts are obtained from the I-O table 1990.

In order to disaggregate the private consumption vector between households, the Household Income and Consumption Expenditures survey for 1987 has been employed. A matrix with dimensions 35 commodities by 40 households can be easily derived from the survey. Twelve of the remaining 19 commodities are zero entries in the I-O table. Therefore, expenditures on 7 commodities have been estimated by assuming that some commodities of the survey incorporate more than one commodity of the I-O table. For instance, the commodity 'cultural expenditures' reported in the

survey has been disaggregated between manufacture of paper and paper products (code 135) and printing, publishing and allied industries (code 136).
At a final stage, RAS has been applied to the household consumption expenditure matrix before inclusion in the disaggregated SAM.

The capital account is employed as a dummy account in order to disaggregate aggregate investment between private investment, public investment and changes in stocks.

Household savings are disaggregated between the different income classes according to the income distribution survey for 1987. Our estimates indicate that the marginal propensity to save is 17.08% for Turkey as a whole, 10.12% for the urban areas and 27.44% for the rural areas. It is important to note that according to the income distribution survey, the marginal propensity to save is 21.57% for Turkey as a whole, 13.78% for the urban areas and 32.86% for the rural areas. Several Turkish economists and statisticians are not completely satisfied by these estimates. They argue that the consumption level in the rural areas has been under-estimated. Furthermore, the SIS has re-estimated private final consumption for Turkey. The new estimates for 1987 show that this figure is equal to 51018 billions of TL rather than 31892 billions of TL as reported in the income distribution survey. Thus, it seems that a lower marginal propensity to save than the one estimated for 1987 by the survey is likely to be more appropriate for the Turkish economy.

The retained earnings of the private enterprises are estimated using a survey published by the Istanbul Chamber of Industry for 1990. This survey publishes all relevant data of the 500 largest industrial establishments in Turkey, 409 of which are private and 91 are public. The gross value added of the private enterprises comprises the 23% of the GDP produced by the private industrial sector in Turkey. In addition, the share of the value added of the industrial sector in the aggregate GDP at current producer prices is 25.3% in 1990. Thus, this survey is a good representation of Turkish private industrial enterprises. According to a Capital Market Board rule at least 50%, and no more than 70% of the super normal profit, has to be distributed between shareholders. It is assumed that the 48.82% of the super normal profit is retained by private enterprises in the form of savings, while the 51.18% of it is distributed to shareholders. Hence, using this assumption and the already mentioned survey, we arrive at the conclusion that 13543 billions of TL can be treated as retained earnings of the private enterprises. It is important to emphasise that even if the dividends distributed to households are calculated as residuals, the underlying assumption behind this estimate can be summarised as follows: (i) all the operating surplus generated by services net of the ownership of dwellings is allocated to households; (ii) the rent, the interest payments and the 51.18% of the super normal profit of the industrial sector are distributed to households.

With regard to services, the official statistics regarding trade, hotels, restaurants and other services show that the average number of employees for each establishment, and the ratio of the total persons engaged relative to employees. Both ratios indicate clearly that the service activity, with the exception of the financial institutions (i.e. banks, stockbrokers and foreign exchange offices), is mainly household-based. Unfortunately, similar data are not collected for construction, transport and communication. However, it is believed that many of these activities are also carried out by small enterprises. In conclusion, since the value added of the financial institutions is relatively small, relative to the value added in the "Financial Institutions and Insurance" account as a whole, the operating surplus generated from services can be entirely allocated to households.

With regard to the industrial sector, rent and interest payments are allocated directly to households as we do not have any data concerning transactions between enterprises.

The transfers of the SEE to the rest of the world current account are equal to 1080 billions of TL. The transfers of the private companies paid overseas (1695 billions of TL) are composed of 1270 billions of TL in the form of interest payments and 425 billions of TL in the form of capital income. The interest has been disaggregated according to the share of the operating surplus of each company, while the capital income has been disaggregated according to the share of the foreign investment in each sector.

Since the disaggregated SAM for Turkey is quite large and comprises many zero entries, seven tables have been constructed to show the transactions between the disaggregated accounts.

Table 2.C2 shows the disaggregation of the gross value added to factors of production.[68] Table 2.C3 shows the source of income received by households and enterprises, and their current payments. Tables 2.C4 and 2.C5 show the urban and the rural household consumption expenditure on commodities, respectively. Table 2.C6 shows the inter-industry transactions. Table 2.C7 shows the disaggregation of government consumption expenditure, private and public investment and changes in stocks, respectively. With regard to Table 2.C8, columns 1 and 2 show the disaggregation of domestic commodities and exports; columns 3 and 4 show the disaggregation of indirect taxes on composite commodities and duties on imports paid to government, respectively; and column 5 shows the imports net of taxes coming from the rest of the world.

[2.C.4] Definition of accounts

The disaggregated SAM for Turkey comprises 226 accounts. The code numbers used to identify the accounts have been organised as follows:

[68] The first row and the first column of these tables designate the code numbers used to identify the accounts, as set out in the next section [2.C.4].

I - FACTORS OF PRODUCTION

Labour:

1. Scientific, technical, professional and related workers.
2. Administrative, executive and managerial workers.
3. Clerical and related workers.
4. Sales workers.
5. Service workers.
6. Agricultural, animal husbandry and forestry workers, fishermen and hunters.
7. Non-agricultural production and related workers, transport equipment operators and labourers.
8. Workers not classifiable by occupation.

Capital:

9. Rent.
10. Operating surplus in agriculture.
11. Operating surplus in non-agriculture.
12. Operating surplus in trade.
13. Operating surplus in services.

II - HOUSEHOLDS

Urban and	Rural household	(monthly disposable income groups - thousands of TL):
14	34	0 - 133
15.	35	133 - 267
16.	36	267 - 400
17	37	400 - 533
18.	38	533 - 667
19.	39	667 - 800
20.	40	800 - 933
21.	41	933 - 1067
22.	42	1067 - 1200
23.	43	1200 - 1333
24.	44	1333 - 1600
25.	45	1600 - 1867
26.	46	1867 - 2133
27.	47	2133 - 2400
28.	48	2400 - 2667
29.	49	2667 - 4000
30.	50	4000 - 5333
31.	51	5333 - 13333
32.	52	13333 - 26667
33.	53	26667 - 66667

III - COMPANIES

Private enterprises:

54. Enterprises in non-agricultural sectors.
55. Enterprises in trade sectors.
56. Enterprises in services.

Public enterprises:

57. State economic enterprises.

IV - GOVERNMENT

58. Government.

V - VI - VII ACTIVITIES COMPOSITE and IMPORTED COMMODITIES

Activities	Composite	Imports	
59.	113	167	Agriculture and animal husbandry.
60.	114	168	Forestry.
61.	115	169	Fisheries.
62.	116	170	Coal mining.
63.	117	171	Crude petroleum and natural gas production.
64.	118	172	Iron ore mining.
65.	119	173	Non-ferrous ore mining, non-metallic mineral mining, stone quarrying.
66.	120	174	Slaughtering, preparing and preserved meat.
67.	121	175	Canning and preserving of fruits and vegetables.
68.	122	176	Manufacture of vegetable and animal oils and fats.
69.	123	177	Grain mill products.
70.	124	178	Sugar.
71.	125	179	Manufacture of other food products.
72.	126	180	Alcoholic beverages.
73.	127	181	Soft drinks and carbonated water industries.
74.	128	182	Tobacco manufactures.
75.	129	183	Manufacture of textiles (inc. ginning).
76.	130	184	Manufacture of wearing apparel.
77.	131	185	Manufacture of leather and fur products.
78.	132	186	Manufacture of footwear.
79.	133	187	Manufacture of wood and wood products.
80.	134	188	Manufacture of wood furniture and fixtures.
81.	135	189	Manufacture of paper and paper products.
82.	136	190	Printing, publishing and allied industries.
83.	137	191	Manufacture of fertilisers.
84.	138	192	Manufacture of drugs and medicines.
85.	139	193	Manufacture of other chemical products.

86.	140	194	Petroleum refineries.
87.	141	195	Manufacture of petroleum and coal products.
88.	142	196	Manufacture of rubber products.
89.	143	197	Manufacture of plastic products.
90.	144	198	Manufacture of glass and glass products.
91.	145	199	Manufacture of cement.
92.	146	200	Manufacture of other non-metallic mineral products.
93.	147	201	Manufacture of iron and steel.
94.	148	202	Manufacture of non-ferrous metal.
95.	149	203	Manufacture of fabricated metal products.
96.	150	204	Manufacture of machinery except electrical.
97.	151	205	Manufacture of agricultural machinery and equipment.
98.	152	206	Manufacture of electrical machinery.
99.	153	207	Manufacture of shipbuilding and repairing.
100.	154	208	Manufacture of railroad equipment.
101.	155	209	Manufacture of land transport vehicles and equipment.
102.	156	210	Manufacture of other transport equipment.
103.	157	211	Other manufacturing industries.
104.	158	212	Electricity.
105.	159	213	Gas manufacture and waterworks.
106.	160	214	Building construction, other construction.
107.	161	215	Wholesale and retail trade.
108.	162	216	Restaurants and hotels.
109.	163	217	Railway transport, other land transport, water transport, air transport.
110.	164	218	Communications.
111.	165	219	Financial institutions and insurance.
112.	166	220	Personal and professional services, public services, ownership of dwellings.

VIII - CAPITAL ACCOUNT

221. Gross capital formation.
222. Private gross fixed capital formation.
223. Public gross fixed capital formation.
224. Changes in stocks.

IX - REST OF THE WORLD CURRENT ACCOUNT

225. Rest of the world current account.

X - REST OF THE WORLD CAPITAL ACCOUNT

226. Rest of the world capital account.

Table 2.C2 Disaggregation of gross value added to factors of production (Billions of 1990 TL)

Code	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76
1	0	0	0	175	9	8	55	9	9	14	15	25	77	28	15	65	109	37
2	226	0	0	22	1	1	7	14	13	21	22	37	113	41	22	95	160	54
3	541	140	0	120	6	6	38	10	9	14	15	26	78	28	15	66	111	37
4	0	0	16	0	0	0	0	0	0	1	0	1	3	1	1	2	4	1
5	243	226	222	65	3	3	20	5	5	8	8	15	44	16	9	37	62	21
6	4582	21	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	132	261	0	1031	52	49	326	126	115	187	195	339	1023	372	203	859	1449	491
8	0	0	0	0	0	0	0	3	2	4	4	7	22	8	4	19	31	11
10	54586	2209	1850															
11				542	1311	31	1903	509	461	801	562	-48	2875	1092	278	1428	6483	2371

Code	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
1	3	7	20	8	30	20	13	21	69	12	9	32	12	22	31	34	89	22
2	4	10	29	12	44	29	20	31	101	18	13	47	17	33	46	50	131	33
3	3	7	20	8	30	20	14	21	70	12	9	33	12	23	31	34	90	23
4	0	0	1	0	1	1	0	1	2	0	0	1	0	1	1	1	3	1
5	2	4	11	5	17	11	8	12	39	7	5	18	7	13	18	19	51	13
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	38	95	263	112	392	265	178	275	917	160	114	429	153	298	413	447	1184	297
8	1	2	6	2	9	6	4	6	20	3	2	9	3	6	9	10	26	6
11	794	326	2554	464	1101	562	291	1214	3277	4158	449	891	577	830	1882	1159	1456	1088

Code	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112
1	51	45	10	61	7	9	105	2	25	577	98	782	942	233	247	118	2510	15075
2	77	66	14	90	10	13	155	3	37	93	16	1247	160	40	204	97	935	1581
3	53	46	9	62	7	9	107	2	26	865	147	406	1656	410	818	392	3214	4914
4	2	1	0	3	0	0	3	0	1	4	1	1	3718	921	2	1	67	18
5	30	26	5	35	4	5	60	1	14	209	35	294	5249	1301	132	63	386	4862
6	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	5
7	691	600	124	816	94	117	1398	23	338	975	166	10074	1276	316	2945	1411	183	4819
8	15	13	3	18	2	3	30	1	8	19	3	15	44	11	46	22	15	380
9																		11365
11																		
12	2737	2242	499	2077	86	21	1773	32	813	3984	1156	10466						
13													44456	6213				
															43023	1872	3882	10899

Table 2.C3 Households and enterprises: Receipts and outlays (Billions of 1990 TL)

Code	1	2	3	4	5	6	7	8	9	10	11	12	13
14	39	0	93	21	221	9	851	10	10	3			
15	370	4	1584	94	1119	23	3125	33	55	70			
16	1758	37	2024	122	1676	28	4024	86	144	181			
17	1518	73	1567	178	1354	30	3867	120	284	234			
18	1343	110	1143	219	778	30	2944	70	315	293			
19	1219	142	898	187	489	25	2244	96	319	289			
20	1051	157	915	209	442	22	1876	103	343	309			
21	915	160	601	168	355	22	1339	80	336	241			
22	785	157	508	221	221	15	1062	53	336	244			
23	804	147	322	160	168	8	796	50	257	97			
24	1317	479	517	300	328	25	995	53	469	243			
25	1109	323	313	228	335	23	754	17	403	375			
26	1025	349	195	191	322	19	452	0	363	285			
27	979	293	17	157	114	18	483	0	373	134			
28	746	129	110	112	208	3	217	17	211	82			
29	1738	729	254	305	194	32	820	0	854	474			
30	616	367	0	160	74	7	253	0	475	183			
31	1245	882	0	248	268	7	290	0	625	229			
32	0	727	0	59	0	9	163	0	276	112			
33	0	127	0	36	0	0	0	0	12	0			
34	65	2	42	14	201	82	633	3	16	310			
35	318	6	508	30	892	250	1737	10	90	1696			
36	623	56	652	91	992	327	2256	3	152	2925			
37	636	56	915	126	818	402	1858	0	156	4490			
38	512	60	508	162	912	390	1297	33	151	4952			
39	227	45	576	76	556	326	1291	13	163	4822			
40	188	91	169	61	181	310	1273	0	80	4675			
41	104	45	186	48	87	348	537	0	64	4050			
42	65	60	59	100	47	305	597	0	35	3958			
43	32	17	161	46	40	124	265	0	64	2941			
44	45	69	25	64	215	436	567	10	113	6426			
45	58	50	0	88	255	264	205	33	153	3648			
46	65	17	0	107	87	116	115	0	68	1604			
47	156	108	0	106	0	40	181	0	21	1506			
48	78	32	0	74	0	50	127	0	3	902			
49	253	58	0	109	34	87	109	0	82	1598			
50	0	140	0	68	0	170	0	0	6	2441			
51	0	47	0	44	0	198	0	0	947	1354			
52	0	0	0	0	0	33	0	0	155	27			
53	0	0	0	0	0	0	0	0	0	0			
54											54279		
55												41558	
56													49629
57											6176	2163	2482
58													
276									2386	241	9101	6948	7565
280													

Code	58	CMP-COM	276	54	55	56	57	58	280
14	78	1747	-525	11	6	15		6	4
15	434	9101	-2074	187	247	350		125	75
16	722	13593	-1590	599	571	897		328	248
17	749	13541	-906	1000	1071	1357		435	298
18	708	11877	294	1288	1500	2000		372	476
19	646	10432	528	1393	1555	1943		342	465
20	705	10476	1001	1677	1902	2475		308	392
21	613	8699	1038	1726	1445	2380		232	353
22	564	7477	1286	1494	1906	1870		243	210
23	449	6182	735	1389	1438	1254		156	320
24	940	12548	1455	2849	2811	3668		232	657
25	807	10109	1537	2126	2594	3208		190	453
26	667	7321	1859	1580	2360	2349		137	218
27	547	6342	863	1467	1854	1654		100	109
28	408	4285	1073	752	1587	1346		52	195
29	1326	13218	3283	4324	3292	4109		167	535
30	665	5569	2396	2040	1987	1897		47	525
31	1623	13542	2528	5986	3087	4326		35	464
32	630	2570	2797	3025	682	878		0	66
33	370	1288	1546	2489	539	0		0	0
34	69	2773	-1370	24	4	63		10	2
35	279	7066	-941	163	70	545		87	2
36	462	10477	-198	643	528	1325		156	11
37	481	10998	1236	668	869	1464		205	53
38	447	10476	1919	650	1243	1492		199	281
39	358	7906	2753	377	817	1362		148	216
40	290	6402	2873	583	578	1072		99	204
41	265	5476	2565	621	651	1422		48	96
42	228	4331	3033	438	987	793		66	81
43	116	2770	1935	199	405	399		50	77
44	310	6428	4482	599	981	1439		40	192
45	225	4029	2805	417	804	856		33	195
46	189	2595	1450	316	1102	622		16	0
47	265	2412	2476	404	1055	1513		13	51
48	126	1324	1138	230	743	347		3	0
49	311	2835	2888	338	1193	1639		13	521
50	200	2004	2612	638	722	625		7	0
51	256	1738	2775	489	434	515		1	741
52	83	248	464	579	0	0		0	0
53	0	0	0	0	0	0		0	0
54								6340	731
55								4854	559
56								5796	1799
57								1257	1292
58				1275	976	1189	4388		
276				13543			7902	-11955	
280				755	374	566	1080	6275	

Table 2.C4 Urban households consumption expenditure (Billions of 1990 TL)

Code	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
113	456	1948	3008	2796	2310	1867	1802	1451	1128	911	1690	1339	958	629	492	1295	455	827	283	51
114	4	47	63	53	41	31	34	25	18	18	28	26	16	10	2	13	1	4	0	3
115	20	77	128	124	108	102	105	85	77	62	113	102	63	53	34	120	52	81	55	6
116	5	35	67	68	62	57	64	47	41	33	85	65	57	36	21	70	25	52	10	4
117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	9	51	94	105	93	84	88	73	60	44	98	81	55	37	33	80	30	53	11	3
121	2	8	13	12	10	9	8	7	5	4	8	7	5	4	3	7	4	6	2	1
122	32	118	182	154	120	100	90	72	52	40	75	61	43	32	20	49	18	23	11	3
123	75	267	378	300	232	179	162	116	84	64	107	75	53	32	22	56	17	28	10	4
124	34	112	150	125	100	76	65	49	35	29	47	34	25	15	12	30	9	17	8	1
125	107	418	656	491	502	418	401	326	256	222	394	304	215	161	125	334	116	191	65	17
126	1	22	36	53	59	57	64	50	54	50	76	61	58	52	46	108	62	129	33	30
127	1	390	8	11	11	10	11	12	11	9	20	16	11	10	9	20	10	22	5	1
128	61	301	442	398	357	267	263	204	162	142	258	180	147	94	73	195	115	178	35	31
129	52	429	628	637	513	402	439	291	211	185	374	249	220	128	94	304	90	101	135	24
130	20	119	223	252	228	210	223	188	160	132	254	215	151	170	98	350	141	253	92	33
131	1	7	14	16	14	13	14	12	10	8	16	13	9	9	6	22	9	16	6	2
132	5	27	51	57	52	48	51	43	36	30	58	49	34	39	22	80	32	58	21	7
133	10	27	90	129	108	113	86	61	52	27	112	86	39	136	55	69	62	141	31	1
134	5	13	43	61	51	54	41	29	25	13	53	41	19	65	26	33	29	67	15	0
135	2	29	56	40	49	40	40	39	30	29	53	37	29	29	22	66	34	59	7	3
136	4	79	156	102	136	108	106	106	79	80	143	86	73	68	62	173	87	146	17	7
137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
138	24	89	118	139	102	87	103	89	72	49	126	142	73	41	48	153	90	178	46	10
139	79	287	481	467	381	342	334	288	238	202	393	360	243	227	123	442	210	385	85	19
140	6	21	85	161	154	187	276	292	244	219	572	452	462	340	211	683	248	502	115	20
141	14	47	67	56	45	34	32	26	19	15	28	20	13	9	8	17	5	8	5	0
142	6	60	77	103	106	83	74	71	47	38	100	92	48	40	28	74	51	78	12	15
143	4	41	53	71	72	57	51	48	32	26	67	63	33	28	19	51	35	53	8	9
144	4	38	49	66	67	53	47	45	30	24	63	57	30	26	18	47	33	49	7	9
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	2	18	24	32	33	25	23	22	15	12	30	27	15	12	9	23	16	24	4	4
147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
149	27	146	257	261	223	220	222	194	175	134	285	299	191	216	100	383	201	401	58	16
150	17	110	197	201	159	115	142	93	125	76	165	106	69	43	26	104	89	135	22	52
151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
152	6	126	153	162	97	123	113	84	134	95	146	179	119	136	73	291	125	383	15	44
153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	1	11	13	21	28	32	20	28	25	61	182	81	37	46	80	274	92	1709	15	147
156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
157	5	280	268	240	139	171	143	64	205	162	177	280	140	44	56	381	140	189	0	2
158	13	56	94	87	74	62	59	45	40	33	63	41	37	33	27	54	23	46	4	7
159	16	52	86	81	66	53	58	43	35	27	60	33	33	25	18	56	15	50	8	0
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
161	186	995	1533	1570	1404	1253	1257	1077	902	746	1588	1271	890	908	609	1773	783	2271	359	212
162	58	297	571	624	656	635	643	566	561	438	1012	744	607	490	408	1280	501	1534	315	274
163	197	1171	1787	1984	1804	1646	1638	1309	1139	988	1872	1472	1036	979	482	1910	744	1554	301	84
164	8	26	42	74	66	76	90	95	80	71	208	128	105	71	69	218	73	138	41	10
165	2	6	9	17	15	17	21	22	18	16	47	29	24	16	15	49	17	31	9	2
166	166	700	1143	1140	1030	916	973	912	755	618	1302	1106	836	803	581	1481	680	1372	289	120

Table 2.C5 Rural households consumption expenditure (Billions of 1990 TL)

Code	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
113	939	2186	2900	2994	2784	2155	1650	1477	1139	659	1637	1018	556	518	294	733	531	389	44	0
114	22	62	48	70	57	48	33	30	33	22	52	35	8	7	6	6	10	13	1	0
115	25	63	91	89	88	63	63	45	40	23	56	29	12	17	6	20	10	12	0	0
116	5	22	26	41	29	25	20	12	15	6	21	8	8	6	6	10	5	4	1	0
117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	13	43	60	74	66	66	41	44	31	17	54	33	16	19	10	28	19	21	0	0
121	3	8	11	11	10	8	6	6	4	3	6	4	2	2	2	3	2	1	0	0
122	46	112	148	171	148	112	91	85	72	46	89	56	36	24	23	45	20	17	5	0
123	47	140	179	166	131	103	69	59	42	26	71	44	27	25	12	21	8	9	0	0
124	55	109	144	146	124	90	75	73	61	30	79	55	30	28	16	29	26	24	4	0
125	151	379	490	588	539	439	312	310	279	144	372	262	126	122	71	161	115	73	13	0
126	5	15	68	60	49	52	40	21	9	5	16	22	9	11	18	2	0	2	0	0
127	1	3	4	7	8	4	2	3	2	1	2	1	1	1	1	1	2	1	0	0
128	118	219	367	345	282	233	159	155	107	66	153	95	79	77	36	43	35	67	6	0
129	89	276	443	454	491	386	344	278	209	133	270	168	73	92	48	125	95	129	29	0
130	25	105	189	172	248	171	107	96	94	66	137	86	48	39	32	71	35	50	7	0
131	2	7	12	11	15	11	7	6	6	4	8	5	3	2	2	4	2	3	0	0
132	6	24	43	39	56	39	24	21	21	15	31	20	11	9	7	16	8	10	2	0
133	8	41	85	102	108	95	106	48	52	40	30	51	17	52	9	10	12	8	0	0
134	4	19	40	48	50	45	51	23	25	19	14	24	8	25	4	5	6	4	0	0
135	3	15	23	30	33	13	18	15	15	6	9	16	4	6	7	5	1	3	0	0
136	6	37	54	81	93	26	48	43	39	15	19	46	10	17	23	12	3	7	1	0
137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
138	44	113	95	113	114	70	72	72	45	26	90	54	49	21	28	30	7	14	24	0
139	77	198	291	302	269	236	154	131	113	71	160	101	78	52	32	74	45	42	5	0
140	3	8	18	45	34	25	11	9	10	2	11	3	5	1	3	9	4	0	0	0
141	10	27	38	35	30	20	14	13	11	6	15	10	5	4	3	7	3	5	0	0
142	10	23	79	82	83	79	57	34	22	40	44	15	18	23	5	24	15	4	0	0
143	7	16	54	56	57	54	39	23	15	28	30	10	12	16	4	16	11	3	0	0
144	6	14	50	52	53	50	36	22	14	26	28	10	11	15	3	15	10	2	0	0
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	3	7	24	25	25	24	18	11	7	12	14	5	5	7	2	7	5	1	0	0
147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
149	31	98	160	161	152	141	86	72	62	42	93	65	40	29	16	36	12	17	1	0
150	27	83	159	218	104	87	139	86	64	37	82	75	29	42	35	29	23	12	0	0
151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
152	9	59	115	157	113	92	98	73	19	29	65	41	106	55	19	44	147	34	0	0
153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	0	13	42	39	82	22	23	25	20	8	58	4	47	60	6	121	107	114	2	0
156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
157	27	81	155	214	102	85	136	85	63	36	81	74	29	41	35	28	22	11	0	0
158	11	33	47	47	43	33	25	24	19	12	29	15	7	7	3	9	6	10	1	0
159	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
161	250	725	1129	1205	1268	917	734	608	506	335	711	485	312	311	169	361	268	255	34	0
162	99	250	480	471	407	398	316	316	248	165	459	235	201	205	76	158	145	166	19	0
163	411	1024	1507	1388	1440	952	779	691	544	400	979	470	360	243	153	363	96	71	13	0
164	3	14	38	39	60	55	33	21	27	7	40	21	11	11	6	23	18	10	9	0
165	1	3	9	9	14	13	8	5	6	2	9	5	3	2	1	5	4	2	2	0
166	171	392	561	641	617	369	358	305	221	140	304	253	183	168	92	126	111	118	25	0

Table 2.C6 Disaggregation of intermediate consumption (Billions of 1990 TL)

Code	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
113	14866	0	13	0	0	0	0	1671	930	740	4341	1811	4171	207	29	1847	3339	0	257	0	0	0	18	0	0	11	8
114	41	5	0	49	0	0	9	0	0	0	1	0	77	0	0	0	3	0	1	1	1946	52	209	0	0	0	4
115	0	0	2	0	0	0	0	0	0	0	0	0	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0
116	5	3	0	6	0	1	6	1	2	10	2	105	34	0	0	1	4	4	1	0	5	1	12	0	11	0	18
117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0
118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	4	0	1	0	0	0	1	0	0	1	0	1	14	0	0	0	0	0	0	0	0	0	1	0	70	0	77
120	0	0	5	0	0	0	0	218	4	7	0	0	1	0	0	0	0	144	382	46	1	0	0	0	0	0	70
121	0	0	8	0	0	0	0	0	8	7	3	0	16	5	124	0	0	0	0	0	0	0	0	0	1	0	0
122	128	0	4	0	0	0	0	14	5	965	12	0	434	0	0	0	0	0	0	0	0	0	0	0	0	0	116
123	93	0	9	1	0	0	0	0	2	6	12	0	2844	7	0	0	1	0	0	0	0	0	0	0	0	0	0
124	55	0	4	0	0	0	0	0	9	1	0	0	447	22	92	0	0	0	0	0	0	0	0	0	0	1	6
125	1712	0	40	2	0	0	0	78	10	19	1	0	1923	15	0	0	0	1	0	0	4	0	11	0	0	25	26
126	0	0	1	0	0	0	0	0	0	0	0	0	8	74	0	0	0	0	0	0	0	0	0	0	0	0	0
127	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
129	117	2	15	0	0	0	0	1	1	207	68	11	30	0	0	15	8277	3724	64	50	0	49	12	1	13	0	9
130	0	0	0	2	0	0	1	4	1	1	0	3	4	1	1	2	1	1	0	0	1	0	4	1	2	4	9
131	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1054	340	502	0	1	0	0	0	0	0
132	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	81	0	0	5	0	0	0	0
133	51	0	9	0	0	0	1	0	5	0	0	0	106	2	7	0	0	3	2	8	1617	823	7	0	0	0	14
134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	132	0	0	0	0	0
135	34	1	0	0	3	0	0	2	27	11	1	11	130	2	18	185	8	13	3	6	24	1	1622	1127	0	35	69
136	0	2	0	0	2	0	1	2	3	2	3	1	14	4	3	2	6	9	1	1	3	1	15	77	1	6	17
137	2395	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	213	0	2
138	138	0	0	0	0	0	0	0	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1184	0
139	470	3	0	27	24	4	21	16	3	13	0	1	511	49	33	3	351	48	87	48	108	70	262	121	532	108	3676
140	1968	24	222	152	31	20	139	33	42	37	11	90	357	26	14	6	62	143	9	11	23	5	207	9	44	42	1647
141	127	5	21	9	1	1	16	0	0	3	0	16	1	0	0	0	2	2	6	0	1	0	0	0	1	0	22
142	287	2	4	3	1	0	21	0	0	0	0	0	3	0	0	0	5	0	1	51	0	44	1	1	0	9	1
143	50	1	1	0	0	0	0	4	64	19	3	17	42	2	51	0	24	22	8	77	0	6	3	8	34	4	69
144	0	0	0	0	0	0	0	0	23	0	0	0	5	55	57	0	0	0	0	0	64	2	0	0	0	47	10
145	0	0	0	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	16	2	1	0	0	0	16
147	0	0	0	91	28	1	3	0	8	45	0	0	2	0	0	0	4	0	0	0	19	17	0	0	0	0	4
148	0	0	0	0	0	0	0	0	3	0	0	0	14	0	1	22	0	0	2	0	0	0	2	61	0	0	51
149	160	9	0	35	0	0	5	2	31	28	4	0	23	23	41	1	26	11	8	38	12	28	7	4	0	7	121
150	0	0	0	2	6	6	46	7	0	23	0	30	26	9	2	13	16	20	1	0	16	4	45	8	10	5	81
151	192	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
152	0	0	1	16	1	0	4	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
153	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
154	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	0	6	0	3	3	4	45	0	0	0	2	0	8	0	1	80	6	0	0	0	2	0	0	0	0	0	0
156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
157	0	1	0	2	1	0	0	0	0	0	0	0	0	0	0	18	3	65	7	4	0	1	3	1	0	1	1
158	94	2	0	153	9	17	62	24	18	54	203	93	181	22	21	12	864	78	10	15	434	36	255	24	106	12	190
159	132	1	0	1	0	0	1	3	1	2	9	11	30	0	1	1	26	8	1	2	54	4	20	2	1	3	6
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
161	1588	13	62	71	16	7	67	247	85	254	136	89	856	50	74	105	2037	1406	166	151	146	131	221	229	82	330	698
162	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
163	2389	230	35	61	110	4	38	231	100	192	229	270	814	49	46	108	809	430	91	55	504	134	212	160	175	107	654
164	0	5	2	3	1	1	2	4	4	6	13	1	33	1	7	2	77	36	6	10	118	26	12	20	2	9	27
165	2617	3	9	73	26	4	60	29	40	42	45	145	102	8	10	25	327	187	34	21	34	40	69	74	68	56	128
166	278	172	30	6	13	4	38	21	25	187	58	20	274	33	75	5	2323	89	10	23	108	28	44	195	10	138	198

Table 2.C7 Disaggregation of public consumption and gross capital formation (Billions of 1990 TL)

Code	58	277	278	279
113	330	87	18	3109
114	183	0	0	-387
115	0	0	0	-13
116	293	0	0	119
117	0	0	0	573
118	0	0	0	-6
119	0	0	0	780
120	563	0	0	58
121	99	0	0	103
122	51	0	0	-261
123	59	0	0	-587
124	43	0	0	662
125	299	0	0	522
126	0	0	0	27
127	7	0	0	134
128	0	0	0	171
129	71	36	52	1092
130	407	7	2	648
131	1	0	0	271
132	175	0	0	222
133	17	0	0	-140
134	0	166	109	137
135	133	0	0	182
136	30	0	0	48
137	0	0	0	-10
138	73	0	0	13
139	103	0	0	-101
140	1371	0	0	-4232
141	123	0	0	-581
142	36	0	0	-23
143	8	0	0	43
144	36	0	0	-12
145	28	0	0	-33
146	41	0	0	-366
147	24	0	0	940
148	1	0	0	1649
149	73	681	333	403
150	585	7189	3533	445
151	0	1189	18	269
152	205	2176	1031	1192
153	0	365	197	104
154	0	45	345	-128
155	35	4827	604	408
156	0	838	73	-34
157	98	1194	547	11
158	408	0	0	0
159	342	0	0	0
160	223	37582	19696	0
161	1068	4040	1632	2146
162	283	0	0	0
163	1109	1242	373	2813
164	452	0	0	0
165	637	0	0	0
166	32956	0	0	0

Table 2.C8 Domestic goods, exports, indirect taxes and duties (Billions of 1990 TL)

Code	DOM-COM (1)	225 (2)	Code	58 (3)	Code	58 (4)	225 (5)
59	87907	2394	113	139	167	421	2167
60	3324	26	114	25	168	47	431
61	2530	93	115	3	169	2	12
62	2741	1	116	142	170	36	808
63	1655	4	117	198	171	17	9916
64	174	0	118	7	172	9	182
65	2435	504	119	81	173	37	271
66	3028	260	120	5	174	54	476
67	594	1472	121	12	175	9	46
68	3496	437	122	27	176	92	722
69	5813	166	123	93	177	45	167
70	3126	8	124	0	178	69	801
71	15606	2217	125	98	179	143	639
72	1940	315	126	33	180	32	110
73	1161	98	127	39	181	6	30
74	4909	114	128	2	182	968	922
75	20798	6214	129	844	183	327	2086
76	5706	4814	130	243	184	11	576
77	1941	399	131	67	185	18	484
78	1569	87	132	62	186	25	40
79	8099	66	133	64	187	43	121
80	2189	60	134	161	188	16	39
81	4783	120	135	78	189	258	763
82	2990	49	136	164	190	24	109
83	1817	164	137	0	191	126	658
84	3559	166	138	56	192	81	815
85	11281	1262	139	63	193	1984	6860
86	14631	749	140	6693	194	1779	1639
87	2138	14	141	3	195	33	201
88	4750	158	142	13	196	203	417
89	2635	115	143	95	197	112	262
90	1870	410	144	57	198	84	164
91	4470	158	145	62	199	10	118
92	3392	207	146	102	200	175	415
93	13050	2746	147	371	201	340	4524
94	4172	558	148	43	202	136	5313
95	9120	391	149	172	203	382	1037
96	6974	410	150	108	204	1404	9218
97	1906	24	151	62	205	43	123
98	8147	832	152	300	206	1267	4375
99	344	130	153	9	207	67	508
100	310	0	154	0	208	5	61
101	10469	439	155	167	209	1961	3446
102	91	4	156	1	210	32	844
103	4446	366	157	269	211	461	2018
104	9532	85	158	0	212	1	13
105	2387	29	159	14	213	0	1
106	56015	0	160	1485	214	0	0
107	67090	5411	161	0	215	0	0
108	17118	3527	162	376	216	0	1220
109	63569	12476	163	1160	217	0	2128
110	5797	58	164	338	218	0	78
111	14169	128	165	426	219	0	5
112	62441	1126	166	5488	220	0	656

Appendix 2.D The GAMS code: the case of VERs

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$TITLE  TURKEYSAM: DISAGGREGATED TRADE MODEL WITH THE EC - 1990

$OFFSYMLIST OFFSYMXREF OFFUPPER
$STITLE  DEFINITION OF ACCOUNT SET

SETS

I SECTORS /
      Agr         Agriculture
      Min         Mining
      Food        Food products
      Drink       Beverages tobacco
      Text        Textiles
      Wear        Wearing apparel
      Leat        Leather and fur products
      Foot        Footwear
      Wood        Wood and wood products
      Chem        Chemical products
      Petr        Petroleum and coal products
      Nmet        Non-metallic mineral products
      Met         Iron steel and non-ferrous metal
      Mach        Machinery
      Mtran       Transport equipment and other
      Elgas       Electricity Gas and waterworks
      Cons        Construction
      Whol        Wholesale retail trade restaurant and hotels
      Tran        Transport and communications
      Oser        Other services /

IRS(I) SECTORS WITH IRS / Text, Wear /

CRS(I) SECTORS WITH CRS / Agr, Min, Food, Drink, Leat, Foot, Wood,  Chem, Petr, Nmet,
               Met, Mach, Mtran, Elgas, Cons, Whol, Tran, Oser /

T(I) TRADABLES / Agr, Min, Food, Drink, Text, Wear, Leat, Foot, Wood, Chem, Petr,
               Nmet, Met, Mach, Mtran, Elgas, Whol, Tran, Oser /

NT(CRS) NONTRADABLES / Cons  /

TCRS(I) TRADABLES WITH CRS / Agr, Min, Food, Drink, Leat, Foot, Wood, Chem, Petr,
               Nmet, Met, Mach, Mtran, Elgas, Whol, Tran, Oser /

HCG(I) HOUSECONSGOODS / Agr, Min, Food, Drink, Text, Wear, Leat, Foot, Wood, Chem,
               Petr, Nmet, Mach, Mtran, Elgas, Whol, Tran,  Oser /

C     LABOURFORCE /
      Prof        Professional labour
      Mana        Managers
      White       White collars
      Sale        Sale workers
      Serv        Service workers
      Farm        Agricultural workers
      Nfarm       Non agricultural workers
      Other       Others /

HH    HOUSEHOLDS /
      U14         Urban 1
      U15         Urban 2
      U16         Urban 3
      U17         Urban 4
      U18         Urban 5
      U19         Urban 6
      U20         Urban 7
      U21         Urban 8
      U22         Urban 9
      U23         Urban 10
      U24         Urban 11
      U25         Urban 12
      U26         Urban 13
      U27         Urban 14
      U28         Urban 15
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          U29          Urban 16
          U30          Urban 17
          U31          Urban 18
          U32          Urban 19
          U33          Urban 20
          R34          Rural 1
          R35          Rural 2
          R36          Rural 3
          R37          Rural 4
          R38          Rural 5
          R39          Rural 6
          R40          Rural 7
          R41          Rural 8
          R42          Rural 9
          R43          Rural 10
          R44          Rural 11
          R45          Rural 12
          R46          Rural 13
          R47          Rural 14
          R48          Rural 15
          R49          Rural 16
          R50          Rural 17
          R51          Rural 18
          R52          Rural 19

 UH(HH) URBAN HOUSEHOLDS / U14, U15, U16, U17, U18, U19, U20, U21, U22, U23, U24,
               U25, U26, U27, U28, U29, U30, U31, U32, U33/

 RH(HH) RURAL HOUSEHOLDS / R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44,
               R45, R46, R47, R48, R49, R50, R51, R52 /

  ALIAS  (I,J);

$STITLE  DEFINITION OF SOCIAL ACCOUNTING MATRIX FOR TURKEY - 1990

 TABLE  VARIE(I,*) MISCELLANEOUS PARAMETERS

       Ind-Tax Dom-Com Export Import Duty TAREU FUNDEU GCON CAP-ACC TETA PCMARG
Agr        167   93927   2513   3079  469   7.5  118.7  514    2814    5
Min        428    7433    510  11276   99   1.3    0.6  293    1466    5
Food       234   31897   4561   3264  413  21.4  174.9 1114     498    5
Drink       73    8082    526   2068 1006  31.3   52.8    8     332    5
Text       844   21642   6214   2414  327  17.6  104.9   71    1179    5   0.21
Wear       243    5949   4814    587   11   1.5    5.9  407     658    5   0.21
Leat        66    2007    399    501   18   2.2    8.5    1     271    5
Foot        62    1631     87     65   25   3.1   11.9  175     222    5
Wood       467   18527    295   1374  341  21.7  119.6  181     502    5
Chem       118   16776   1592  10524 2191  85.1 1135.2  177     -98    5
Petr      6695   23464    763   3652 1812   3.4  459.6 1494   -4813    5
Nmet       327   17444   1047   1960  584  42.0  289.6  149    -391    5
Met        415   17636   3304  10313  476   8.4  226.0   25    2589    5
Mach       641   26787   1656  17850 3097 186.3 1677.6  863   18460    5
Mtran      446   16106    939   9403 2526 141.7 1292.2  133    9396    5
Elgas       14   11934    115     15    1               750       0    5
Cons      1485   57500      0      0    0               223   57277    5
Whol       376   84584   8938   1220    0              1351    7818    5
Tran      1498   70864  12534   2205    0              1561    4428    5
Oser      5914   82524   1255    662    0             33593       0    5

+         EPSI ETAC ETAR  SIGMA  IMPEC15 EXPEC15  EXPECDUTY
Agr      2.000    3    3  0.945      691    1166          0
Min      0.500    3    3  0.426      179     444          0
Food     1.050    3    3  0.945     1323    2437          0
Drink    1.835    3    3  0.886       58      17          0
Text     2.000    2    2  0.927      846    5982       0.15
Wear     3.400    2    2  0.927       12    4000       0.30
Leat     3.400    2    2  0.927      252      97          0
Foot     3.400    2    2  0.927        9      25          0
Wood     2.000    2    2  0.899      739      57          0
Chem     1.762    2    2  1.009     5552     691          0
Petr     0.400    2    2  0.374      413     534          0
Nmet     1.169    2    2  0.966      926     829          0
Met      0.762    2    2  0.911     2932    1091          0
Mach     0.839    2    2  1.105    10457    1255          0
Mtran    1.511    2    2  1.670     4191     301          0
Elgas    2.000    2    2  1.884        7       2          0
Cons     2.000            1.988        0       0
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Whol	2.000	1	1	1.557	593	3931	0
Tran	2.000	1	1	1.890	1073	5513	0
Oser	2.000	1	1	2.010	322	552	0 ;

TABLE IO(J,I) INPUT OUTPUT 1990

	AGR	MIN	FOOD	DRINK	TEXT	WEAR	LEAT	FOOT	WOOD	CHEM
AGR	14926	59	13790	2084	3342	0	257	1	2225	23
MIN	13	15	171	1	4	4	1	0	19	256
FOOD	2058	3	7051	266	1	145	382	46	17	246
DRINK	4	0	8	73	0	0	0	0	0	0
TEXT	134	0	318	15	8278	3724	64	50	62	22
WEAR	0	3	13	5	1	1	0	0	7	14
LEAT	0	1	0	0	1	1054	340	502	1	0
FOOT	0	1	1	0	0	0	0	82	5	0
WOOD	96	8	317	223	15	25	6	15	5448	142
CHEM	3008	76	550	85	351	48	87	48	561	5714
PETR	2367	368	589	47	64	145	15	11	246	1756
NMET	345	29	183	165	30	22	8	129	148	190
MET	0	125	73	23	4	0	2	0	100	55
MACH	363	122	176	88	42	31	9	39	123	228
MTRAN	35	73	10	99	8	65	7	4	6	2
ELGAS	230	243	628	58	890	86	11	17	829	318
WHOL	1666	161	1666	230	2037	1406	166	151	726	1111
TRAN	2661	219	1896	212	886	465	96	65	1186	974
OSER	3109	225	987	157	2649	276	44	45	593	596

+	PETR	NMET	MET	MACH	MTRAN	ELGAS	CONS	WHOL	TRAN	OSER
AGR	0	381	2	9	1	5	1	2806	107	41
MIN	10246	704	1314	22	17	1345	1227	80	309	28
FOOD	0	1	0	0	3	2	0	1940	357	60
DRINK	0	0	0	0	0	0	0	809	222	1
TEXT	1	100	1	20	63	2	0	77	189	48
WEAR	3	11	13	18	7	4	0	15	65	1
LEAT	0	7	0	2	0	0	0	0	0	1
FOOT	0	1	0	2	0	5	0	0	0	0
WOOD	6	186	15	217	115	34	4028	1006	103	494
CHEM	173	1643	100	766	210	54	707	305	157	1701
PETR	952	725	1025	284	90	239	1195	1477	12309	356
NMET	19	2461	67	495	201	8	7724	327	1854	358
MET	26	112	8249	6297	3936	7	6192	0	62	73
MACH	30	235	620	4763	668	385	1707	172	1416	1519
MTRAN	0	3	3	206	3255	116	960	78	2413	550
ELGAS	128	1228	1370	378	165	634	215	986	236	453
CONS	0	0	0	0	0	0	0	0	0	0
WHOL	422	866	1328	1643	1278	249	3564	3311	4019	1437
TRAN	411	1115	1531	1377	802	422	3595	4979	3933	2138
OSER	144	733	375	784	443	175	1614	7831	2755	3495;

TABLE LABINC(*,I) Labour INCOME Activity Matrix

	AGR	MIN	FOOD	DRINK	TEXT	WEAR	LEAT	FOOT	WOOD	CHEM
PROF	0	247	149	108	109	37	3	7	78	103
MANA	226	31	220	158	160	54	4	10	114	152
WHITE	681	170	152	109	111	37	3	7	78	105
SALE	16	0	5	4	4	1	0	0	3	3
SERV	691	91	85	62	62	21	2	4	44	59
FARM	4606	0	0	0	0	0	0	0	0	0
NFARM	393	1458	1985	1434	1449	491	38	95	1032	1370
OTHER	0	0	42	31	31	11	1	2	23	30
CAPITAL	58645	3787	5159	2798	6483	2371	794	326	4681	4781

+	PETR	NMET	MET	MACH	MTRAN	ELGAS	CONS	WHOL	TRAN	OSER
PROF	21	131	111	167	148	675	782	1175	365	17585
MANA	31	193	164	247	218	109	1247	200	301	2516
WHITE	21	133	113	170	151	1012	406	2066	1210	8128
SALE	0	4	4	6	4	5	1	4639	3	85
SERV	12	75	64	96	84	244	294	6550	195	5248
FARM	0	0	0	0	0	0	1	2	0	5
NFARM	274	1740	1481	2231	1970	1141	10074	1592	4356	5002
OTHER	5	37	32	49	44	22	15	55	68	395
CAPITAL	4607	5339	2544	7554	2726	5140	10466	50668	44895	26147;

TABLE HHINCOME(HH,*) Household Income

	PROF	MANA	WHITE	SALE	SERV	FARM	NFARM	OTHER	GOV	ROW	CAPIT
U14	39	0	93	21	221	9	851	10	6	4	46

U15	370	4	1584	94	1119	23	3125	33	125	75	909
U16	1758	37	2025	122	1676	28	4025	86	328	248	2392
U17	1517	73	1567	177	1354	30	3867	120	435	298	3946
U18	1343	110	1143	218	778	30	2944	70	372	476	5395
U19	1219	142	898	187	489	25	2244	96	342	465	5499
U20	1051	157	915	209	442	22	1877	103	308	392	6706
U21	915	160	601	168	355	22	1339	80	232	353	6125
U22	785	158	508	221	221	15	1062	53	243	210	5851
U23	804	147	322	160	168	8	796	50	156	320	4435
U24	1317	479	517	300	328	25	995	53	232	653	10044
U25	1109	324	313	228	335	23	754	17	190	453	8707
U26	1025	350	195	191	322	19	452	0	137	218	6938
U27	979	293	17	157	114	18	483	0	100	109	5482
U28	746	129	110	112	208	3	217	17	52	195	3977
U29	1738	729	254	305	194	32	820	0	167	535	13053
U30	616	367	0	160	74	7	253	0	47	525	6581
U31	1245	883	0	248	268	7	290	0	35	464	14253
U32	0	727	0	59	0	9	163	0	0	66	4973
U33	0	127	0	36	0	0	0	0	0	0	3041
R34	65	2	42	14	201	82	633	3	10	2	418
R35	318	6	508	30	892	250	1737	10	87	2	2564
R36	623	56	652	91	992	328	2256	3	156	11	5573
R37	636	56	915	126	818	402	1858	0	205	53	7646
R38	512	60	508	162	912	390	1297	33	199	281	8488
R39	227	45	576	76	556	326	1292	13	148	216	7542
R40	188	91	169	61	181	310	1273	0	99	204	6989
R41	104	45	186	48	87	348	537	0	48	96	6807
R42	65	60	59	100	47	305	597	0	66	81	6212
R43	32	17	161	46	40	124	265	0	50	77	4009
R44	45	69	25	64	215	436	567	10	40	192	9557
R45	58	50	0	88	255	264	205	33	33	195	5878
R46	65	17	0	107	87	116	115	0	16	0	3711
R47	156	108	0	106	0	40	181	0	13	51	4498
R48	78	32	0	74	0	50	127	0	3	0	2224
R49	253	58	0	109	34	87	109	0	13	521	4850
R50	0	140	0	68	0	170	0	0	7	0	4431
R51	0	47	0	44	0	198	0	0	1	741	3738
R52	0	0	0	0	0	33	0	0	0	0	762

TABLE HHCONSUM(*,HH) Household Consumption Expenditure

	U14	U15	U16	U17	U18	U19	U20	U21	U22	U23	U24	U25	U26	U27
HTAX	78	434	722	749	708	646	705	613	564	449	940	807	667	547
SAV	-525	-2074	-1590	-906	294	528	1001	1038	1286	735	1455	1537	1859	863
Agr	480	2072	3199	2973	2459	2000	1941	1561	1223	991	1831	1467	1037	692
Min	5	35	67	68	62	57	64	47	41	33	85	65	57	36
Food	259	974	1473	1187	1057	866	814	643	492	403	729	562	396	281
Drink	63	713	486	462	427	334	338	266	227	201	354	257	216	156
Text	52	429	628	637	513	402	439	291	211	185	374	249	220	128
Wear	20	119	223	252	228	210	223	188	160	132	254	215	151	170
Leat	1	7	14	16	14	13	14	12	10	8	16	13	9	9
Foot	5	27	51	57	52	48	51	43	36	30	58	49	34	39
Wood	21	148	345	332	344	315	273	235	186	149	361	250	160	298
Chem	103	376	599	606	483	429	437	377	310	251	519	502	316	268
Petr	20	68	152	217	199	221	308	318	263	234	600	472	475	349
Nmet	16	157	203	272	278	218	195	186	124	100	260	239	126	106
Met	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mach	50	382	607	624	479	458	477	371	434	305	596	584	379	395
Mtran	6	291	281	261	167	203	163	92	230	223	359	361	177	90
Elgas	29	108	180	168	140	115	117	88	75	60	123	74	70	58
Cons	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Whol	244	1292	2104	2194	2060	1888	1900	1643	1463	1184	2600	2015	1497	1398
Tran	205	1197	1829	2058	1870	1722	1728	1404	1219	1059	2080	1600	1141	1050
Oser	168	706	1152	1157	1045	933	994	934	773	634	1349	1135	860	819

+	U28	U29	U30	U31	U32	U33	R34	R35	R36	R37	R38	R39	R40	R41	R42
HTAX	408	1326	665	1623	630	370	69	279	462	481	447	358	290	265	228
SAV	1073	3283	2396	2528	2797	1546	-1370	-941	-198	1236	1919	2753	2873	2565	3033
Agr	528	1428	508	912	338	60	986	2311	3039	3153	2929	2266	1746	1552	1212
Min	21	70	25	52	10	4	5	22	26	41	29	25	20	12	15
Food	215	556	194	318	107	29	315	791	1032	1156	1018	818	594	577	489
Drink	128	323	187	329	73	62	124	237	439	412	339	289	201	179	118
Text	94	304	90	101	135	24	89	276	443	454	491	386	344	278	209
Wear	98	350	141	253	92	33	25	105	189	172	248	171	107	96	94
Leat	6	22	9	16	6	2	2	7	12	11	15	11	7	6	6
Foot	22	80	32	58	21	7	6	24	43	39	56	39	24	21	21
Wood	165	341	212	413	70	11	21	112	202	261	284	179	223	129	131
Chem	171	595	300	563	131	29	121	311	386	415	383	306	226	203	158

```
Petr     219  700  253  510  120   20     13   35   56   80   64   45   25   22   21
Nmet      74  195  135  204   31   37     26   60  207  215  218  207  150   90   58
Met        0    0    0    0    0    0      0    0    0    0    0    0    0    0    0
Mach     199  778  415  919   95  112     67  240  434  536  369  320  323  231  145
Mtran    136  655  232 1898   15  149     27   94  197  253  184  107  159  110   83
Elgas     45  110   38   96   12    7     11   33   48   47   43   33   25   24   19
Cons       0    0    0    0    0    0      0    0    0    0    0    0    0    0    0
Whol    1017 3053 1284 3805  674  486    349  975 1609 1676 1675 1315 1050  924  754
Tran     551 2128  817 1692  342   94    414 1038 1545 1427 1500 1007  812  712  571
Oser     596 1530  697 1403  298  122    172  395  570  650  631  382  366  310  227

+        R43  R44  R45  R46  R47  R48  R49  R50  R51  R52
HTAX     116  310  225  189  265  126  311  200  256   83
SAV     1935 4482 2805 1450 2476 1138 2888 2612 2775  464
Agr      704 1745 1082  576  542  306  759  551  414   45
Min        6   21    8    8    6    6   10    5    4    1
Food     266  671  454  237  220  134  287  190  145   22
Drink     72  171  118   89   89   55   46   37   70    6
Text     133  270  168   73   92   48  125   95  129   29
Wear      66  137   86   48   39   32   71   35   50    7
Leat       4    8    5    3    2    2    4    2    3    0
Foot      15   31   20   11    9    7   16    8   10    2
Wood      80   72  137   39  100   43   32   22   22    1
Chem      97  250  155  127   73   60  104   52   56   29
Petr       8   26   13   10    5    6   16    7    5    0
Nmet     106  116   40   46   61   14   62   41   10    0
Met        0    0    0    0    0    0    0    0    0    0
Mach     108  240  181  175  126   70  109  182   63    1
Mtran     44  139   78   76  101   41  149  129  125    2
Elgas     12   29   15    7    7    3    9    6   10    1
Cons       0    0    0    0    0    0    0    0    0    0
Whol     500 1170  720  513  516  245  519  413  421   53
Tran     407 1019  491  371  254  159  386  114   81   22
Oser     142  313  258  186  170   93  131  115  120   27       ;

PARAMETER
          A(I,J)           INPUT-OUTPUT COEFFICIENTS
          TD0(J)           INDIRECT TAX ON DOMESTIC COMMODITIES
          TM0(J)           TARIFF ON IMPORTS
          TC0(J)           TARIFF ON IMPORTS FROM CEE
          TR0(J)           TARIFF ON IMPORTS FROM ROW
          TEC0(J)          TARIFF ON EXPORTS IMPOSED BY CEE
          ETAC(I)          EXPORT DEMAND ELASTICITY BY THE EC
          AD(I)            PRODUCTION FUNCTION SHIFT PARAMETER
          ADS(I)           PRODUCTION FUNCTION SHIFT PARAMETER ADJUSTED
          ARM(J)           ARMINGTON SHIFT PARAMETER
          ARMM(J)          IMPORT SHIFT PARAMETER
          GAMMA(I)         PRODUCTION FUNCTION SHARE PARAMETER
          ELA(I)           CET ELASTICITY
          ELAE(I)          EXPORT CET ELASTICITY
          EPSI(J)          ARMINGTON ELASTICITY
          EPSIM(J)         ELASTICITY BETWEEN DIFFERENT IMPORTS
          BETA(J)          ARMINGTON SHARE PARAMETER
          SIGMA(I)         PRODUCTION ELASTICITY
          OMEGA(C)         LABOUR SUPPLY ELASTICITY
          IMPDOM(J)        USED FOR BETA
          ICEEIROW(J)      USED FOR ALFA
          KSHR(J)          INVESTMENT SHARES
          GBS(J)           GOVERNMENT CONSUMPTION SHARES
          ALAK(I)          USED FOR GAMMA
          CESV(I)          USED FOR AD
          ALFA(J)          IMPORT SHARE PARAMETER
          DTAX             DIRECT TAX RATE
          MPSH             MARGINAL PROPENSITY TO SAVE HH
          HBS(J)           HOUSEHOLD CONSUMPTION SHARES
          ALFAE(I)         CET SHARE PARAMETER
          CETA(I)          CET FUNCTION
          CETS(I)          CET SHIFT PARAMETER
          EDOM(I)          EXPORT DOMESTIC GOODS RATIO
          SHARE(I)         CET ON EXPORTS SHARE PARAMETER
          CETAE(I)         CET EXPORT FUNCTION
          SHIFT(I)         CET EXPORT SHIFT PARAMETER
          EDOME(I)         EXPORT EU ROW RATIO
          LFSHARE(IRS)     SHARE OF FIXED LABOUR COST
```

```
*DUMMIES TO HOLD INITIAL DATA

          LEONTIEF(J,I) INTERMEDIATE DEMAND MATRIX
          X0(J)         INTERMEDIATE DEMAND
          INDTAX0(J)    INDIRECT TAXES
          DOM0(J)       DOMESTIC OUTPUT
          DO0(J)        DOMESTIC OUTPUT INCLUDING EXPORTS
          TARIF0(J)     TARIFFS
          PECW0(I)      WORLD PRICE FOR EXPORTS TO EEC
          PE0(I)        PRICE OF COMPOSITE EXPORTS
          PERW0(I)      WORLD PRICE FOR EXPORTS TO ROW
          PWM0(J)       WORLD PRICE FOR IMPORTS
          IMP0(J)       IMPORTS
          ICEE0(J)      IMPORT FROM CEE
          IROW0(J)      IMPORT FROM ROW
          PY0(I)        OUTPUT PRICE
          P0(J)         CMP COMMODITY PRICE
          PV0(I)        VALUE ADDED PRICE
          WAGE0(I)      WAGE DEF
          RENT0(I)      RENT DEF
          PD0(I)        DOMESTIC PRICE
          PM0(I)        IMPORT PRICE
          PC0(J)        IMPORT PRICE FROM EU
          PR0(J)        IMPORT PRICE FROM ROW
          PEC0(I)       EXPORT PRICE TO EU
          PERW0(I)      EXPORT PRICE TO ROW
          Y00(I)        PRODUCTION IN NOMINAL TERMS
          Y0(I)         PRODUCTION IN REAL TERMS
          AL0(I)        LABOUR FORCE
          AK0(I)        CAPITAL
          Q0(J)         COMPOSITE COMMODITIES
          E0(J)         EXPORTS
          TOTECEE0(J)   EXPORTS PLUS VERs TO EU
          ECEE0(J)      EXPORTS TOWARDS EU
          EROW0(J)      EXPORTS TOWARDS ROW
          HR0           HOUSEHOLD REVENUE
          HC0(J)        HOUSEHOLD CONSUMPTION
          THC0          TOTAL HOUSEHOLD CONSUMPTION
          GC0(J)        GOVERNMENT CONSUMPTION
          TGC0          TOTAL GOVERNMENT CONSUMPTION
          Z0(J)         INVESTMENT BY SECTOR OF ORIGIN
          INV0          TOTAL INVESTMENT BY SECTOR OF ORIGIN
          THG0          GOVERNMENT TRANSFERS TO HOUSEHOLDS
          THW0          ROW TRANSFERS TO HOUSEHOLDS
          LINC0(C,I)    LABOUR INCOME BY CATEGORY
          ALAB0(I)      LABOUR BY SECTOR
          AKAP0(I)      OPERATING URPLUS
          FKINC0        CAPITAL INCOME
          FLINC0        LABOUR INCOME
          HR0           HOUSEHOLD REVENUE
          HCM0(J)       HOUSEHOLD CONSUMPTION MATRIX
          HHC0          HOUSEHOLD CONSUMPTION
          HTAX0         PRIVATE DIRECT TAXES
          TDTH0         TOTAL PRIVATE DIRECT TAXES
          HS0           HOUSEHOLS SAVINGS
          DEPREC0       CAPITAL DEPRECIATION PLUS FIRM SAVINGS
          TGK0          NET GOVERNMENT TRANSFERS TO CAPITAL-FIRMS
          TWK0          NET ROW TRANSFERS TO CAPITAL-FIRMS
          TKINC0        TOTAL CAPITAL INCOME
          RENTVER0      RENT ON VERS
          GOODMKTEQ(J)  EQUILIBRIUM IN THE GOODS MARKET

* DUMMIES TO HOLD INITIAL DATA FOR OLIGOPOLISTIC FIRMS

          PROFIT0(IRS)  SECTORAL PROFITS
          VERRENT0(IRS) RENT ON VER
          MC0(IRS)      MARGINAL COST
          AKF0(IRS)     FIXED AGGREGATE CAPITAL
          ALF0(IRS)     FIXED AGGREGATE LABOUR
          AVC0(IRS)     AVERAGE COSTS
          n0(i)         NUMBER OF SYMMETRIC DOMESTIC FIRMS
          elas0(IRS)    DEMAND ELASTICITY FACING FIRMS FOR DOMESTIC OUTPUT
          elase0(IRS)   DEMAND ELASTICITY FACING FIRMS FOR EXPORTS
          FIXED0(IRS)   FIXED COSTS
          PCM(IRS)      PRICE COST MARGIN
          fi(irs)       ELASTICITY OF SUBSTITUTION AMONG BRANDS
          fie(irs)      CES AMONG BRANDS FACED BY A FOREIGN CONSUMER
```

```
* VARIABLES PER FIRM

           ys0(i)        output
           l0(i)         labour
           k0(i)         capital
           lf0(irs)      fixed labour
           kf0(irs)      fixed capital
           fix0(irs)     fixed costs
           ;


***************************************************
*                                                 *
** CALIBRATION OF ALL SHIFT AND SHARE PARAMETERS **
*                                                 *
***************************************************

* GET TEC0, RENTVER0

TEC0(I) = VARIE(I,'EXPECDUTY');
TOTECEE0(I) = VARIE(I,'EXPEC15');
RENTVER0(I) = TEC0(I)*TOTECEE0(I)/(1+TEC0(I));

DISPLAY TEC0, RENTVER0;

* GET A(I,J),

LEONTIEF(J,I) = IO(J,I);
LINC0(C,I) = LABINC(C,I);
ALAB0(I) = SUM(C,LINC0(C,I));
AKAP0(I) = LABINC('CAPITAL',I) - RENTVER0(I);
Y0(I) = ALAB0(I) + AKAP0(I) + SUM(J,LEONTIEF(J,I));
A(J,I) = LEONTIEF(J,I)/Y0(I);

DISPLAY A;

*********************************************************************
*
*                SECTORS WITH COMPETITIVE MARKETS - CRS
*
*********************************************************************

* GET  GAMMA, AD

SIGMA(CRS) = VARIE(CRS,'SIGMA') ;
AL0(CRS) = SUM(C,LINC0(C,CRS));
AK0(CRS) = AKAP0(CRS);
ALAK(CRS) = (AL0(CRS)/AK0(CRS))**(1/SIGMA(CRS));
GAMMA(CRS) = ALAK(CRS)/(1+ALAK(CRS));
CESV(CRS)$GAMMA(CRS) = (GAMMA(CRS)*AL0(CRS)**((SIGMA(CRS)-1)/SIGMA(CRS)) +
(1-GAMMA(CRS))*AK0(CRS)**((SIGMA(CRS)-1)/SIGMA(CRS)))**(SIGMA(CRS)/(SIGMA(CRS)-1));
AD(CRS)$CESV(CRS) = Y0(CRS)/CESV(CRS);
ADS(CRS) = AD(CRS)**((SIGMA(CRS)-1)/SIGMA(CRS));

*********************************************************************
*
*       SECTORS WITH MARKET STRUCTURE FACING FIXED COSTS - IRS
*
*********************************************************************

SIGMA(IRS) = VARIE(IRS,'SIGMA') ;
ALF0(IRS) = LABINC('PROF',IRS) + LABINC('MANA',IRS) + LABINC('WHITE',IRS);
LFSHARE(IRS) = ALF0(IRS) / SUM(C,LINC0(C,IRS)); DISPLAY LFSHARE;
AL0(IRS) = SUM(C,LINC0(C,IRS)) - ALF0(IRS);
AKF0(IRS) = 0.15*Y0(IRS);
AK0(IRS) = AKAP0(IRS) - AKF0(IRS);
ALAK(IRS) = (AL0(IRS)/AK0(IRS))**(1/SIGMA(IRS));
GAMMA(IRS) = ALAK(IRS)/(1+ALAK(IRS));
CESV(IRS)$GAMMA(IRS) = (GAMMA(IRS)*AL0(IRS)**((SIGMA(IRS)-1)/SIGMA(IRS)) +
(1-GAMMA(IRS))*AK0(IRS)**((SIGMA(IRS)-1)/SIGMA(IRS)))**(SIGMA(IRS)/(SIGMA(IRS)-1));
AD(IRS)$CESV(IRS) = Y0(IRS)/CESV(IRS);
ADS(IRS) = AD(IRS)**((SIGMA(IRS)-1)/SIGMA(IRS));

DISPLAY AD, ADS, GAMMA, SIGMA, ALF0, AL0, AKF0, AK0;
```

```
* GET MAIN VARIABLES

INDTAX0(I) = VARIE(I,'IND-TAX');
TARIF0(J) = VARIE(J,'DUTY');
DOM0(J) = VARIE(J,'DOM-COM');
DO0(J) = (DOM0(J) - INDTAX0(J));
IMP0(J) = (VARIE(J,'IMPORT'));
Q0(J) = (IMP0(J) + DO0(J));
TOTECEE0(I) = VARIE(I,'EXPEC15');
ECEE0(I) = (TOTECEE0(I) - RENTVER0(I));
E0(I) = (VARIE(I,'EXPORT') - RENTVER0(I)) ;
EROW0(I) = E0(I)-ECEE0(I);
Y00(I) = E0(I) + DO0(I);

DISPLAY Y0, Y00;


* GET TD, HCM

*TD0(J) = INDTAX0(J)/(PM0(J)*IMP0(J) + PD0(J)*DO0(J));
TD0(J) = INDTAX0(J)/(IMP0(J) + DO0(J)); DISPLAY TD0;
HCM0(J) = SUM(HH,HHCONSUM(J,HH))/(1 + TD0(J));


*****************************************************************************
* GET MURKUP VARIABLES
*
EPSI(J) = VARIE(J,'EPSI'); ETAC(IRS) = VARIE(IRS,'ETAC');
fi(irs) = 8; fie(irs) = 8; n0(irs) = 20;
*
*****************************************************************************
*                                                                           *
*                          COURNOT                                          *
*                                                                           *
elas0(irs) = ( 1/fi(irs) + ( 1/EPSI(IRS) - 1/fi(irs) ) / n0(irs) +
             ( Q0(IRS)/HCM0(IRS) - 1/EPSI(IRS) ) *
               DO0(IRS)/( n0(irs)*Q0(IRS)*(1+TD0(IRS)) ) )**(-1);

elase0(irs) = ( 1/fie(irs) + (1/ETAC(IRS) - 1/fie(irs))/n0(irs) )**(-1);
*****************************************************************************

*****************************************************************************
*                                                                           *
*                          BERTRAND                                         *
*                                                                           *

*elas0(irs) = (1 - 1/n0(irs))*fi(irs) +
*            ( (1 - DO0(IRS)/Q0(IRS)*(1+TD0(IRS)))*EPSI(IRS) +
*              (HCM0(IRS)/Q0(IRS))*DO0(IRS)/Q0(IRS)*(1+TD0(IRS)) ) / n0(irs);

*elase0(irs) = fie(irs) + ( ETAC(IRS) - fie(irs) ) / n0(irs) ;
*****************************************************************************
*
DISPLAY elas0, elase0;
*****************************************************************************


* GET PRICES AND COST EQUATIONS

MC0(IRS) = (((GAMMA(IRS)**SIGMA(IRS)) + ((1-GAMMA(IRS))**SIGMA(IRS)))
           **(1/(1-SIGMA(IRS))))/AD(IRS) + SUM(J,A(J,IRS));

PD0(IRS) = MC0(IRS) / (1 - 1/elas0(irs));
PEC0(IRS) = MC0(IRS) / (1 - 1/elase0(irs));
PD0(CRS) = 1; PEC0(CRS) = 1 ; PERW0(CRS) = 1;
PERW0(IRS) = PD0(IRS);
PE0(I)$T(I) = ( PEC0(I)*ECEE0(I) + PERW0(I)*EROW0(I) ) / E0(I);
PY0(I) = ( PD0(I)*DO0(I) + PE0(I)*E0(I) ) / Y0(I);
AVC0(IRS) = PY0(IRS);
P0(J) = (1 + TD0(J))*PD0(J);
PM0(J) = PD0(J);
PC0(J) = PD0(J);
PR0(J) = PD0(J);
PECW0(I) = PEC0(I)*(1 + TEC0(I) );
PV0(I) = (((GAMMA(I)**SIGMA(I)) + ((1-GAMMA(I))**SIGMA(I)))
          **(1/(1-SIGMA(I))))/AD(I);
DISPLAY MC0, AVC0, PY0, PV0, PECW0;
```

```
* GET WAGE, RENT, FIXED AND AVERAGE COSTS, PROFITS
WAGE0(CRS) = ADS(CRS)*GAMMA(CRS)*PV0(CRS)*(Y0(CRS)/AL0(CRS))**(1/SIGMA(CRS));
RENT0(CRS) = ADS(CRS)*(1-GAMMA(CRS))*PV0(CRS)*(Y0(CRS)/AK0(CRS))**(1/SIGMA(CRS));

WAGE0(IRS) = ADS(IRS)*GAMMA(IRS)*PV0(IRS)*
             (Y0(IRS)/AL0(IRS))**(1/SIGMA(IRS));
RENT0(IRS) = ADS(IRS)*(1-GAMMA(IRS))*PV0(IRS)*
             (Y0(IRS)/AK0(IRS))**(1/SIGMA(IRS));

FIXED0(IRS) = AVC0(IRS)*Y0(IRS) - WAGE0(IRS)*AL0(IRS) - RENT0(IRS)*AK0(IRS) -
              SUM(J,A(J,IRS))*Y0(IRS);

DISPLAY  WAGE0, RENT0, FIXED0;


* GET BETA FROM COSTMIN, Q0 FROM ABSORPTION, ARM FORM ARMINGTON

IMPDOM(T) = (IMP0(T)/DO0(T))**(1/EPSI(T));
BETA(T) = IMPDOM(T)/(1+IMPDOM(T));
ARM(T) = Q0(T)/((BETA(T)*IMP0(T)**((EPSI(T)-1)/EPSI(T))
         + (1-BETA(T))*DO0(T)**((EPSI(T)-1)/EPSI(T)))
         **(EPSI(T)/(EPSI(T)-1)));
DISPLAY ARM;


* GET TM

TM0(J)$T(J) = TARIF0(J)/(PM0(J)*IMP0(J)-TARIF0(J));
PWM0(J) = PM0(J)/(1 + TM0(J));
TC0(J) = TM0(J);
TR0(J) = TM0(J);

DISPLAY TM0;


* GET ALFAE AND CETS FROM CET FUNCTION

ELA(I)$T(I) = 2.9;
EDOM(I)$T(I) =(DO0(I)/E0(I))**(1/ELA(I));
ALFAE(I)$T(I) = EDOM(I)/(1+EDOM(I)) ;
CETA(I)$T(I) = (ALFAE(I)*E0(I)**((ELA(I)+1)/ELA(I)) +
          (1-ALFAE(I))*DO0(I)**((ELA(I)+1)/ELA(I)))**(ELA(I)/(ELA(I)+1));
CETS(I)$T(I) = Y0(I)/CETA(I);
DISPLAY ALFAE, CETS;


* GET SHARE AND SHIFT FROM CET FUNCTION

ELAE(I)$T(I) = 5 ;
EDOME(I)$T(I) =(EROW0(I)/ECEE0(I))**(1/ELAE(I));
SHARE(I)$T(I) = EDOME(I)/(1+EDOME(I)) ;
CETAE(I)$T(I) = (SHARE(I)*ECEE0(I)**((ELAE(I)+1)/ELAE(I)) +
         (1-SHARE(I))*EROW0(I)**((ELAE(I)+1)/ELAE(I)))**(ELAE(I)/(ELAE(I)+1));
SHIFT(I)$T(I) = E0(I)/CETAE(I);
DISPLAY SHARE, SHIFT;


* GET ALFA AND ARMM BY INCLUDING TARIFFS IN ICEE AND IROW

ICEE0(J) = (VARIE(J,'IMPEC15')*(1+TC0(J)));
IROW0(J) = (IMP0(J)-ICEE0(J));
EPSIM(T) = 5;
ICEEIROW(T) = (ICEE0(T)/IROW0(T))**(1/EPSIM(T));
ALFA(T) = ICEEIROW(T)/(1+ICEEIROW(T));
ARMM(T) = IMP0(T)/((ALFA(T)*ICEE0(T)**((EPSIM(T)-1)/EPSIM(T))
          + (1-ALFA(T))*IROW0(T)**((EPSIM(T)-1)/EPSIM(T)))
          **(EPSIM(T)/(EPSIM(T)-1)));
DISPLAY ALFA, ARMM;

******************************************************************************
*                              VARIABLES PER FIRM
******************************************************************************

n0(crs) = 1;
ys0(i) = Y0(I)/n0(i);
l0(i) = AL0(I)/n0(i);
```

```
k0(i) = AK0(I)/n0(i);
lf0(irs) = ALF0(IRS)/n0(irs);
kf0(irs) = AKF0(IRS)/n0(irs);
fix0(irs) = FIXED0(IRS)/n0(irs);
****************************************************************************

* GET SHHK
TGK0 = 10418;
TWK0 = 1606;
DEPREC0 =  47685;

* GET DTAX
THG0 = SUM(HH,HHINCOME(HH,"GOV"));
THW0 = SUM(HH,HHINCOME(HH,"ROW")) ;
PROFIT0(IRS) = (PY0(IRS)-AVC0(IRS))*Y0(IRS) ;
VERRENT0(IRS) = TEC0(IRS)*ECEE0(IRS);
FKINC0 = SUM(IRS,RENT0(IRS)*(AK0(IRS) + AKF0(IRS))) +
         SUM(CRS,RENT0(CRS)*AK0(CRS)) +  TGK0 + TWK0 - DEPREC0 ;
FLINC0 = SUM(CRS,WAGE0(CRS)*AL0(CRS)) +
         SUM(IRS,WAGE0(IRS)*(AL0(IRS) + ALF0(IRS)));
HR0 = 334836 ;
HTAX0 = SUM(HH,HHCONSUM("HTAX",HH));
DTAX = HTAX0/HR0; DISPLAY DTAX;

***************************************************************************
*  The absorption in the SAM contains VAT. This must be extracted to get an
*  equilibrium in the goods market.
*  Remember that  (1 + TD0(J)) = P0(J)/PD0(J)
***************************************************************************

* GET MPSH, HBS
HHC0 = SUM(J,(1 + TD0(J))*HCM0(J));
HBS(J)$HCM0(J) = (1 + TD0(J))*HCM0(J)/HHC0; DISPLAY HBS;
HS0 = SUM(HH,HHCONSUM("SAV",HH));
MPSH = HS0/(HR0-HTAX0); DISPLAY MPSH;

* GET KSHR
Z0(J) = VARIE(J,"CAP-ACC")/(1 + TD0(J));
INV0 = SUM(J,(1 + TD0(J))*Z0(J));
KSHR(J) = (1 + TD0(J))*Z0(J)/INV0; DISPLAY KSHR;

* GET GBS
GC0(J) = VARIE(J,"GCON")/(1 + TD0(J));
TGC0 = SUM(J,(1 + TD0(J))*GC0(J));
GBS(J) = (1 + TD0(J))*GC0(J)/TGC0; DISPLAY GBS;

* GET X0
X0(J) = SUM(I,LEONTIEF(J,I))/(1 + TD0(J));

* EQUILIBRIUM IN THE GOODS MARKET
GOODMKTEQ(J) = Q0(J) - (HCM0(J) + GC0(J) + Z0(J) + X0(J));
DISPLAY GOODMKTEQ;

*************************************
*                                   *
**          VARIABLES              **
*                                   *
*************************************

FREE VARIABLES
           THG          GOVERNMENT TRANSFERS TO HOUSEHOLDS
           THW          REMITTANCES FROM ABROAD
           HS           HOUSHOLD SAVINGS
           GS           GOVERNMENT SAVINGS
           WS           FOREIGN SAVINGS
           Z(J)         INVESTMENT BY SECTOR OF ORIGIN
           TWG          GOVERNMENT TRANSFERS ABROAD
           AGLAB        EXCESS DEMAND FOR LABOUR
           AGCAP        EXCESS DEMAND FOR CAPITAL

*WELFARE INDICATOR FOR OBJECTIVE FUNCTION
           UTILITY      OBJECTIVE FUNCTION VARIABLE ;

POSITIVE VARIABLE

           MC(IRS)       MARGINAL COST
           AVC(IRS)      AVERAGE COSTS
```

```
          fix(irs)        FIXED COSTS
          n(i)            NUMBER OF SYMMETRIC FIRMS
          E(I)            EXPORTS
          elas(irs)       FIRM PERCEIVED PRICE ELASTICITY FOR DOMESTIC OUTPUT
          elase(irs)      FIRM PRECEIVED PRICE ELASTICITY FOR EXPORTS
          TD(I)           INDIRECT TAX ON DOMESTIC CONSUMPTION
          TC(J)           TARIFF ON IMPORTS FROM CEE
          TR(J)           TARIFF ON IMPORTS FROM ROW
          TEC(J)          TARIFF ON EXPORTS IMPOSED BY CEE
          PEC(I)          PRICE OF EXPORTS TO THE EC
          PECW(IRS)       WORLD PRICE OF EXPORTS TO THE EC
          PERW(I)         PRICE OF EXPORTS TO THE ROW
          PV(I)           NET OR VALUE ADDED PRICE
          P(J)            COMPOSITE PRICE OF COMMODITY J
          PD(J)           DOMESTIC PRICE OF COMMODITY
          PM(J)           DOMESTIC PRICE OF IMPORT
          PC(J)           DOMESTIC PRICE OF IMPORT FROM CEE
          PE(I)           DOMESTIC PRICE OF EXPORTS
          PR(J)           DOMESTIC PRICE OF IMPORT FROM ROW
          PY(I)           DOMESTIC PRICE OF DOMESTIC OUTPUT
          WAGE            WAGE
          RENT            RENT
          PWM(J)          WORLD PRICE OF COMMODITY M IMPORTED
          CPI             LEYSPERES PRICE INDEX OF DOMESTIC GOODS
          X(J)            INTERMEDIATE INPUTS DEMAND
          ys(i)           DOMESTIC PRODUCTION OF COMPOSITE GOODS
          l(i)            COMPENSATION OF EMPLOYEES
          k(i)            OPERATING SURPLUS
          D(J)            DOMESTIC DEMAND OF COMMODITIES
          IMP(J)          IMPORTS
          ICEE(J)         IMPORT FROM EC
          IROW(J)         IMPORT FROM ROW
          Q(J)            COMPOSITE COMMODITY
          EEU(I)          EXPORTS TOWARDS CEE
          EROW(I)         EXPORTS TOWARDS ROW
          FKINC           FACTOR INCOME
          FLINC           LABOUR INCOME
          HR              HOUSEHOLD INCOME
          HCM             HOUSEHOLD CONSUMPTION MATRIX
          SAV             AGGREGATE SAVINGS
          INV             AGGREGATE INVESTMENT ON J
          INTAX           INDIRECT TAX ON VALUE ADDED NET OF EXPORTS
          TDTH            DIRECT TAXES ON HOUSEHOLD INCOME
          TARIF           TARIFFS ON IMPORTS
          DEPREC          DEPRECIATION
          TGK             NET GOVERNMENT TRANSFERS TO CAPITAL-FIRMS
          TWK             NET ROW TRANSFERS TO CAPITAL-FIRMS
          R               GOVERNMENT INCOME
          GC(J)           GOVERNMENT CONSUMPTION
          TGCON           TOTAL GOVERNMENT CONSUMPTION
          HC(J)           HOUSEHOLD CONSUMPTION
          PROFIT(IRS)     PROFITS RATE
          VERRENT(IRS)    RENT ON VERs
          ;

******************************
*                            *
**        EQUATIONS         **
*                            *
******************************

EQUATIONS

** Price Equations

        ABSORPT(J)         VALUE OF DOMESTIC SALES
        PMDEF(J)           DEFINITION OF DOMESTIC IMPORT PRICE
        PCDEF(J)           DEFINITION OF DOMESTIC IMPORT PRICE FROM EU
        PRDEF(J)           DEFINITION OF DOMESTIC IMPORT PRICE FROM ROW
        PYDEF(I)           DEFINITION OF PRODUCER PRICE
        PEDEF(I)           DEFINITION OF PRICE FOR EXPORTS
        PDDEF(IRS)         DEFINITION OF DOMESTIC PRICE
        COURNOTD(IRS)      FIRM PERCEIVED PRICE ELASTICITY FOR DOMESTIC OUTPUT
*         BERTRAND(IRS)      FIRM PERCEIVED PRICE ELASTICITY FOR DOMESTIC OUTPUT
        PECDEF(IRS)        DEFINITION OF WORLD PRICE FOR EXPORTS TO THE EC
        COURNOTE(IRS)      FIRM PERCEIVED PRICE ELASTICITY FOR EXPORTS
*         BERTRANE(IRS)      FIRM PERCEIVED PRICE ELASTICITY FOR EXPORTS
```

```
          PECWDEF(IRS)        DEFINITION OF PRICE FOR EXPORTS TO THE EC
          PVADEF(I)           DEFINITION OF ACTIVITY OR VALUE ADDED PRICE
          CPINDEX             LEYSPERES PRICE INDEX OF DOMESTIC GOODS


** Production and Factor Inputs Equations

          OUTPUTCR(CRS)       GROSS DOMESTIC OUTPUT CRS
          AGGLCRS(CRS)        AGGREGATE LABOUR DEFINITION BY CATEGORY - CRS
          AGGKCRS(CRS)        AGGREGATE CAPITAL DEFINITION BY CATEGORY - CRS
*           OUTPUTIR(IRS)       GROSS DOMESTIC OUTPUT IRS
          AGGLIRS(IRS)        AGGREGATE LABOUR DEFINITION BY CATEGORY - IRS
          AGGKIRS(IRS)        AGGREGATE CAPITAL DEFINITION BY CATEGORY - IRS
          MARGCOST(IRS)       MARGINAL COSTS
          AVCDEF(IRS)         AVERAGE COSTS
          FIXEDCOST(IRS)      FIXED COSTS

** TRADE EQUATIONS

          ARMINGTON(T)        ARMINGTON CES SPECIFICATION TRADABLES
          ARMINGTONT(NT)      ARMINGTON CES SPECIFICATION NONTRADABLES
          COSTMIN(T)          COST MINIMIZATION FOR COMPOSITE GOOD
          ARMINGIMP(T)        CES SPECIFICATION FOR IMPORTS
          COMIMP(T)           COST MINIMIZATION FOR COMPOSITE IMPORT
          CET(I)              CET SPECIFICATION FOR TRADABLES
          EXPCET(I)           CET SPECIFICATION FOR EXPORTS
          CETNT(NT)           CET SPECIFICATION FOR NONTRADABLES
          EXPORT(I)           EXPORT SALE MAXIMIZATION
          ECDEMAND(IRS)       EXPORT DEMAND BY EC

** Income Equations

          VERRENTS(IRS)       RENT ON VERs
          FACKINC             CAPITAL INCOME
          FACLINC             LABOUR INCOME
          HHINC               HOUSEHOLD INCOME

** Tax equations

          DIRTH               DIRECT TAXES ON HOUSEHOLD INCOME
          INDTAX              INDIRECT TAXES ON VALUE ADDED
          TARIFFS             TARIFF ON IMPORTS
          GYDEF               GOVERNMENT INCOME

** Savings and Investment Equations

          SAVDEF              AGGREGATE SAVINGS
          HHSDEF              HOUSEHOLDS SAVINGS
          GSDEF               GOVERNMENT SAVINGS
          ZDEFC(CRS)          INVESTMENT BY SECTOR OF ORIGIN
          ZDEFI(IRS)          INVESTMENT BY SECTOR OF ORIGIN


** Expenditure Equations

          INTDEF(J)           INTERMEDIATE DEMAND
          HHCDEFC(CRS)        HOUSEHOLD CONSUMPTION
          HHCDEFI(IRS)        HOUSEHOLD CONSUMPTION
          GOVCDEFC(CRS)       GOVERNMENT CONSUMPTION
          GOVCDEFI(IRS)       GOVERNMENT CONSUMPTION

** Market Clearing Conditions

          LABMARKET           LABOUR MARKET EQUILIBRIUM
          CAPMARKT            CAPITAL MARKET EQUILIBRIUM
          GOODEQC(CRS)        CRS GOODS MARKET EQUILIBRIUM
          GOODEQI(IRS)        IRS GOODS MARKET EQUILIBRIUM
          BOPEQ               BALANCE OF PAYMENT EQUILIBRIUM
          SAVINVEQ            SAVINGS INVESTMENT EQUILIBRIUM
          PROFEQ(IRS)         PROCE EQUALS AVERAGE COST

** Objective Function

          OBJ                 OBJECTIVE FUNCTION ;
```

```
** EQUATION ASSIGNMENT

** Price Equations

ABSORPT(J)..       P(J)*Q(J) =E= (1 + TD(J))*(PM(J)*IMP(J) + PD(J)*D(J));
PMDEF(J)..         PM(J)*IMP(J) =E= PC(J)*ICEE(J) + PR(J)*IROW(J);
PCDEF(J)..         PC(J) =E= PWM(J)*(1+TC(J));
PRDEF(J)..         PR(J) =E= PWM(J)*(1+TR(J));

PYDEF(I)..         PY(I)*n(i)*ys(i) =E= PD(I)*D(I) + PE(I)*E(I) ;

PEDEF(I)$T(I)..    PE(I) =E= ( PEC(I)*EEU(I) + PERW(I)*EROW(I) )/E(I);

PDDEF(IRS)..       PD(IRS) =E= MC(IRS) / (1 - 1/elas(irs));

COURNOTD(IRS)..    elas(irs) =E= ( 1/fi(irs) +
                         ( 1/EPSI(IRS) - 1/fi(irs) ) / n(irs) +
                         ( Q(IRS)/HC(IRS) - 1/EPSI(IRS) ) *
                          PD(IRS)*D(IRS)/( n(irs)*P(IRS)*Q(IRS) ) )**(-1);

*BERTRAND(IRS)..    elas(irs) =E= (1 - 1/n(irs))*fi(irs) +
*              ( ( 1 - PD(IRS)*D(IRS)/(P(IRS)*Q(IRS)) )*EPSI(IRS) +
*           (HC(IRS)/Q(IRS))*PD(IRS)*D(IRS)/(P(IRS)*Q(IRS)) ) / n(irs);

PECDEF(IRS)..      PEC(IRS) =E= MC(IRS) / (1 - 1/elase(irs));

COURNOTE(IRS)..     elase(irs) =E= ( 1/fie(irs) +
                               ( 1/ETAC(IRS) - 1/fie(irs) ) / n(irs) )**(-1);

*BERTRANE(IRS)..    elase(irs) =E= fie(irs) + ( ETAC(IRS) - fie(irs) ) / n(irs) ;

PECWDEF(IRS)..     PECW(IRS) =E= PEC(IRS) * ( 1 + TEC(IRS) ) ;

PVADEF(I)..        PV(I) =E= (((GAMMA(I)**SIGMA(I))*WAGE**(1-SIGMA(I)) +
                         ((1-GAMMA(I))**SIGMA(I))*RENT**(1-SIGMA(I)))
                         **(1/(1-SIGMA(I))))/AD(I) ;

CPINDEX..          CPI =E= SUM(J,PD(J)*DO0(J))/SUM(J,PD0(J)*DO0(J));

** Production and Factor Inputs Equations

* CRS SECTORS

OUTPUTCR(CRS)..

        ys(crs) =E= AD(CRS)*(GAMMA(CRS)*l(crs)**((SIGMA(CRS)-1)/SIGMA(CRS)) +
                (1-GAMMA(CRS))*k(crs)**((SIGMA(CRS)-1)/SIGMA(CRS)))
                **(SIGMA(CRS)/(SIGMA(CRS)-1));
AGGLCRS(CRS)..

        l(crs) =E= ys(crs)*(ADS(CRS)*GAMMA(CRS)*PV(CRS)/WAGE)**SIGMA(CRS);


AGGKCRS(CRS)..

        k(crs) =E= ys(crs)*(ADS(CRS)*(1-GAMMA(CRS))*PV(CRS)/RENT)**SIGMA(CRS);

** IRS SECTORS

*OUTPUTIR(IRS)..
*        ys(irs) =E= AD(IRS)*(GAMMA(IRS)*l(irs)**((SIGMA(IRS)-1)/SIGMA(IRS)) +
*                (1-GAMMA(IRS))*k(irs)**((SIGMA(IRS)-1)/SIGMA(IRS)))
*                **(SIGMA(IRS)/(SIGMA(IRS)-1)) + lf0(irs) + kf0(irs);

AGGLIRS(IRS)..

         l(irs) =E= ys(irs)*(ADS(IRS)*GAMMA(IRS)*
                    PV(IRS)/WAGE)**SIGMA(IRS);
AGGKIRS(IRS)..

         k(irs) =E= ys(irs)*(ADS(IRS)*(1-GAMMA(IRS))*
                    PV(IRS)/RENT)**SIGMA(IRS);

MARGCOST(IRS)..  MC(IRS) =E= (((GAMMA(IRS)**SIGMA(IRS))*WAGE**(1-SIGMA(IRS))+
                       ((1-GAMMA(IRS))**SIGMA(IRS))*RENT**(1-SIGMA(IRS)))
                 **(1/(1-SIGMA(IRS))))/AD(IRS) + SUM(J,A(J,IRS)*P(J)/P0(J));
```

```
AVCDEF(IRS)..      AVC(IRS) =E= (WAGE*l(irs) + RENT*k(irs))/ys(irs) +
                              SUM(J,A(J,IRS)*P(J)/P0(J)) + fix(irs)/ys(irs);

FIXEDCOST(IRS)..   fix(irs) =E= WAGE*lf0(irs) + RENT*kf0(irs);

** TRADE EQUATIONS

ARMINGTON(T)..     Q(T) =E= ARM(T)*(BETA(T)*IMP(T)**((EPSI(T)-1)/EPSI(T)) +
             (1-BETA(T))*D(T)**((EPSI(T)-1)/EPSI(T)))**(EPSI(T)/(EPSI(T)-1));

ARMINGTONT(NT)..      Q(NT) =E= D(NT);

COSTMIN(T)..     IMP(T)/D(T) =E= (PD(T)/PM(T)*BETA(T)/(1-BETA(T)))**EPSI(T);

ARMINGIMP(T).. IMP(T) =E= ARMM(T)*(ALFA(T)*ICEE(T)**((EPSIM(T)-1)/EPSIM(T)) +
        (1-ALFA(T))*IROW(T)**((EPSIM(T)-1)/EPSIM(T)))**(EPSIM(T)/(EPSIM(T)-1));

COMIMP(T)..    ICEE(T)/IROW(T) =E= (PR(T)/PC(T)*ALFA(T)/(1-ALFA(T)))**EPSIM(T);

CET(I)$T(I)..      n(i)*ys(i) =E= CETS(I)*(ALFAE(I)*E(I)**((ELA(I)+1)/ELA(I)) +
               (1-ALFAE(I))*D(I)**((ELA(I)+1)/ELA(I)))**(ELA(I)/(ELA(I)+1));


EXPCET(I)$T(I)..     E(I) =E= SHIFT(I)*(SHARE(I)*EEU(I)**((ELAE(I)+1)/ELAE(I)) +
         (1-SHARE(I))*EROW(I)**((ELAE(I)+1)/ELAE(I)))**(ELAE(I)/(ELAE(I)+1));

CETNT(NT)..           YS(NT) =E= D(NT);

EXPORT(I)$TCRS(I)..    EEU(I)/EROW(I) =E=
                 ( (1-SHARE(I))*PEC(I)/(SHARE(I)*PERW(I)) )**ELAE(I);

ECDEMAND(IRS)..       EEU(IRS) =E= ECEE0(IRS)*(PECW0(IRS)/PECW(IRS))**ETAC(IRS);

** Income Equations

VERRENTS(IRS)..   VERRENT(IRS) =E= PEC(IRS)*TEC(IRS)*EEU(IRS)/PEC0(IRS);

FACKINC..      FKINC =E=  SUM(IRS,RENT*n(irs) * (k(irs) + kf0(irs)))+
                         SUM(CRS,RENT*n(crs)*k(crs)) +  TGK + TWK - DEPREC ;

FACLINC..      FLINC =E= SUM(CRS,WAGE*n(crs)*l(crs)) +
                       SUM(IRS,WAGE*n(irs) * (l(irs) + lf0(irs)));

HHINC..        HR =E= SUM(IRS,PROFIT(IRS)*n(irs)*ys(irs)) +
                  SUM(IRS,VERRENT(IRS)) + FLINC + FKINC + THG + THW  ;


** Tax equations

DIRTH..     TDTH =E= DTAX*HR;

INDTAX..    INTAX =E= SUM(J, TD(J)*(PM(J)*IMP(J)/PM0(J) + PD(J)*D(J)/PD0(J)) );

TARIFFS..   TARIF=E= SUM(J,TC(J)*PWM(J)*ICEE(J) + TR(J)*PWM(J)*IROW(J));

GYDEF..     R =E= TDTH + INTAX + TARIF ;


** Savings and Investment Equations

SAVDEF..              SAV =E= DEPREC + HS + GS + WS;

HHSDEF..              HS =E= MPSH*(1-DTAX)*HR;

GSDEF..               GS =E= R - TGCON - THG - TWG - TGK;


** Expenditure Equations

ZDEFC(CRS)..          (1+TD0(CRS))*Z(CRS) =E= KSHR(CRS)*INV;
ZDEFI(IRS)..          (1+TD0(IRS))*Z(IRS) =E= KSHR(IRS)*INV;

INTDEF(J)..            (1+TD0(J))*X(J) =E= SUM(I,A(J,I)*n(i)*ys(i));

HHCDEFC(CRS)..        HC(CRS) =E= HBS(CRS)*(1-MPSH)*(1-DTAX)*HR/P(CRS);
```

```
HHCDEFI(IRS)..       HC(IRS) =E= HBS(IRS)*(1-MPSH)*(1-DTAX)*HR*PD0(IRS)/P(IRS);

GOVCDEFC(CRS)..      (1+TD0(CRS))*GC(CRS) =E= GBS(CRS)*TGCON;
GOVCDEFI(IRS)..      (1+TD0(IRS))*GC(IRS) =E= GBS(IRS)*TGCON;

** Market Clearing Conditions

LABMARKET..      AGLAB =E= SUM(crs,n(crs)*l(crs)) +
                           SUM(irs,n(irs)*(l(irs) + lf0(irs)));

CAPMARKT..       AGCAP =E= SUM(crs,n(crs)*k(crs)) +
                           SUM(irs,n(irs)*(k(irs) + kf0(irs)));

GOODEQC(CRS)..       Q(CRS) =E= HC(CRS) + GC(CRS) + Z(CRS) + X(CRS);
GOODEQI(IRS)..       Q(IRS) =E= HC(IRS) + GC(IRS) + Z(IRS) + X(IRS);

BOPEQ..        SUM(I,PEC(I)*EEU(I)/PEC0(I)) + SUM(I,PERW(I)*EROW(I)/PERW0(I)) +
                    SUM(IRS,VERRENT(IRS)) + TWK + WS + THW  =E=
              SUM(J,PC(J)*ICEE(J)/PC0(J) + PR(J)*IROW(J)/PR0(J)) - TARIF + TWG;

SAVINVEQ..                 SAV =E= INV ;

PROFEQ(IRS)..              PY(IRS) =E= AVC(IRS) + PROFIT(IRS);

** Objective Function

OBJ..                UTILITY =E= 1 ;

*MODEL SETUP - INITIALIZATION

 n.L(crs) = 1;
 n.L(irs) = n0(irs);
 MC.L(IRS) = MC0(IRS);
 AVC.L(IRS) = AVC0(IRS);
 VERRENT.L(IRS) = VERRENT0(IRS);
 fix.L(irs) = fix0(irs);
 elas.l(irs) = elas0(irs);
 elase.l(irs) = elase0(irs);
 THG.L = THG0;
 THW.L = THW0;
 TWG.L = 6273;
 TGK.L = TGK0;
 TWK.L = TWK0;
 HS.L = HS0;
 DEPREC.L = DEPREC0;
 FKINC.L = FKINC0;
 FLINC.L = FLINC0;
 HR.L = HR0;
 HC.L(J) = HCM0(J);
 WS.L = 12859 ;
 INV.L = INV0;
 SAV.L = 102608;
 GC.L(J) = GC0(J);
 TGCON.L = TGC0;
 E.L(I) = E0(I);
 EEU.L(I) = ECEE0(I);
 EROW.L(I) = EROW0(I);
 GS.L = -11955;
 Z.L(J) = Z0(J);
 X.L(J) = X0(J);
 ys.L(i) = ys0(i);
 l.L(i) = l0(i);
 k.L(i) = k0(i);
 D.L(J) = DO0(J);
 IMP.L(J) = IMP0(J);
 ICEE.L(J) = ICEE0(J);
 IROW.L(J) = IROW0(J);
 Q.L(J) = Q0(J);
 TDTH.L = HTAX0;
 INTAX.L = SUM(J,INDTAX0(J));
 TARIF.L = SUM(J,TARIF0(J));
 TEC.L(I) = TEC0(I);
 TC.L(J) = TM0(J);
 TR.L(J) = TM0(J);
 TD.L(I) = TD0(I);
 R.L = 52520;
 AGLAB.L = SUM(CRS,AL0(CRS)) + SUM(IRS,AL0(IRS) + ALF0(IRS));
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```
AGCAP.L = SUM(CRS,AK0(CRS)) + SUM(IRS,AK0(IRS) + AKF0(IRS));

CPI.L = 1; PE.L(I) = PE0(I); PEC.L(I) = PEC0(I); PECW.L(IRS) = PECW0(IRS);
PERW.L(I) = PERW0(I); P.L(J) = P0(J); PD.L(J) = PD0(J); PM.L(J) = PM0(J);
PY.L(I) = PY0(I); PC.L(J) = PC0(J); PR.L(J) = PR0(J); PV.L(I) = PV0(I);
PWM.L(J) = PWM0(J); WAGE.L = 1; RENT.L = 1; P.LO(J) = 0.01; PC.LO(J) = 0.01;
PR.LO(J) = 0.01; PD.LO(J) = 0.01; PM.LO(J) = 0.01; PY.LO(I) = 0.01;
PEC.LO(I) = 0.01; PECW.LO(IRS) = 0.01; PV.LO(I) = 0.01;
WAGE.LO = 0.01; RENT.LO = 0.01; CPI.LO = 0.01;
PECW.UP(IRS) = PECW0(IRS) ;


*CLOSURE RULES

    CPI.FX = CPI.L;
    PWM.FX(J) = PWM.L(J) ;
    PERW.FX(I) = PERW.L(I) ;
    PEC.FX(CRS) = PEC.L(CRS) ;
    PROFIT.FX(IRS) = 0;
    TR.FX(J) = TR.L(J);
    TEC.FX(I) = TEC.L(I);
    TD.FX(J) = TD.L(J);
    THG.FX = THG.L;
    THW.FX = THW.L;
    TWG.FX = TWG.L;
    TGK.FX = TGK.L;
    TWK.FX = TWK.L;
    DEPREC.FX = DEPREC.L;
    IMP.FX(NT) = 0;
    ICEE.FX(NT) = 0;
    IROW.FX(NT) = 0;
    E.FX(NT) = 0;
    EEU.FX(NT) = 0;
    EROW.FX(NT) = 0;
    TGCON.FX = TGCON.L;
    WS.FX = WS.L ;
    GS.FX = GS.L;
    INV.FX = INV.L;
    AGLAB.FX = AGLAB.L;
    AGCAP.FX = AGCAP.L;
    n.FX(crs) = n.L(crs);

MODEL TURKAG90 SQUARE BASE MODEL / ALL / ;

SOLVE TURKAG90 MAXIMIZING UTILITY USING NLP;
```

Appendix 3.A Numerical model: the case of an export tax

This appendix reports the algebraic formulation of the numerical model employed to study the economic impact of the introduction of the RHK export tax in Turkish textiles and apparel. The appendix has been split into six sections: (i) equations related to prices and costs; (ii) equations related to production and factor demand; (iii) equations related to domestic and foreign trade; (iv) equations related to income; (v) equations related to final demand and intermediate demand; (vi) equations related to the market clearing conditions.

[3.A.1] Price and cost equations

(3.A1) $$p_j = \Delta_j^{-1}\left[\varphi_j^{\varepsilon_j}\overline{pwm}_j^{1-\varepsilon_j} + (1-\varphi_j)^{\varepsilon_j} pd_j^{1-\varepsilon_j}\right]^{1/(1-\varepsilon_j)}$$

(3.A2) $$py_i y_i = pd_i\, D_i/n_i + (pwe_i - te_i)E_i/n_i$$

(3.A3) $$py_{crs} = \Lambda_{crs}^{-1}\left[\beta_{crs}^{\rho_{crs}} pd_{crs}^{1-\rho_{crs}} + (1-\beta_{crs})^{\rho_{crs}}\overline{pwe}_{crs}^{1-\rho_{crs}}\right]^{1/(1-\rho_{crs})}$$

(3.A4) $$pd_i\left(1-\frac{1+\lambda_i}{n_i\eta_i^d}\right) = c_i$$

(3.A5) $$pwe_i\left(1-\frac{1+\lambda_i}{n_i\eta_i^e}\right) = c_i$$

(3.A6) $$pv_j = \Theta_j^{-1}\left[\gamma_j^{\sigma_j} w^{1-\sigma_j} + (1-\gamma_j)^{\sigma_j} r^{1-\sigma_j}\right]^{1/(1-\sigma_j)}$$

(3.A7) $$c_i = pv_i + \sum_j a_{ji} p_j$$

(3.A8) $$ac_i = \left[w\left(l_i + l_i^f\right) + r\left(k_i + k_i^f\right) + \sum_j p_j a_{ji} y_i \right] \Big/ y_i$$

(3.A9) $$te_i = pwe_i \left\{ 1 - \frac{1+\lambda_i}{n_i \eta_i^e} \right\} - c_i$$

(3.A10) $$\eta_i^e = \xi_i + (1-\xi_i) \frac{\zeta_i^{\xi_i} pwe_i^{(1-\xi_i)}}{(1-\zeta_i)\chi_i^{(1-\xi_i)} + \zeta_i^{\xi_i} pwe_i^{(1-\xi_i)}}$$

(3.A11) $$\overline{\Lambda} = \frac{\sum_j pd_j \overline{D}_j}{\sum_j \overline{pd}_j \overline{D}_j}$$

[3.A.2] Production and factor demand equations

(3.A12) $$Y_{crs} = \Theta_{crs} \left[\gamma_{crs} AL_{crs}{}^{(\sigma_{crs}-1)/\sigma_{crs}} + (1-\gamma_{crs}) AK_{crs}{}^{(\sigma_{crs}-1)/\sigma_{crs}} \right]^{\sigma_{crs}/(\sigma_{crs}-1)}$$

(3.A13) $$AL_{crs} = \Theta_{crs}^{(\sigma_{crs}-1)} \gamma_{crs}^{\sigma_{crs}} w^{-\sigma_{crs}} pv_{crs}^{\sigma_{crs}} Y_{crs}$$

(3.A14) $$AK_{crs} = \Theta_{crs}^{(\sigma_{crs}-1)} (1-\gamma_{crs})^{\sigma_{crs}} r^{-\sigma_{crs}} pv_{crs}^{\sigma_{crs}} Y_{crs}$$

(3.A15) $$l_i = \Theta_i^{(\sigma_i-1)} \gamma_i^{\sigma_i} w^{-\sigma_i} pv_i^{\sigma_i} y_i$$

(3.A16) $$k_i = \Theta_i^{(\sigma_i-1)} (1-\gamma_i)^{\sigma_i} r^{-\sigma_i} pv_i^{\sigma_i} y_i$$

[3.A.3] Trade equations

(3.A17) $$Q_j = \Delta_j \left[\varphi_j M_j^{(\varepsilon_j-1)} + (1-\varphi_j) D_j^{(\varepsilon_j-1)} \right]^{\varepsilon_j/(\varepsilon_j-1)}$$

(3.A18) $$\frac{M_j}{D_j}=\left(\frac{1-\varphi_j}{\varphi_j}\right)^{-\varepsilon_j}\left(\frac{pd_j}{\overline{pwm_j}}\right)^{\varepsilon_j}$$

(3.A19) $$Y_{crs}=\Omega_{crs}\left[\beta_{crs}D_{crs}^{(\rho_{crs}+1)/\rho_{crs}}+(1-\beta_{crs})E_{crs}^{(\rho_{crs}+1)/\rho_{crs}}\right]^{\rho_{crs}/(\rho_{crs}+1)}$$

(3.A20) $$\frac{D_{crs}}{E_{crs}}=\left(\frac{\beta_{crs}}{1-\beta_{crs}}\right)^{-\rho_{crs}}\left(\frac{pd_{crs}}{\overline{pwe}_{crs}}\right)^{\rho_{crs}}$$

(3.A21) $$y_i=\frac{\Omega_i}{n_i}\left[\beta_i D_i^{(\rho_i+1)/\rho_i}+(1-\beta_i)E_i^{(\rho_i+1)/\rho_i}\right]^{\rho_i/(\rho_i+1)}$$

(3.A22) $$E_i=\left(\frac{\zeta_i}{1-\zeta_i}\right)^{-\xi_i}\left(\frac{\bar{\chi}_i}{pwe_i}\right)^{\xi_i}\overline{D_i^*}$$

[3.A.4] Income equations

(3.A23) $$\pi_i=(py_i-ac_i)y_i$$

(3.A24) $$HR=w\overline{LAB}+r\overline{CAP}+\sum_i n_i\pi_i+\sum_i te_iE_i$$

[3.A.5] Intermediate and final demand equations

(3.A25) $$X_j=\sum_{crs}a_{jcrs}Y_{crs}+\sum_i a_{ji}n_iy_i$$

(3.A26) $$C_j=\vartheta_j\frac{HR}{p_j}$$

[3.A.6] Market clearing conditions

(3.A27) $Q_j = C_j + X_j$

(3.A28) $\sum_{crs} \overline{pwe}_{crs} E_{crs} + \sum_i pwe_i E_i = \sum_j \overline{pwm}_j M_j$

(3.A29) $\overline{LAB} = \sum_{crs} AL_{crs} + \sum_i n_i^d \left(l_i + l_i^f \right)$

(3.A30) $\overline{CAP} = \sum_{crs} AK_{crs} + \sum_i n_i^d \left(k_i + k_i^f \right)$ with fixed costs

(3.A30a) $\overline{CAP} = \sum_{crs} AK_{crs} + \sum_i n_i^d k_i$ with sunk costs

(3.A31) $py_i = ac_i$

Variables (*):

ac_i	Average cost
AL_{crs}	Labour
AK_{crs}	Capital
c_i	Marginal cost
C_j	Private demand of goods
$\overline{CAP}$	Aggregate capital stock
D_j	Demand for domestic commodity
$\overline{D}_j$	Domestic commodities demanded in the base year
$\overline{D}_i^*$	Foreign domestic goods
E_i	Export demand
HR	Household revenues

k_i	Capital per domestic firm
l_i	Labour per domestic firm
$\overline{LAB}$	Aggregate labour
M_j	Imports
n_i	Number of firms
p_j	Price of the final and the intermediate good
$\overline{pd}_j$	Price of the domestic good in the base year
pd_j	Price of domestically produced commodity
pv_j	Value added price
py_j	Aggregate producer price
$\overline{pwe}_{crs}$	World price of exports
pwe_i	World price of exports
$\overline{pwm}_j$	World price of imports
Q_j	Composite commodity
r	Return to capital
X_j	Intermediate demand
y_i	Output per domestic firm
Y_{crs}	Output by the industry
w	Wage
$\overline{\chi}_i$	World price of similar exported goods
η_i^e	Price elasticity of export demand
π_i	Profit per domestic firm
$\overline{\Lambda}$	Numeraire

Parameters (*):

a_{jj}	Leontief input-output coefficients.
k_i^f	Fixed amount of capital per domestic firm
l_i^f	Fixed amount of labour per domestic firm
v_i	Conjectural variation shift parameter
β_j	Share parameter in the CET aggregation function
ε_j	Elasticity of substitution between imported and domestically produced
φ_j	Share parameter in the Armington trade aggregation function
γ_j	Share parameter in the CES production function
η_i^d	Price elasticity of domestic demand
λ_i	Conjectural variation parameter
ϑ_j	Household budget shares
ρ_j	CET elasticity in the production possibility frontier
σ_j	Elasticity of substitution among primary factors of production
ξ_i	Elasticity of substitution among exports and foreign domestic goods
ζ_i	Share parameter in the foreign Armington trade aggregation function
Δ_j	Shift parameter in the first nest Armington trade aggregation function
Θ_j	Shift parameter in the CES production function
Ω_j	Shift parameter in the CET aggregation function

(*) Parameter and variables with a bar are set exogenously. *crs* and *i* denote sectors facing constant and increasing returns to scale, respectively ($j = crs \cup i$).

Appendix 3.B The GAMS code: the case of an export tax

```
*(Sets, data set and calibration of some parameters can be found in Appendix 2.D)

$TITLE  TURKEYSAM: DISAGGREGATED TRADE MODEL - 1990

PARAMETER
          lamda0(irs)     CONJECTURAL VARIATION
          EPSI1(IRS)      ARMINGTON ELASTICITY IN THE FOREIGN REGION
          BETA1(IRS)      ARMINGTON SHARE PARAMETER IN THE FOREIGN REGION
          EXPDOM1(IRS)    USED FOR BETA1

*DUMMIES TO HOLD INITIAL DATA
          DO1(IRS)        FOREIGN PRODUCTION
          ELAS0(IRS)      PRICE ELASTICITY OF DOMESTIC DEMAND
          ETAC0(IRS)      PRICE ELASTICITY OF FOREIGN DEMAND
          PECW0(J)        WORLD PRICE FOR EXPORTS

*************************************************
*                                               *
** CALIBRATION OF SOME SHIFT AND SHARE PARAMETERS **
*                                               *
*************************************************

* GET ELASTICITIES AND MARK-UP VARIABLES

EPSI1('TEXT') = 2.2;
EPSI1('WEAR') = 4.4;
DO1('TEXT') = 796236;
DO1('WEAR') = 543903;
EXPDOM1(IRS) = (E0(IRS)/DO1(IRS))**(1/EPSI1(IRS));
BETA1(IRS) = EXPDOM1(IRS)/(1+EXPDOM1(IRS));
ETAC0(IRS) = EPSI1(IRS) + (1-EPSI1(IRS))*BETA1(IRS)**EPSI1(IRS) /
          ( (1-BETA1(IRS))**EPSI1(IRS) + BETA1(IRS)**EPSI1(IRS) )  ;
ELAS0(IRS) = ETAC0(IRS);
lamda0(irs) = 2 ;
PECW0(IRS) = MC0(IRS) / ( 1 - (1 + lamda0(irs))/(n0(irs)*ETAC0(IRS)) );

* GET PRICES

PECW0(CRS) = 1;
AVC0(IRS) = PECW0(IRS);
PD0(I) = PECW0(I); PM0(J) = PECW0(J); PY0(I) = PECW0(I) ;
```

```
************************************
*                                  *
**           VARIABLES            **
*                                  *
************************************

FREE VARIABLES
          THG           GOVERNMENT TRANSFERS TO HOUSEHOLDS
          THW           REMITTANCES FROM ABROAD
          HS            HOUSHOLD SAVINGS
          GS            GOVERNMENT SAVINGS
          WS            FOREIGN SAVINGS
          Z(J)          INVESTMENT BY SECTOR OF ORIGIN
          TWG           GOVERNMENT TRANSFERS ABROAD
          AGLAB         EXCESS DEMAND FOR LABOUR
          AGCAP         EXCESS DEMAND FOR CAPITAL

*WELFARE INDICATOR FOR OBJECTIVE FUNCTION
          UTILITY       OBJECTIVE FUNCTION VARIABLE ;

POSITIVE VARIABLE

          MC(IRS)        MARGINAL COST
          AVC(IRS)       AVERAGE COSTS
          tc(irs)        TOTAL COST
          n(i)           NUMBER OF SYMMETRIC FIRMS
          RVER(IRS)      EXPORT TAX REVENUES
          elas(irs)      DEMAND PRICE ELASTICITY
          ETAC(irs)      EXPORT PRICE ELASTICITY
          TD(I)          INDIRECT TAX ON DOMESTIC CONSUMPTION
          TEC(I)         OPTIMAL QUOTA PREMIUM - TAX ON EXPORTS
          PECW(I)        PRICE OF EXPORTS
          PV(I)          NET OR VALUE ADDED PRICE
          P(J)           COMPOSITE PRICE OF COMMODITY J
          PD(J)          DOMESTIC PRICE OF COMMODITY
          PM(J)          DOMESTIC PRICE OF IMPORT
          PY(I)          DOMESTIC PRICE OF DOMESTIC OUTPUT
          WAGE           WAGE
          RENT           RENT
          PWM(J)         WORLD PRICE OF COMMODITY M IMPORTED
          CPI            CONSUMER PRICE INDEX
          X(J)           INTERMEDIATE INPUTS DEMAND
          ys(i)          DOMESTIC PRODUCTION OF COMPOSITE GOODS
          l(i)           COMPENSATION OF EMPLOYEES
          k(i)           OPERATING SURPLUS
          DD(J)          DOMESTIC COMMODITIES
          IMP(J)         COMPOSITE IMPORTS
          profit(irs)    RETURN ON PROFITS
          Q(J)           COMPOSITE COMMODITY
          E(I)           EXPORTS
```

```
          lamda(irs)      CONJECTURAL VARIATION
          FKINC           FACTOR INCOME
          FLINC           LABOUR INCOME
          HR              HOUSEHOLD INCOME
          SAV             AGGREGATE SAVINGS
          INV             AGGREGATE INVESTMENT ON J
          INTAX(J)        INDIRECT TAX ON VALUE ADDED
          TDTH            DIRECT TAXES ON HOUSEHOLD INCOME
          TARIF           TARIFFS ON IMPORTS
          DEPREC          DEPRECIATION
          TGK             NET GOVERNMENT TRANSFERS TO CAPITAL-FIRMS
          TWK             NET ROW TRANSFERS TO CAPITAL-FIRMS
          R               GOVERNMENT INCOME
          GC(J)           GOVERNMENT CONSUMPTION
          TGCON           TOTAL GOVERNMENT CONSUMPTION
          HC(J)           HOUSEHOLD CONSUMPTION;

******************************
*                            *
**        EQUATIONS         **
*                            *
******************************

EQUATIONS

** Price and Cost Equations

        ABSORPT(J)          VALUE OF DOMESTIC SALES
        PMDEF(J)            DEFINITION OF DOMESTIC IMPORT PRICE
        PYDEFCRS(CRS)       DEFINITION OF PRODUCER PRICE IN CRS
        PYDEFIRS(IRS)       DEFINITION OF PRODUCER PRICE IN IRS
        PVADEF(I)           DEFINITION OF ACTIVITY OR VALUE ADDED PRICE
        MARKUPD(IRS)        MARKUP RULE FOR DOMESTIC OUTPUT
        MARKUPE(IRS)        MARKUP RULE FOR EXPORTS
        EXPDEMELA(IRS)      PRICE ELASTICITY OF EXPORT DEMAND
        MARGCOST(IRS)       MARGINAL COSTS
        OPTEXTAX(IRS)       OPTIMAL TAX ON EXPORTS
        AVCDEF(IRS)         AVERAGE COSTS
        TOTCOST(IRS)        FIXED COSTS
        CPINDEX             CONSUMER PRICE INDEX


** Production and Factor Inputs Equations

        OUTPUTCR(CRS)     GROSS DOMESTIC OUTPUT CRS
        AGGLCRS(CRS)      AGGREGATE LABOUR DEFINITION BY CATEGORY - CRS
        AGGKCRS(CRS)      AGGREGATE CAPITAL DEFINITION BY CATEGORY - CRS
        AGGLIRS(IRS)      AGGREGATE LABOUR DEFINITION BY CATEGORY - IRS
        AGGKIRS(IRS)      AGGREGATE CAPITAL DEFINITION BY CATEGORY - IRS
```

** TRADE EQUATIONS

ARMINGTON(T)	ARMINGTON CES SPECIFICATION TRADABLES
ARMINGTONT(NT)	ARMINGTON CES SPECIFICATION NONTRADABLES
COSTMIN(T)	COST MINIMIZATION FOR COMPOSITE GOOD
CETIRS(IRS)	CET SPECIFICATION IRS
DOSUPPLY(TCRS)	SUPPLY OD DOMESTIC COMMODITIES
ESUPPLY(TCRS)	SUPPLY OF EXPORTS
CETNT(NT)	CET SPECIFICATION FOR NONTRADABLES
EDEMAND(IRS)	EXPORT DEMAND

** Income Equations

RENTVERS(IRS)	PROFITS
FACKINC	CAPITAL INCOME
FACLINC	LABOUR INCOME
HHINC	HOUSEHOLD INCOME

** Tax equations

DIRTH	DIRECT TAXES ON HOUSEHOLD INCOME
INDTAX(J)	INDIRECT TAXES ON VALUE ADDED
TARIFFS	TARIFF ON IMPORTS
GYDEF	GOVERNMENT INCOME

** Savings and Investment Equations

SAVDEF	AGGREGATE SAVINGS
HHSDEF	HOUSEHOLDS SAVINGS
GSDEF	GOVERNMENT SAVINGS

** Expenditure Equations

ZDEF(J)	INVESTMENT BY SECTOR OF ORIGIN
INTDEF(J)	INTERMEDIATE DEMAND
HHCDEFC(CRS)	HOUSEHOLD CONSUMPTION
HHCDEFI(IRS)	HOUSEHOLD CONSUMPTION
GOVCDEF(J)	GOVERNMENT CONSUMPTION

** Market Clearing Conditions

LABMARKET	LABOUR MARKET EQUILIBRIUM
CAPMARKT	CAPITAL MARKET EQUILIBRIUM
GOODEQC(CRS)	CRS GOODS MARKET EQUILIBRIUM
GOODEQI(IRS)	IRS GOODS MARKET EQUILIBRIUM
BOPEQ	BALANCE OF PAYMENT EQUILIBRIUM
SAVINVEQ	SAVINGS INVESTMENT EQUILIBRIUM
PROFEQ(IRS)	PRICE EQUALS AVERAGE COST

```
** Objective Function

       OBJ            OBJECTIVE FUNCTION ;


** EQUATION ASSIGNMENT

** Price and Cost Equations

ABSORPT(J)..      P(J)*Q(J) =E= (1 + TD(J))*(PM(J)*IMP(J) + PD(J)*DD(j));

PMDEF(J)..        PM(J) =E= PWM(J)*( 1+TM0(J) );

PYDEFCRS(CRS).. PY(CRS)*YS(CRS) =E= PD(CRS)*DD(CRS) + PECW(CRS)*E(CRS);
PYDEFIRS(IRS).. PY(IRS)*n(irs)*ys(irs) =E= PD(IRS)*DD(IRS) +
                                 ( PECW(IRS) - TEC(IRS) )*E(IRS);

PVADEF(I)..       PV(I) =E= (((GAMMA(I)**SIGMA(I))*WAGE**(1-SIGMA(I)) +
                  ((1-GAMMA(I))**SIGMA(I))*RENT**(1-SIGMA(I)))
                  **(1/(1-SIGMA(I))))/AD(I) ;

MARKUPD(IRS)..    PD(IRS) =E= MC(IRS) / ( 1 - (1 + lamda(irs))
                             / (n(irs)*elas(irs)) );

MARKUPE(IRS)..    PECW(IRS) =E= MC(IRS) / ( 1 - lamdapar(irs)/ETAC(irs) );

EXPDEMELA(IRS)..

        ETAC(IRS) =E= EPSI1(IRS) + (1-EPSI1(IRS))*BETA1(IRS)**EPSI1(IRS)*
                   PECW(IRS)**(1-EPSI1(IRS)) /
                ( (1-BETA1(IRS))**EPSI1(IRS)*PECW0(IRS)**(1-EPSI1(IRS)) +
                   BETA1(IRS)**EPSI1(IRS)*PECW(IRS)**(1-EPSI1(IRS)) ) ;


MARGCOST(IRS).. MC(IRS) =E= (((GAMMA(IRS)**SIGMA(IRS))*WAGE**(1-SIGMA(IRS)) +
                   ((1-GAMMA(IRS))**SIGMA(IRS))*RENT**(1-SIGMA(IRS)))
               **(1/(1-SIGMA(IRS))))/AD(IRS) + SUM(J,A(J,IRS)*P(J)/P0(J)) ;

OPTEXTAX(IRS).. TEC(IRS) =E= PECW(IRS)*
                   (1 - (1 + lamda(irs))/(n(irs)*ETAC(irs))) - MC(IRS);

AVCDEF(IRS)..   AVC(IRS) =E=  TC(IRS) / ys(irs) ;

TOTCOST(IRS)..  TC(irs) =E= WAGE*lf0(irs) + RENT*kf0(irs) +
                    WAGE*l(irs) + RENT*k(irs) +
                    SUM(J,A(J,IRS)*ys(irs)*P(J)/P0(J)) ;

CPINDEX..       CPI =E= SUM(J,PD(J)*DO0(J))/SUM(J,PD0(J)*DO0(J));
```

```
** Production and Factor Inputs Equations

* CRS SECTORS

OUTPUTCR(CRS)..

        ys(crs) =E= AD(CRS)*(GAMMA(CRS)*l(crs)**((SIGMA(CRS)-1)/SIGMA(CRS)) +
                (1-GAMMA(CRS))*k(crs)**((SIGMA(CRS)-1)/SIGMA(CRS)))
                **(SIGMA(CRS)/(SIGMA(CRS)-1));
AGGLCRS(CRS)..

        l(crs) =E= ys(crs)*(ADS(CRS)*GAMMA(CRS)*PV(CRS)/WAGE)**SIGMA(CRS);

AGGKCRS(CRS)..

        k(crs) =E= ys(crs)*(ADS(CRS)*(1-GAMMA(CRS))*PV(CRS)/RENT)**SIGMA(CRS);

** IRS SECTORS

AGGLIRS(IRS)..

         l(irs) =E= ys(irs)*(ADS(IRS)*GAMMA(IRS)*
                   PV(IRS)/WAGE)**SIGMA(IRS);
AGGKIRS(IRS)..

         k(irs) =E= ys(irs)*(ADS(IRS)*(1-GAMMA(IRS))*
                   PV(IRS)/RENT)**SIGMA(IRS);


** TRADE EQUATIONS

ARMINGTON(T)..      Q(T) =E= ARM(T)*(BETA(T)*IMP(T)**((EPSI(T)-1)/EPSI(T)) +
                           (1-BETA(T))*DD(t)**((EPSI(T)-1)/EPSI(T)))**
                           (EPSI(T)/(EPSI(T)-1));

ARMINGTONT(NT)..    Q(NT) =E= DD(NT);

COSTMIN(T)..        (IMP(T) / DD(T)) =E=
                         ( (PD(T)/PM(T))*BETA(T)/(1-BETA(T)) )**EPSI(T);
CETIRS(IRS)..       n(irs)*ys(irs) =E= CETS(IRS) *
                 ( ALFAE(IRS)*DD(IRS)**((ELA(IRS)+1)/ELA(IRS)) +
                (1-ALFAE(IRS))*E(IRS)**((ELA(IRS)+1)/ELA(IRS)) )
                **(ELA(IRS)/(ELA(IRS)+1));

DOSUPPLY(TCRS)..

          DD(TCRS) =E= YS(TCRS)*CETADJ(TCRS)*(ALFAE(TCRS)**(-ELA(TCRS)))*
                      ( PD(TCRS)/PY(TCRS) )**ELA(TCRS);
```

```
ESUPPLY(TCRS)..

           E(TCRS) =E= YS(TCRS)*CETADJ(TCRS)*((1-ALFAE(TCRS))**(-ELA(TCRS)))*
                            ( PECW(TCRS)/PY(TCRS) )**ELA(TCRS);

CETNT(NT)..          YS(NT) =E= DD(NT);

EDEMAND(IRS)..       E(IRS) =E= DO1(IRS)*( PECW0(IRS)/PECW(IRS) )**EPSI1(IRS)*
                           ( BETA1(IRS)/(1-BETA1(IRS)) )**EPSI1(IRS);

** Income Equations

RENTVERS(IRS).. RVER(IRS) =E= TEC(IRS)*E(IRS);

FACKINC..       FKINC =E=  SUM(IRS,RENT*n(irs) * (k(irs) + kf0(irs))) +
                     SUM(CRS,RENT*n(crs)*k(crs)) +  TGK + TWK - DEPREC ;

FACLINC..       FLINC =E= SUM(CRS,WAGE*n(crs)*l(crs)) +
                     SUM(IRS,WAGE*n(irs) * (l(irs) + lf0(irs)));

HHINC..         HR =E= SUM(IRS,RVER(IRS)) + FLINC + FKINC + THG + THW +
                   SUM(IRS,PROFIT(IRS)*n(irs)*ys(irs));


** Tax equations

DIRTH..         TDTH =E= DTAX*HR;

INDTAX(J)..     INTAX(J) =E= TD(J)*(PM(J)*IMP(J)/PM0(J) + PD(J)*DD(J)/PD0(J));

TARIFFS..       TARIF=E= SUM(J,TM0(J)*PWM(J)*IMP(J));

GYDEF..         R =E= TDTH + SUM(J,INTAX(J)) + TARIF ;


** Savings and Investment Equations

SAVDEF..             SAV =E= DEPREC + HS + GS + WS;

HHSDEF..             HS =E= MPSH*(1-DTAX)*HR;

GSDEF..              GS =E= R - TGCON - THG - TWG - TGK ;


** Expenditure Equations

ZDEF(J)..            (1+TD0(J))*Z(J) =E= KSHR(J)*INV;

INTDEF(J)..          (1+TD0(J))*X(J) =E= SUM(I,A(J,I)*n(i)*ys(i));
```

```
HHCDEFC(CRS)..        HC(CRS) =E= HBS(CRS)*(1-MPSH)*(1-DTAX)*HR/P(CRS);

HHCDEFI(IRS)..        HC(IRS) =E= HBS(IRS)*(1-MPSH)*(1-DTAX)*HR*PY0(IRS)/P(IRS);

GOVCDEF(J)..          (1+TD0(J))*GC(J) =E= GBS(J)*TGCON;


** Market Clearing Conditions

LABMARKET..           AGLAB =E= SUM(crs,n(crs)*l(crs)) +
                              SUM(irs,n(irs)*(l(irs) + lf0(irs)));

** With fixed costs

CAPMARKT..            AGCAP =E= SUM(crs,n(crs)*k(crs)) +
                              SUM(irs,n(irs)*(k(irs) + kf0(irs)));

** With sunk costs

CAPMARKT..            AGCAP =E= SUM(crs,n(crs)*k(crs)) + SUM(irs,n(irs)*k(irs));

GOODEQC(CRS)..        Q(CRS) =E= HC(CRS) + GC(CRS) + Z(CRS) + X(CRS);

GOODEQI(IRS)..        Q(IRS) =E= HC(IRS) + GC(IRS) + Z(IRS) + X(IRS);

BOPEQ..               SUM(I,PECW(I)*E(I)/PECW0(I)) + TWK + WS + THW
                    =E= SUM(T, PM(T)*IMP(T)/PM0(T)) - TARIF + TWG;

SAVINVEQ..            SAV =E= INV ;

PROFEQ(IRS)..         PY(IRS) =E= AVC(IRS) + PROFIT(IRS);


** Objective Function

OBJ..                 UTILITY =E= 1;

*MODEL SETUP - INITIALIZATION

 n.L(crs) = 1;
 n.L(irs) = n0(irs);
 lamda.L(irs) = lamda0(irs);
 MC.L(IRS) = MC0(IRS);
 AVC.L(IRS) = AVC0(IRS);
 RVER.L(IRS) = 0;
 elas.l(irs) = elas0(irs);
 ETAC.L(irs) = ETAC0(irs);
 THG.L = THG0;
 THW.L = THW0;
 TWG.L = 6273;
```

```
TGK.L = TGK0;
TWK.L = TWK0;
HS.L = HS0;
DEPREC.L = DEPREC0;
FKINC.L = FKINC0;
FLINC.L = FLINC0;
HR.L = HR0;
HC.L(J) = HCM0(J);
WS.L = 12859 ;
INV.L = INV0;
SAV.L = 102608;
GC.L(J) = GC0(J);
TGCON.L = TGC0;
GS.L = -11955;
Z.L(J) = Z0(J);
X.L(J) = X0(J);
ys.L(i) = ys0(i);
l.L(i) = l0(i);
k.L(i) = k0(i);
DD.L(J) = DO0(J);
E.L(I) = E0(I);
IMP.L(J) = IMP0(J);
PROFIT.L(IRS) = 0;
Q.L(J) = Q0(J);
TDTH.L = HTAX0;
INTAX.L(J) = INDTAX0(J);
TARIF.L = SUM(J,TARIF0(J));
TC.L(IRS) = AVC.L(IRS)*ys.L(irs);
TEC.L(I) = 0;
TD.L(I) = TD0(I);
R.L = 52520 ;
AGLAB.L = SUM(CRS,AL0(CRS)) + SUM(IRS,AL0(IRS) + ALF0(IRS));
AGCAP.L = SUM(CRS,AK0(CRS)) + SUM(IRS,AK0(IRS) + AKF0(IRS));

CPI.L = 1; PECW.L(I) = PECW0(I); P.L(J) = P0(J); PD.L(J) = PD0(J); PM.L(J) = PM0(J);
Y.L(I) = PY0(I); PV.L(I) = PV0(I); PWM.L(J) = PWM0(J); WAGE.L = 1; RENT.L = 1;
P.LO(J) = 0.01; PD.LO(J) = 0.01; PM.LO(J) = 0.01; PY.LO(I) = 0.01; PV.LO(I) = 0.01;
WAGE.LO = 0.01; RENT.LO = 0.01; E.UP(IRS) = E0(IRS); PECW.LO(IRS) = PECW0(IRS);
ETAC.LO(IRS) = 1.01;


*CLOSURE RULES
   ELAS.FX(irs) = ELAS.L(irs);
   CPI.FX = CPI.L;
   PROFIT.FX(IRS) = PROFIT.L(IRS);
   PWM.FX(J) = PWM.L(J) ;
   PECW.FX(CRS) = PECW.L(CRS) ;
   TD.FX(J) = TD.L(J);
   TEC.FX(CRS) = TEC.L(CRS);
   THG.FX = THG.L;
```

```
   THW.FX = THW.L;
   TWG.FX = TWG.L;
   TGK.FX = TGK.L;
   TWK.FX = TWK.L;
   DEPREC.FX = DEPREC.L;
   IMP.FX(NT) = 0;
   E.FX(NT) = 0;
   TGCON.FX = TGCON.L;
   WS.FX = WS.L ;
   GS.FX = GS.L;
   INV.FX = INV.L;
   AGLAB.FX = AGLAB.L;
   AGCAP.FX = AGCAP.L;
   n.FX(crs) = n.L(crs);

MODEL TURKAG90 SQUARE BASE MODEL / ALL / ;

SOLVE TURKAG90 MAXIMIZING UTILITY USING NLP;
```

Appendix 3.C: Calibration of the foreign demand elasticity

Assume that a hypothetical foreign consumer purchases domestic goods and Turkish exports as their substitute. In addition, assume that the elasticity of substitution (ξ_i) is constant. In this case, the foreign consumer faces the following problem:

$$\max_{E_i, D_i^*}\left(pwe_i E_i + \chi_i D_i^*\right)$$

$$\text{s.t.}\quad Q_i^* = \left[\zeta_i E_i^{(\xi_i - 1)} + (1-\zeta_i) D_i^{*(\xi_i - 1)}\right]^{\xi_i/(\xi_i - 1)},$$

where Q_i^* denotes foreign total sectoral demand.

The solution of this problem is $\dfrac{E_i}{D_i^*} = \left(\dfrac{1-\zeta_i}{\zeta_i}\right)^{-\xi_i}\left(\dfrac{\chi_i}{pwe_i}\right)^{\xi_i}$. By assuming that at the benchmark $\chi_i = pwe_i$, then $\zeta_i = \left[\left(\dfrac{E_i}{D_i^*}\right)^{-1/\xi_i} + 1\right]^{-1}$. Given ξ_i, the absolute value of the foreign demand elasticity can be calibrated as follows: $\eta_i^e = \xi_i + (1-\xi_i)\zeta_i^{\xi_i}\left[(1-\zeta_i) + \zeta_i^{\xi_i}\right]^{-1}$. In order to calibrate ζ_i, I employed OECD data related to 18 countries to which Turkey ships almost all textiles and apparel exports (Table 3.C1). The amount of domestic goods consumed by the foreign consumer (D_i^*) is given by domestic production plus imports, minus exports. By using the data below, and by converting these firstly, into US dollars and secondly, into Turkish lira (TL/1\$ = 2607.6), I estimate that the total 18 OECD countries consumption in textiles is 796236 million Turkish lira and in apparel 543902 million Turkish lira.

Table 3.C1: Value of production, exports and imports in 18 OECD countries, 1990 (million countries' respective currencies)

	Production		Exports		Imports		Exchange rate
	Textiles	Apparel	Textiles	Apparel	Textiles	Apparel	(1 $)
Australia	5052	3329	1531	80	1976	628	1.281
Austria	43044	18181	27009	8391	27904	19148	11.370
Belgium	240139	89994	219945	57410	130779	93747	33.418
Canada	6228	7063	661	272	3206	2645	1.167
Denmark	10404	4762	5575	3563	6657	4859	6.189
Finland	3693	3638	1055	1711	3670	1373	3.824
France	115718	74190	37651	20773	50036	32427	5.445
Germany	47777	25011	20056	9011	25430	23375	1.616
Greece	641233	168162	184213	170523	217842	49337	158.510
Italy	63590000	33259000	15361000	9363000	8825000	2419000	1198.100
Japan	7561000	5480000	777000	59000	1194000	892000	144.790
Netherlands	5940	2290	7790	8070	7885	6588	1.821
Norway	3326	1050	1062	267	5050	5773	6.260
Portugal	885822	307959	343005	338169	28120	41229	142.550
Spain	976	637	164604	46603	236100	288264	101.930
Sweden	3979	1284	4201	1701	10392	11311	5.919
UK	8791	5052	3177	1222	4604	2901	0.563
US	84034	47269	7459	1829	12619	20129	1.000

Source: OECD (1995), *The OECD STAN Database for Industrial Analysis 1975-1994*, Paris.

Appendix 4.A Numerical model: the CU agreement

This appendix reports the algebraic formulation of the numerical model employed to study the economic impact and the income distribution effects of the CU agreement between Turkey and the EU on the Turkish economy. The appendix has been split into eight sections: (i) equations related to prices; (ii) equations related to production and factor demand; (iii) equations related to domestic and foreign trade; (iv) equations related to income; (v) equations related to taxes; (vi) equation related to savings and investment; (vii) equation related to final demand and intermediate demand; (viii) equations related to the market clearing conditions.

[4.A.1] Price equations

(4.A1) $$p_j = \Delta_j^{-1}(1+t_j)\left[\varsigma_j^{\varepsilon_j} pm_j^{C\,1-\varepsilon_j} + (1-\varsigma_j)^{\varepsilon_j} pd_j^{1-\varepsilon_j}\right]^{1/(1-\varepsilon_j)}$$

(4.A2) $$pm_j^C = \mathrm{A}_j^{-1}\left[\alpha_j^{\mu_j} pm_j^{EU\,1-\mu_j} + (1-\alpha_j)^{\mu_j} pm_j^{RoW\,1-\mu_j}\right]^{1/(1-\mu_j)}$$

(4.A3) $$pm_j^{EU} = \overline{pwm}_j^{EU}\left(1+tm_j^{EU}\right)$$

(4.A4) $$pm_j^{RoW} = \overline{pwm}_j^{RoW}\left(1+tm_j^{RoW}\right)$$

(4.A5) $$py_i = \Phi_i^{-1}\left[\varphi_i^{\phi_i} pd_i^{1-\phi_i} + (1-\varphi_i)^{\phi_i} pe_i^{C\,1-\phi_i}\right]^{1/(1-\phi_i)}$$

(4.A6) $$pe_i^C = \mathrm{B}_i^{-1}\left[\beta_i^{\eta_i} pe_i^{EU\,1-\eta_i} + (1-\beta_i)^{\eta_i} \overline{pwe}_i^{RoW\,1-\eta_i}\right]^{1/(1-\eta_i)}$$

(4.A7) $$pe_i^{EU} = \frac{\overline{pwe}_i^{EU}}{1+qr_i^{EU}}$$

(4.A8) $$pv_i = \mathrm{X}_i^{-1}\left[\gamma_i^{s\sigma_i} w_i^{s(1-\sigma_i)} + \gamma_i^{u\sigma_i} w_i^{u(1-\sigma_i)} + (1-\gamma_i^s-\gamma_i^u)^{\sigma_i} r^{(1-\sigma_i)}\right]^{1/(1-\sigma_i)}$$

(4.A9) $$w_i^s = \mathrm{H}_i^{s-1}\left[\sum_s \delta_{is}^{\xi_i^s} w_s^{1-\xi_i^s}\right]^{1/(1-\xi_i^s)}$$

(4.A10) $$w_i^u = \mathrm{H}_i^{u-1}\left[\sum_u \delta_{iu}^{\xi_i^u} w_u^{1-\xi_i^u}\right]^{1/\left(1-\xi_i^u\right)}$$

(4.A11) $$\overline{\Omega} = \frac{\sum_j pd_j \overline{D}_j}{\sum_j \overline{pd}_j \overline{D}_j}$$

[4.A.2] Production and factor inputs equations

(4.A12) $$Y_i = \min\left[\frac{x_{ji}}{a_{ji}}, \frac{V_i}{a_i^v}\right]$$

(4.A13) $$V_i = \mathrm{X}_i\left[\gamma_i^s AL_i^{s(\sigma_i-1)/\sigma_i} + \gamma_i^u AL_i^{u(\sigma_i-1)/\sigma_i} + \left(1-\gamma_i^s-\gamma_i^u\right)AK_i^{(\sigma_i-1)/\sigma_i}\right]^{\sigma_i/(\sigma_i-1)}$$

(4.A14) $$AL_i^s = \mathrm{X}_i^{(\sigma_i-1)}\left(\gamma_i^s \frac{pv_i}{w_i^s}\right)^{\sigma_i} V_i$$

(4.A15) $$AL_i^u = \mathrm{X}_i^{(\sigma_i-1)}\left(\gamma_i^u \frac{pv_i}{w_i^u}\right)^{\sigma_i} V_i$$

(4.A16) $$AK_i = \mathrm{X}_i^{(\sigma_i-1)}\left[\left(1-\gamma_i^s-\gamma_i^u\right)\frac{pv_i}{r}\right]^{\sigma_i} V_i$$

(4.A17) $$L_{is} = H_i^{s(\xi_i-1)}\left(\delta_{is}\frac{w_i^s}{w_s}\right)^{\xi_i^s} AL_i^s$$

(4.A18) $$L_{iu} = H_i^{u(\xi_i^u-1)}\left(\delta_{iu}\frac{w_i^u}{w_u}\right)^{\xi_i^u} AL_i^u$$

[4.A.3] Trade equations

(4.A19) $$Q_i = \Delta_i\left[\varsigma_i M_i^{C(\varepsilon_i-1)/\varepsilon_i} + \left(1-\varsigma_i\right)D_i^{(\varepsilon_i-1)/\varepsilon_i}\right]^{\varepsilon_i/(\varepsilon_i-1)}$$

(4.A20) $$\frac{M_j^C}{D_j} = \left(\frac{1-\varsigma_j}{\varsigma_i}\right)^{-\varepsilon_j}\left(\frac{pd_j}{pm_j^C}\right)^{\varepsilon_j}$$

$$M_i^{EU} = \mathrm{A}_j^{\mu_j - 1} \alpha_j^{\mu_j} \left(\frac{pm_j^{EU}}{pm_j^C} \right)^{-\mu_j} M_j^C \tag{4.A21}$$

$$M_j^{RoW} = \mathrm{A}_j^{\mu_j - 1} (1 - \alpha_j)^{\mu_j} \left(\frac{pm_j^{RoW}}{pm_j^C} \right)^{-\mu_j} M_j^C \tag{4.A22}$$

$$Y_i = \Phi_i \left[\varphi_i E_i^{C(\phi_i + 1)/\phi_i} + (1 - \varphi_i) D_i^{(\phi_i + 1)/\phi_i} \right]^{\phi_i/(\phi_i + 1)} \tag{4.A23}$$

$$\frac{E_i}{D_i} = \left(\frac{1 - \varphi_i}{\varphi_i} \right)^{-\phi_i} \left(\frac{pe_i^C}{pd_i} \right)^{\phi_i} \tag{4.A24}$$

$$E_i^{EU} = \mathrm{B}_i^{-1} \left[\beta_i + \beta_i^{\eta_i + 1} (1 - \beta_i)^{-\eta_i} \left(\frac{pe_i^{EU}}{\overline{pwe}_i^{RoW}} \right)^{-(\eta_i + 1)} \right]^{-\left(\frac{\eta_i}{\eta_i + 1} \right)} E_i^C \tag{4.A25}$$

$$E_i^{RoW} = \mathrm{B}_i^{-1} \left[(1 - \beta_i) + \beta_i^{-\eta_i} (1 - \beta_i)^{\eta_i + 1} \left(\frac{\overline{pwe}_i^{RoW}}{pe_i^{EU}} \right)^{-(\eta_i + 1)} \right]^{-\left(\frac{\eta_i}{\eta_i + 1} \right)} E_i^C \tag{4.A26}$$

[4.A.4] Income equations

$$VER_i^{EU} = qr_i^{EU} pe_i^{EU} E_i^{EU} \tag{4.A27}$$

$$\begin{aligned} HR_h = {} & \sum_s \zeta_{hs}^L \sum_i w_s L_{is} + \sum_u \zeta_{hu}^L \sum_i w_u L_{iu} + \zeta_h^{agr} \left(r \widetilde{AK}^{agr} - \overline{DEPK}^{agr} \right) + \\ & \zeta_h^{nagr} \left(\sum_{nagr} r \widetilde{AK}_{nagr} - \overline{DEPK}^{nagr} + \sum_i VER_i^{EU} \right) \end{aligned} \tag{4.A28}$$

$$R = VATTAX + CONTAX + DTAX + TARIFF \tag{4.A29}$$

[4.A.5] Tax equations

$$DTAX = \sum_h td_h (1 - \tau_h) HR_h \tag{4.A30}$$

$$VATTAX = \sum_{nf} t_{nf} \left(pd_{nf} D_{nf} + pm_{nf}^C M_{nf}^C - p_{nf} X_{nf} \right) \quad \text{(non fuel goods)} \tag{4.A31}$$

(4.A32) $$CONTAX = \sum_f t_f \left(pd_f D_f + pm_f^C M_f^C \right) \qquad \text{(fuel)} \quad j = nf \cup f$$

(4.A33) $$TARIFF = \sum_j tm_j^{EU} \overline{pwm}_j^{EU} M_j^{EU} + \sum_j tm_j^{RoW} \overline{pwm}_j^{RoW} M_j^{RoW}$$

[4.A.6] Savings and investment equations

(4.A34) $$S_h = \tau_h (1 - td_h) HR_h$$

(4.A35) $$\overline{BD} = \overline{TGC} - R$$

(4.A36) $$SAV = \sum_h S_h + \overline{DEPK} + \overline{CA} - \overline{BD}$$

(4.A37) $$I_j = \theta_j \overline{INV}$$

[4.A.7] Expenditure equations

(4.A38) $$X_j = \sum_i a_{ji} Y_i$$

(4.A39) $$C_j = \sum_h \vartheta_{jh} (1 - \tau_h)(1 - td_h) \frac{HR_h}{p_j}$$

(4.A40) $$GC_j = \varpi_j \overline{TGC}$$

[4.A.8] Market clearing conditions

(4.A41) $$Q_j = C_j + GC_j + X_j + I_j$$

(4.A42) $$\sum_i \overline{pwe}_i^{EU} E_i^{EU} + \sum_i \overline{pwe}_i^{RoW} E_i^{RoW} + \overline{CA} = \sum_j \overline{pwm}_j^{EU} M_j^{EU} + \sum_j \overline{pwm}_j^{RoW} M_j^{RoW}$$

(4.A43) $$LAB_s = \sum_i L_{is}$$

(4.A44) $$LAB_u = \sum_i L_{iu}$$

(4.A45) $$\overline{CAP} = \sum_i AK_i$$

(4.A46) $$SAV = \overline{INV}$$

Variables (*):

AK_t	Aggregate capital
$\overline{BD}$	Budget deficit
C_j	Private demand of goods
$\overline{CA}$	Current account deficit
$\overline{CAP}$	Aggregate capital stock
D_j	Domestically produced commodities
$\overline{D}_j$	Domestically produced commodities in the base year
$\overline{DEPK}^{agr}$	Fixed capital depreciation in agriculture
$\overline{DEPK}^{nagr}$	Fixed capital depreciation in non-agricultural activities
$DTAX$	Direct tax
E_i^C	Aggregate exports
E_i^{EU}	Exports to the EU
E_i^{RoW}	Exports to the RoW
GC_j	Government spending on goods
I_j	Investment by sector of destination
$\overline{INV}$	Aggregate investment
L_{is}	Sectoral skilled labour
L_{iu}	Sectoral unskilled labour
LAB_s	Aggregate skilled labour
LAB_u	Aggregate unskilled labour
M_j^C	Aggregate imports
M_j^{EU}	Imports from the EU

M_j^{RoW}	Imports from the RoW
p_j	Price of the Armington good
pd_j	Price of domestically produced commodities
$\overline{pd}_j$	Price of domestically produced commodities in the base year
pe_i^C	Composite price of exports
pe_i^{EU}	Supply price of exports to the EU
pm_j^C	Composite price of imports
pm_j^{EU}	Domestic price of imports from the EU
pm_j^{RoW}	Domestic price of imports from the RoW
py_i	Aggregate producer price
$\overline{pwe}_i^{EU}$	Price of exports to the EU prevailing in the EU market
$\overline{pwe}_i^{RoW}$	Price of exports to the RoW prevailing in the RoW market
$\overline{pwm}_j^{EU}$	Price of imports produced by the EU net of duties
$\overline{pwm}_j^{RoW}$	Price of imports produced by the RoW net of duties
R	Government revenues
r	Rent on capital inputs
S_h	Household savings
SAV	Aggregate savings
$TARIFF$	Tariffs
$\overline{TGC}$	Aggregate government spending on goods
V_i	Value added
$VATTAX$	Value added tax
VER_i^{EU}	Rents from voluntary export restraints agreements with the EU
x_{ji}	Raw-material inputs

X_j	Aggregate intermediate demand
Y_i	Output by sectors
w_s	Wage of skilled labours
w_u	Wage of unskilled labours
w_i^s	Average wage of skilled labour
w_i^u	Average wage of unskilled labour
$\overline{\Omega}$	Aggregate domestic price index - numeraire

Parameters

a_i^v	Value added requirement per unit of sectoral output
a_{ij}	Leontief input-output coefficients.
qr_i^{EU}	Export quota premium on Turkish goods in terms of tariff equivalent
t_j	Indirect tax rate
td_h	Direct tax rate on household income
tm_j^{EU}	Effective import tariff rates on EU goods
tm_j^{RoW}	Effective import tariff rates on RoW goods
α_j	Share parameter in the second nest Armington function
β_j	Share parameter in the second nest CET aggregation function
δ_{is}	Share parameter of skilled labour function
δ_{iu}	Share parameter of unskilled labour function
γ_i^s	Share parameter of the value added function
γ_i^u	Share parameter of the value added function
ε_j	Elasticity of substitution between imported and domestic goods

φ_i	Share parameter in the first nest CET aggregation function
ϕ_i	Elasticity of transformation between exports and domestic production
θ_j	Investment share on commodities.
η_i	Elasticity of transformation among exports to different regions
ς_j	Share parameter in the first nest Armington trade aggregation function
τ_h	Household marginal propensity to save
σ_i	Elasticity of substitution among primary factors of production
ζ_h^{agr}	Share parameter of the agricultural capital income to households
ζ_{hs}^{L}	Share parameters of skilled labour income to households
ζ_{hu}^{L}	Share parameters of unskilled labour income to households
ζ_h^{nagr}	Share parameters of non-agricultural capital incomes to households
ξ_i^s	Elasticity of substitution among skilled labours
ξ_i^u	Elasticity of substitution among unskilled labours
ϖ_j	Fixed shares of government spending on goods
ϑ_{jh}	Fixed shares of household spending on goods
μ_j	Elasticity of substitution among imports from different regions
A_j	Shift parameter in the second nest Armington function
B_i	Shift parameter in the second nest CET aggregation function
X_i	Shift parameter of the value added function
Δ_j	Shift parameter in the first nest Armington trade aggregation function
Φ_i	Shift parameter in the first nest CET aggregation function
H_i^s	Shift parameter in the aggregate skilled labour function
H_i^u	Shift parameter in the aggregate unskilled labour function

(*) Parameter and variables with a bar are set exogenously

Appendix 4.B The measurement of inequality

The study focuses on the inequality "within" and "between" urban and rural groups. The data source does not provide any additional information concerning the income redistribution within each income class group. Thus, complete equality between household members within each income class group is postulated and the income arithmetic mean for each representative household member of a given income class group, hr_h, divided by the so called "true" cost of living index, P_h, (Shoven and Whalley, 1992) is employed to measure income inequality.

Jenkins (1991) and Cowell (1995) investigate the properties of different measures of inequality widely used in the economics literature in a simple fashion. It can be shown that for θ approaching zero,

(4.B1) $$\lim_{\theta\to 0} GE_\theta = -\frac{1}{K}\sum_{h=1}^{H} k_h \log\left(\frac{hr_h/P_h}{hr^m}\right),$$

and that for θ approaching one,

(4.B2) $$\lim_{\theta\to 1} GE_\theta = \frac{1}{K}\sum_{h=1}^{H} k_h\left(\frac{hr_h/P_h}{hr^m}\right)\log\left(\frac{hr_h/P_h}{hr^m}\right).$$

As reported by Cowell (1984), the disaggregated version of the generalised entropy measure is given by:

(4.B3) $$GE_\theta = \sum_{g=1}^{G} i_g^\theta m_g^{1-\theta} GE_{\theta w} + GE_{\theta b},$$

where $GE_{\theta w}$ and $GE_{\theta b}$ represent the inequality measure "within" and "between" each group g, respectively; i_g the share of total income held by g's household members; m_g the g's population share; and G the number of mutually exclusive groups, that is the urban and the rural groups.

$GE_{\theta w}$ is calculated as if each group were a separate population, whilst $GE_{\theta b}$ is derived by assuming that every household member within a given group receive the g's mean income (Jenkins, 1991):

$$GE_{\theta b} = \frac{1}{\theta^2 - \theta}\left[\sum_{g=1}^{G} m_g \left(\frac{hr_g^m}{hr^m}\right)^{\theta} - 1\right], \tag{4.B4}$$

where hr_g^m is the mean income within the group in real terms.

Jenkins (1991) also shows that:

$$\lim_{\theta \to 0} GE_{\theta b} = -\sum_{g=1}^{G} m_g \log\left(hr_g^m / hr^m\right), \tag{4.B5}$$

and that

$$\lim_{\theta \to 1} GE_{\theta b} = \sum_{g=1}^{G} i_g \log\left(hr_g^m / hr^m\right). \tag{4.B64}$$

Appendix 4.C The GAMS code: the CU agreement

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*(Sets, data set and calibration of some parameters can be found in Appendix 2.D)

$TITLE  TURKEYSAM: DISAGGREGATED TRADE MODEL WITH THE EC - 1990

NAGR(I) NON AGRICULTURE / Min, Food, Drink, Text, Wear, Leat, Foot, Wood, Chem,
      Petr, Nmet, Met, Mach, Mtran, Elgas, Cons, Whol, Tran, Oser /

CU(I) CUSTOMGOODS / Min, Drink, Text, Wear, Leat, Foot, Wood, Chem, Petr,
      Nmet, Met, Mach, Mtran, Elgas /

IND(I) GOODS SUBJECT TO VAT / Agr, Min, Food, Drink, Text, Wear, Leat, Foot,
       Wood, Chem, Nmet, Met, Mach, Mtran, Elgas, Cons, Whol, Tran, Oser /

 SK   SKILLEDLABOUR /
      Prof          Professional labour
      Mana          Managers
      White         White collars /

 UN   UNSKILLEDLABOUR /
      Sale          Sale workers
      Serv          Service workers
      Farm          Agricultural workers
      Nfarm         Non agricultural workers
      Other         Others /


 TABLE  HHINCOME(HH,*) Household Income

            KAGR      KNAGR     KTRADE    KSERV
U14         3         11        6         25
U15         70        187       247       405
U16         181       599       571       1041
U17         234       1000      1071      1641
U18         293       1288      1500      2315
U19         289       1393      1555      2262
U20         309       1677      1902      2818
U21         241       1726      1445      2716
U22         244       1494      1906      2206
U23         97        1389      1438      1511
U24         243       2849      2811      4137
U25         375       2126      2594      3611
U26         285       1580      2360      2712
U27         134       1467      1854      2027
U28         82        752       1587      1557
U29         474       4324      3292      4963
U30         183       2040      1987      2372
U31         229       5986      3087      4951
U32         112       3025      682       1154
U33         0         2489      539       12
R34         310       24        4         79
R35         1696      163       70        635
R36         2925      643       528       1477
R37         4490      668       869       1620
R38         4952      650       1243      1643
R39         4822      377       817       1525
R40         4675      583       578       1152
R41         4050      621       651       1486
R42         3958      438       987       828
R43         2941      199       405       463
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R44       6426     599      981      1552
R45       3648     417      804      1009
R46       1604     316      1102     690
R47       1506     404      1055     1534
R48       902      230      743      350
R49       1598     338      1193     1721
R50       2441     638      722      631
R51       1354     489      434      1462
R52       27       579      0        155      ;

PARAMETER
          TCO(J)           TARIFF RATE ON IMPORTS FROM EC
          TRO(J)           TARIFF RATE ON IMPORTS FROM ROW
          CETO(J)          COMMON EXTERNAL TARIF
          GAMMALSK(I)      PRODUCTION FUNCTION SHARE PARAMETER
          GAMMALUN(I)      PRODUCTION FUNCTION SHARE PARAMETER
          TETASK(I)        CES ELASTICITY BETWEEN SKILLED
          TETAUN(I)        CES ELASTICITY BETWEEN UNSKILLED
          CESV(I)          USED FOR AD
          LPRSK(I)         USED FOR SKILLED LABOUR
          DELTASK(SK,I)    SHARE PARAMETERS FOR SKILLED LABOUR
          LSKCES(I)        USED FOR SKILLED LABOUR
          LFSK(I)          SKILLED LABOUR FUNCTION SHIFT PARAMETER
          LFSSK(I)         SKILLED LABOUR FUNCTION SHIFT PARAMETER ADJUSTED
          LPRUN(I)         USED FOR UNSKILLED LABOUR
          DELTAUN(UN,I)    SHARE PARAMETERS FOR UNSKILLED LABOUR
          LUNCES(I)        USED FOR UNSKILLED LABOUR
          LFUN(I)          UNSKILLED LABOUR FUNCTION SHIFT PARAMETER
          LFSUN(I)         UNSKILLED LABOUR FUNCTION SHIFT PARAMETER ADJUSTED
          SHHSKL(HH,SK)    SHARE OF SKILLED LABOUR INCOME TO HOUSEHOLDS
          SHHUNL(HH,UN)    SHARE OF UNSKILLED LABOUR INCOME TO HOUSEHOLDS
          SHHK(HH)         SHARE OF NON AGRICULTURAL CAPITAL INCOME TO HH
          SHHKAGR(HH)      SHARE OF AGRICULTURAL CAPITAL INCOME TO HH

*DUMMIES TO HOLD INITIAL DATA

          TARECO(J)        TARIFFS FROM EC IMPORTS
          FUNDECO(J)       FUND FROM EC IMPORTS
          TARRWO(J)        TARIFFS FROM ROW IMPORTS
          FUNDRWO(J)       FUND FROM ROW IMPORTS
          ICEENET(J)       NET IMPORT FROM CEE
          IROWNET(J)       NET IMPORT FROM ROW
          PWMCO(J)         WORLD PRICE OF IMPORTS FROM THE EC
          PWMRO(J)         WORLD PRICE OF IMPORTS FROM THE ROW
          PVO(I)           VALUE ADDED PRICE
          WLSKIO           SKILLED WAGE
          WLUNKO           UNSKILLED WAGE
          SKLINCO(SK,I)    SKILLED LABOUR INCOME
          UNLINCO(UN,I)    UNSKILLED LABOUR INCOME
          LSKIO(I)         SKILLED LABOUR FORCE BY SECTOR
          LUNKO(I)         UNSKILLED LABOUR FORCE BY SECTOR
          TKINCO           CAPITAL INCOME
          HSKLINO(HH,SK)   SKILLED LABOUR INCOME MATRIX
          HUNLINO(HH,UN)   UNSKILLED LABOUR INCOME MATRIX
          FSKLINCO(SK)     SKILLED LABOUR INCOME BY CATEGORY
          FUNLINCO(UN)     UNSKILLED LABOUR INCOME BY CATEGORY
          DEPRECO          CAPITAL DEPRECIATION PLUS FIRM SAVINGS IN NON AGRICUL
          DEPAGRO          CAPITAL DEPRECIATION IN AGRICULTURE

***************************************************
*                                                 *
** CALIBRATION OF ALL SHIFT AND SHARE PARAMETERS **
*                                                 *
***************************************************

** GET ELASTICITIES

TETASK(I) = 2; TETAUN(I) = 5;
```

```
* GET  GAMMA, AD

SKLINC0(SK,I) = LABINC(SK,I);
UNLINC0(UN,I) = LABINC(UN,I);
LSKI0(I) = SUM(SK,SKLINC0(SK,I));
LUNK0(I) = SUM(UN,UNLINC0(UN,I));
GAMMALSK(I) = ( LSKI0(I)**(1/SIGMA(I)) ) / ( LSKI0(I)**(1/SIGMA(I)) +
                LUNK0(I)**(1/SIGMA(I)) + AK0(I)**(1/SIGMA(I)) );
GAMMALUN(I) = ( LUNK0(I)**(1/SIGMA(I)) ) / ( LSKI0(I)**(1/SIGMA(I)) +
                LUNK0(I)**(1/SIGMA(I)) + AK0(I)**(1/SIGMA(I)) );

CESV(I)$GAMMALUN(I) = ( GAMMALSK(I)*LSKI0(I)**((SIGMA(I)-1)/SIGMA(I)) +
                        GAMMALUN(I)*LUNK0(I)**((SIGMA(I)-1)/SIGMA(I)) +
     ( 1 - GAMMALSK(I) - GAMMALUN(I) )*AK0(I)**((SIGMA(I)-1)/SIGMA(I)))
                                         **(SIGMA(I)/(SIGMA(I)-1));
AD(I)$CESV(I) = Y0(I)/CESV(I);
ADS(I) = AD(I)**((SIGMA(I)-1)/SIGMA(I));

DISPLAY GAMMALSK, GAMMALUN;

* GET DELTASK

LPRSK(I) = SUM(SK,SKLINC0(SK,I)**(1/TETASK(I)));
DELTASK(SK,I) = SKLINC0(SK,I)**(1/TETASK(I))/LPRSK(I); DISPLAY DELTASK;
LSKCES(I) = SUM(SK$DELTASK(SK,I),DELTASK(SK,I)*SKLINC0(SK,I)
            **((TETASK(I)-1)/TETASK(I)));
LFSK(I) = LSKI0(I)*LSKCES(I)**(TETASK(I)/(1-TETASK(I)));
LFSSK(I) = LFSK(I)**(TETASK(I)-1);

* GET DELTAUN

LPRUN(I) = SUM(UN,UNLINC0(UN,I)**(1/TETAUN(I)));
DELTAUN(UN,I) = UNLINC0(UN,I)**(1/TETAUN(I))/LPRUN(I); DISPLAY DELTAUN;
LUNCES(I) = SUM(UN$DELTAUN(UN,I),DELTAUN(UN,I)*UNLINC0(UN,I)
            **((TETAUN(I)-1)/TETAUN(I)));
LFUN(I) = LUNK0(I)*LUNCES(I)**(TETAUN(I)/(1-TETAUN(I)));
LFSUN(I) = LFUN(I)**(TETAUN(I)-1);


* GET PV0

PV0(I) = ( ( GAMMALSK(I)**SIGMA(I) + GAMMALUN(I)**SIGMA(I) +
        (1-GAMMALSK(I)-GAMMALUN(I))**SIGMA(I) )**(1/(1-SIGMA(I))) ) / AD(I);

* GET WAGE, RENT

WLSKI0(I) = ADS(I)*GAMMALSK(I)*PV0(I)*(Y0(I)/LSKI0(I))**(1/SIGMA(I));
WLUNK0(I) = ADS(I)*GAMMALUN(I)*PV0(I)*(Y0(I)/LUNK0(I))**(1/SIGMA(I));
RENT0(I) = ADS(I)*(1-GAMMALSK(I)-GAMMALSK(I))*PV0(I)*(Y0(I)/AK0(I))**(1/SIGMA(I));


* GET TC, TR, FUNDS
TARIF0(J) = VARIE(J,'DUTY');
ICEENET(J) = VARIE(J,'IMPEC15');
IROWNET(J) = IMP0(J) - ICEENET(J) - TARIF0(J);
TAREC0(J) = VARIE(J,'TAREU');
FUNDEC0(J) = VARIE(J,'FUNDEU');
TARRW0(J) = VARIE(J,'TARRW');
FUNDRW0(J) = TARIF0(J) - ( TAREC0(J) + FUNDEC0(J) + TARRW0(J) );
TC0(J)$T(J) = (TAREC0(J)+ FUNDEC0(J))/(PC0(J)*ICEENET(J));
TR0(J)$T(J) = (TARRW0(J)+ FUNDRW0(J))/(PR0(J)*IROWNET(J));
PWMC0(J) = PC0(J)/(1 + TC0(J) + FEC0(J));
PWMR0(J) = PR0(J)/(1 + TR0(J) + FRW0(J));


* GET CET
CET0(I) = VARIE(I,'COMEXTARIF');

* GET SHHK
DEPAGR0 = 241;
```

```
DEPRECO =  47685 - DEPAGRO;
PROFITO(I) = TECO(I)*ECEEO(I);
TKINCO = SUM(I,AKO(I) + PROFITO(I)) + TGKO + TWKO - DEPRECO - AKO('AGR');
KINCO(HH) = HHINCOME(HH,'CAPIT') - HHINCOME(HH,'KAGR');
SHHK(HH) = KINCO(HH)/TKINCO; DISPLAY SHHK;
SHHKAGR(HH) = HHINCOME(HH,'KAGR')/( AKO('AGR') - DEPAGRO ); DISPLAY SHHKAGR;

* GET SHHL, DTAX
HSKLINO(HH,SK) = HHINCOME(HH,SK);
HUNLINO(HH,UN) = HHINCOME(HH,UN);
FSKLINCO(SK) = SUM(I,SKLINCO(SK,I));
FUNLINCO(UN) = SUM(I,UNLINCO(UN,I));
SHHSKL(HH,SK)$HSKLINO(HH,SK) = HSKLINO(HH,SK)/FSKLINCO(SK); DISPLAY SHHSKL;
SHHUNL(HH,UN)$HUNLINO(HH,UN) = HUNLINO(HH,UN)/FUNLINCO(UN); DISPLAY SHHUNL;
THGO(HH) = HHINCOME(HH,'GOV');
THWO(HH) = HHINCOME(HH,'ROW');
HRO(HH) = SUM(SK,HSKLINO(HH,SK)) + SUM(UN,HUNLINO(HH,UN)) + KINCO(HH) +
         HHINCOME(HH,'KAGR') + THGO(HH) + THWO(HH);

************************************
*                                  *
**          VARIABLES             **
*                                  *
************************************

FREE VARIABLES

           THG(HH)       GOVERNMENT TRANSFERS TO HOUSEHOLDS
           THW(HH)       REMITTANCES FROM ABROAD
           HS(HH)        HOUSHOLD SAVINGS
           GS            GOVERNMENT SAVINGS
           WS            FOREIGN SAVINGS
           Z(J)          INVESTMENT BY SECTOR OF ORIGIN
           TWG           GOVERNMENT TRANSFERS ABROAD
           INTAX         INDIRECT TAX ON VALUE ADDED NET OF EXPORTS
           SKLAB(SK)     AGGREGATE SUPPLY OF SKILLED LABOUR
           UNLAB(UN)     AGGREGATE SUPPLY OF UNSKILLED LABOUR
           AGCAP         AGGREGATE SUPPLY OF CAPITAL

* INDICATOR FOR OBJECTIVE FUNCTION
           UTILITY       OBJECTIVE FUNCTION VARIABLE ;

POSITIVE VARIABLE

           PROFIT(J)      PROFITS
           VAT            INCREASE IN VAT RATE
           TD(I)          INDIRECT TAX ON DOMESTIC CONSUMPTION
           TC(J)          TARIFF RATE ON IMPORTS FROM EC
           TR(J)          TARIFF RATE ON IMPORTS FROM ROW
           TEC(J)         TARIFF ON EXPORTS IMPOSED BY EC
           PE(I)          PRICE OF EXPORTS
           PEC(I)         PRICE OF EXPORTS TO THE EC
           PECW(VER)      WORLD PRICE OF EXPORTS TO THE EC
           PER(I)         PRICE OF EXPORTS TO THE ROW
           PV(I)          NET OR VALUE ADDED PRICE
           P(J)           COMPOSITE PRICE OF COMMODITY J
           PD(J)          DOMESTIC PRICE OF COMMODITY
           PM(J)          DOMESTIC PRICE OF IMPORT
           PC(J)          DOMESTIC PRICE OF IMPORT FROM EC
           PR(J)          DOMESTIC PRICE OF IMPORT FROM ROW
           PY(I)          DOMESTIC PRICE OF DOMESTIC OUTPUT
           WLSKI(I)       COMPOSITE WAGE - SKILLED
           WLUNK(I)       COMPOSITE WAGE - UNSKILLED
           WAGESK(SK)     WAGE BY SKILLED CATEGORY
           WAGEUN(UN)     WAGE BY UNSKILLED CATEGORY
           RENT           RENT
           CPI            CONSUMER PRICE INDEX
           X(J)           INTERMEDIATE INPUTS DEMAND
           Y(I)           DOMESTIC PRODUCTION OF COMPOSITE GOODS
           LSKI(I)        COMPOSITE SKILLED LABOUR
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          LUNK(I)         COMPOSITE UNSKILLED LABOUR
          LSK(SK,I)       LABOUR FORCE BY SKILLED CATEGORY
          LUN(UN,I)       LABOUR FORCE BY UNSKILLED CATEGORY
          AK(I)           OPERATING SURPLUS
          DO(I)           DOMESTIC DEMAND OF COMMODITIES
          IMP(J)          IMPORTS
          ICEE(J)         IMPORT FROM CEE
          IROW(J)         IMPORT FROM ROW
          Q(J)            COMPOSITE COMMODITY
          ECEE(I)         EXPORTS TOWARDS CEE
          EROW(I)         EXPORTS TOWARDS ROW
          E(I)            TOTAL EXPORTS
          FKINC           NON AGRICULTURAL CAPITAL INCOME
          FSKLINC(SK)     SKILLED LABOUR INCOME
          FUNLINC(UN)     UNSKILLED LABOUR INCOME
          HR(HH)          HOUSEHOLD INCOME
          HCM(HH)         HOUSEHOLD CONSUMPTION MATRIX
          SAV             AGGREGATE SAVINGS
          INV             AGGREGATE INVESTMENT ON J
          TDTH            DIRECT TAXES ON HOUSEHOLD INCOME
          TARIF           TARIFFS ON IMPORTS
          DEPREC          DEPRECIATION
          TGK             NET GOVERNMENT TRANSFERS TO CAPITAL-FIRMS
          TWK             NET ROW TRANSFERS TO CAPITAL-FIRMS
          R               GOVERNMENT INCOME
          GC(J)           GOVERNMENT CONSUMPTION
          TGCON           TOTAL GOVERNMENT CONSUMPTION
          HC(J)           HOUSEHOLD CONSUMPTION;

*****************************
*                           *
**        EQUATIONS        **
*                           *
*****************************

EQUATIONS

** Price Equations

       ABSORPTN(J)       VALUE OF DOMESTIC SALES
       PMDEF(J)          DEFINITION OF DOMESTIC IMPORT PRICE
       PCDEF(J)          DEFINITION OF DOMESTIC IMPORT PRICE FROM EU
       PRDEF(J)          DEFINITION OF DOMESTIC IMPORT PRICE FROM ROW
       PYDEF(I)          DEFINITION OF PRODUCER PRICE
       PEDEF(I)          DEFINITION OF PRICE FOR EXPORTS
       PECDEF(VER)       DEFINITION OF PRICE FOR EXPORTS TO THE EC
       PERDEF(I)         DEFINITION OF PRICE FOR EXPORTS TO THE ROW
       WAGESKDEF(I)      SKILLED WAGE DEFINITION
       WAGEUNDEF(I)      UNSKILLED WAGE DEFINITION
       PVADEF(I)         DEFINITION OF ACTIVITY OR VALUE ADDED PRICE
       CPINDEX           CONSUMER PRICE INDEX

** Production and Factor Inputs Equations

       OUTPUT(I)         GROSS DOMESTIC OUTPUT
       AGSKLAB(I)        AGGREGATE DEMAND FOR SKILLED LABOUR
       AGUNLAB(I)        AGGREGATE DEMAND FOR UNSKILLED LABOUR
       AGGKAP(I)         AGGREGATE CAPITAL DEMAND
       SKLABDEM(SK,I)    SKILLED LABOUR DEMAND FUNCTION
       UNLABDEM(UN,I)    UNSKILLED LABOUR DEMAND FUNCTION

** TRADE EQUATIONS

       ARMINGTON(T)      ARMINGTON CES SPECIFICATION TRADABLES
       ARMINGTONT(NT)    ARMINGTON CES SPECIFICATION NONTRADABLES
       COSTMIN(T)        COST MINIMIZATION FOR COMPOSITE GOOD
       ARMINGIMP(T)      CES SPECIFICATION FOR IMPORTS
       COMIMP(T)         COST MINIMIZATION FOR COMPOSITE IMPORT
       CET(I)            CET SPECIFICATION FOR TRADABLES
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          CETNT(NT)          CET SPECIFICATION FOR NONTRADABLES
          ESUPPLY(I)         EXPORT SUPPLY FUNCTION
          EXPORT(I)          TOTAL EXPORTS
          EXPCET(I)          CET SPECIFICATION FOR EXPORTS

** Income Equations

          PROFITS(I)         RENTS ON VERs
          FACKINC            NON AGRICULTURAL CAPITAL INCOME
          FACSKLINC(SK)      SKILLED LABOUR INCOME
          FACUNLINC(UN)      UNSKILLED LABOUR INCOME
          HHINC(HH)          HOUSEHOLD INCOME

** Tax equations

          DIRTH              DIRECT TAXES ON HOUSEHOLD INCOME
          VATTAX(J)          INDIRECT TAXES ON VALUE ADDED (CONSUMPTION DEFINITION)
          INDTAX             CONSUMPTION TAX ON PETROLEUM PRODUCTS
          TARIFFS            TARIFF ON IMPORTS
          GYDEF              GOVERNMENT INCOME

** Savings and Investment Equations

          SAVDEF             AGGREGATE SAVINGS
          HHSDEF(HH)         HOUSEHOLDS SAVINGS
          GSDEF              GOVERNMENT SAVINGS
          ZDEF(J)            INVESTMENT BY SECTOR OF ORIGIN

** Expenditure Equations

          INTDEF(J)          INTERMEDIATE DEMAND
          INTPDEF            PETROLEUM INTERMEDIATE DEMAND
          HHCDEF(J)          HOUSEHOLD CONSUMPTION
          GOVCDEF(J)         GOVERNMENT CONSUMPTION

** Market Clearing Conditions

          SKLABMARKT         SKILLED LABOUR MARKET EQUILIBRIUM
          UNLABMARKT         UNSKILLED LABOUR MARKET EQUILIBRIUM
          CAPMARKT           CAPITAL MARKET EQUILIBRIUM
          GOODEQ(J)          GOODS MARKET EQUILIBRIUM
          BOPEQ              BALANCE OF PAYMENT EQUILIBRIUM
          SAVINVEQ           SAVINGS INVESTMENT EQUILIBRIUM

** Objective Function

          OBJ                OBJECTIVE FUNCTION ;

** EQUATION ASSIGNMENT

** Price Equations

ABSORPTN(J)..       P(J)*Q(J) =E= (1 + VAT*TD(J))*(PM(J)*IMP(J) + PD(J)*DO(J));

PMDEF(J)..          PM(J)*IMP(J) =E= PC(J)*ICEE(J) + PR(J)*IROW(J);

PCDEF(J)..          PC(J) =E= PWMC0(J)*(1 + TC(J));

PRDEF(J)..          PR(J) =E= PWMR0(J)*(1 + TR(J));

PYDEF(I)..          PY(I)*Y(I) =E= PD(I)*DO(I) + PE(I)*E(I);

PEDEF(I)$T(I)..     PE(I) =E= ( PEC(I)*ECEE(I) + PER(I)*EROW(I) )/E(I);

PECDEF(VER)..       PEC(VER) =E= PECW(VER)/(1+TEC(VER)) ;

PERDEF(I)$T(I)..    PER(I) =E= PERW0(I) ;
```

```
PVADEF(I)..          PV(I)  =E=  (((GAMMALSK(I)**SIGMA(I))*WLSKI(I)**(1-SIGMA(I)) +
                                  (GAMMALUN(I)**SIGMA(I))*WLUNK(I)**(1-SIGMA(I)) +
                    ((1-GAMMALSK(I)-GAMMALUN(I))**SIGMA(I))*RENT**(1-SIGMA(I)))
                          **(1/(1-SIGMA(I))))/AD(I) ;

WAGESKDEF(I)..       WLSKI(I)  =E=  SUM(SK,WAGESK(SK)*LSK(SK,I))/LSKI(I);

WAGEUNDEF(I)..       WLUNK(I)  =E=  SUM(UN,WAGEUN(UN)*LUN(UN,I))/LUNK(I);

CPINDEX..            CPI  =E=  SUM(J,PD(J)*DO0(J))/SUM(J,PD0(J)*DO0(J));


** Production and Factor Inputs Equations

** First stage

OUTPUT(I)..     Y(I)  =E=  AD(I)*(GAMMALSK(I)*LSKI(I)**((SIGMA(I)-1)/SIGMA(I)) +
                                 GAMMALUN(I)*LUNK(I)**((SIGMA(I)-1)/SIGMA(I)) +
               (1-GAMMALSK(I)-GAMMALUN(I))*AK(I)**((SIGMA(I)-1)/SIGMA(I)))
                                           **(SIGMA(I)/(SIGMA(I)-1));

** Second stage

AGSKLAB(I)..    LSKI(I)  =E=  Y(I)*(ADS(I)*GAMMALSK(I)*PV(I)/WLSKI(I))**SIGMA(I);

AGUNLAB(I)..    LUNK(I)  =E=  Y(I)*(ADS(I)*GAMMALUN(I)*PV(I)/WLUNK(I))**SIGMA(I);

AGGKAP(I)..     AK(I)  =E=  Y(I)*(ADS(I)*(1-GAMMALSK(I)-GAMMALUN(I))*PV(I)/RENT)
                                                                   **SIGMA(I);

** Third stage

SKLABDEM(SK,I)..
               LSK(SK,I)  =E=  LFSSK(I)*LSKI(I)*
                             (DELTASK(SK,I)*WLSKI(I)/WAGESK(SK))**TETASK(I);

UNLABDEM(UN,I)..
               LUN(UN,I)  =E=  LFSUN(I)*LUNK(I)*
                             (DELTAUN(UN,I)*WLUNK(I)/WAGEUN(UN))**TETAUN(I);

** Trade Equations

ARMINGTON(T)..      Q(T)  =E=  ARM(T)*(BETA(T)*IMP(T)**((EPSI(T)-1)/EPSI(T)) +
              (1-BETA(T))*DO(T)**((EPSI(T)-1)/EPSI(T)))**(EPSI(T)/(EPSI(T)-1));

ARMINGTONT(NT)..    Q(NT)  =E=  DO(NT);

COSTMIN(T)..        IMP(T)/DO(T)  =E=  (PD(T)/PM(T)*BETA(T)/(1-BETA(T)))**EPSI(T);

ARMINGIMP(T).. IMP(T)  =E=  ARMM(T)*(ALFA(T)*ICEE(T)**((EPSIM(T)-1)/EPSIM(T)) +
        (1-ALFA(T))*IROW(T)**((EPSIM(T)-1)/EPSIM(T)))**(EPSIM(T)/(EPSIM(T)-1));

COMIMP(T)..     ICEE(T)/IROW(T)  =E=  (PR(T)/PC(T)*ALFA(T)/(1-ALFA(T)))**EPSIM(T);


CET(I)$T(I)..        Y(I)  =E=  CETS(I)*(ALFAE(I)*E(I)**((ELA(I)+1)/ELA(I)) +
               (1-ALFAE(I))*DO(I)**((ELA(I)+1)/ELA(I)))**(ELA(I)/(ELA(I)+1));

CETNT(NT)..          Y(NT)  =E=  DO(NT);

ESUPPLY(I)$T(I)..    E(I)/DO(I)  =E=
               (  (1-ALFAE(I))*PE(I)/(ALFAE(I)*PD(I))  )**ELA(I);

EXPCET(I)$T(I)..     E(I)  =E=  SHIFT(I)*(SHARE(I)*ECEE(I)**((ELAE(I)+1)/ELAE(I)) +
          (1-SHARE(I))*EROW(I)**((ELAE(I)+1)/ELAE(I)))**(ELAE(I)/(ELAE(I)+1));

EXPORT(I)$T(I)..     ECEE(I)/EROW(I)  =E=
               (  (1-SHARE(I))*PEC(I)/(SHARE(I)*PER(I))  )**ELAE(I);
```

```
** Income Equations

PROFITS(I)..         PROFIT(I) =E= PEC(I)*TEC(I)*ECEE(I);

FACKINC..            FKINC =E= SUM(NAGR,RENT*AK(NAGR) + PROFIT(NAGR)) + TGK +
                             TWK - DEPREC;

FACSKLINC(SK)..      FSKLINC(SK) =E= SUM(I,WAGESK(SK)*LSK(SK,I));

FACUNLINC(UN)..      FUNLINC(UN) =E= SUM(I,WAGEUN(UN)*LUN(UN,I));

HHINC(HH)..          HR(HH) =E= SUM(SK,SHHSKL(HH,SK)*FSKLINC(SK)) +
                             SUM(UN,SHHUNL(HH,UN)*FUNLINC(UN)) +
                             SHHK(HH)*FKINC + SHHKAGR(HH)*( RENT*AK('AGR') -
                             DEPAGR0 ) + THG(HH) + THW(HH);

** Tax equations

DIRTH..             TDTH =E= SUM(HH,DTAX(HH)*HR(HH));

VATTAX(J)$IND(J)..  INTAX(J) =E= VAT*TD(J)*( PM(J)*IMP(J) + PD(J)*DO(J) -
                                  P(J)*X(J)/P0(J) ) ;

INDTAX('PETR')..    INTAX('PETR') =E= VAT*TD('PETR')*( PM('PETR')*IMP('PETR')+
                                             PD('PETR')*DO('PETR') );

TARIFFS..           TARIF =E= SUM(J,TC(J)*PWMC0(J)*ICEE(J) +
                              TR(J)*PWMR0(J)*IROW(J));

GYDEF..             R =E= TDTH + SUM(J,INTAX(J)) + TARIF ;

** Savings and Investment Equations

SAVDEF..            SAV =E= DEPREC + DEPAGR0 + SUM(HH,HS(HH)) + GS + WS;

HHSDEF(HH)..        HS(HH) =E= MPSH(HH)*(1-DTAX(HH))*HR(HH);

GSDEF..             GS =E= R - TGCON - SUM(HH,THG(HH)) - TWG - TGK;

ZDEF(I)..           (1+TD0(I))*Z(I) =E= KSHR(I)*INV;

** Expenditure Equations

INTDEF(J)$IND(J).. X(J) =E= SUM(I,A(J,I)*Y(I));
INTPDEF..          (1+TD0('PETR'))*X('PETR') =E= SUM(I,A('PETR',I)*Y(I));

HHCDEF(J)..         HC(J) =E= SUM(HH,HBS(J,HH)*(1-MPSH(HH))*(1-DTAX(HH))*
                           HR(HH))/P(J);

GOVCDEF(J)..        (1+TD0(J))*GC(J) =E= GBS(J)*TGCON;

** Market Clearing Conditions

SKLABMARKT(SK)..    SKLAB(SK) =E= SUM(I,LSK(SK,I));
UNLABMARKT(UN)..    UNLAB(UN) =E= SUM(I,LUN(UN,I));

*UNLABMARKT('Farm').. UNLAB('Farm') =E= SUM(I,LUN('Farm',I));

CAPMARKT..          AGCAP =E= SUM(I,AK(I));

GOODEQ(I)..         Q(I) =E= HC(I) + GC(I) + Z(I) + X(I);

BOPEQ..             SUM(I,PEC(I)*ECEE(I)) + SUM(I,PER(I)*EROW(I)) +
              SUM(I,PEC(I)*TEC(I)*ECEE(I)) + TWK + WS + SUM(HH,THW(HH))
          =E= SUM(J,PWMC0(J)*ICEE(J)) + SUM(J,PWMR0(J)*IROW(J)) + TWG;
```

```
SAVINVEQ..          SAV =E= INV ;

** Objective Function

OBJ..               UTILITY =E= 1;

*MODEL SETUP - INITIALIZATION

 PROFIT.L(I) = PROFIT0(I);
 VAT.L = 1;
 THG.L(HH) = THG0(HH);
 THW.L(HH) = THW0(HH);
 TWG.L = 6273;
 TGK.L = TGK0;
 TWK.L = TWK0;
 HS.L(HH) = HS0(HH);
 DEPREC.L = DEPREC0;
 FKINC.L = TKINC0;
 FSKLINC.L(SK) = FSKLINC0(SK);
 FUNLINC.L(UN) = FUNLINC0(UN);
 HR.L(HH) = HR0(HH);
 HCM.L(HH) = SUM(J,HCM0(J,HH));
 HC.L(J) = HC0(J);
 WS.L = 12859 ;
 INV.L = INV0;
 SAV.L = 102608;
 GC.L(J) = GC0(J);
 TGCON.L = TGC0;
 ECEE.L(I) = ECEE0(I); EROW.L(I) = EROW0(I); E.L(I) = E0(I);
 GS.L = -11955;
 Z.L(J) = Z0(J);
 X.L(J) = X0(J);
 Y.L(I) = Y0(I);
 LSK.L(SK,I) = SKLINC0(SK,I); LUN.L(UN,I) = UNLINC0(UN,I);
 LSKI.L(I) = LSKI0(I); LUNK.L(I) = LUNK0(I);
 SKLAB.L(SK) = SUM(I,LSK.L(SK,I)); UNLAB.L(UN) = SUM(I,LUN.L(UN,I));
 AK.L(I) = AK0(I);
 AGCAP.L = SUM(I,AK0(I));
 DO.L(J) = DO0(J);
 IMP.L(J) = IMP0(J); ICEE.L(J) = ICEE0(J); IROW.L(J) = IROW0(J);
 Q.L(J) = Q0(J);
 TDTH.L = SUM(HH,HTAX0(HH));
 INTAX.L(J) = INDTAX0(J);
 TARIF.L = SUM(J,TAREC0(J) + TARRW0(J) + FUNDRW0(J) + FUNDEC0(J));
 TEC.L(I) = TEC0(I);
 TC.L(J) = TC00(J); TR.L(J) = TR00(J);
 TD.L(I) = TD0(I);
 R.L = 52520;

 CPI.L = 1; PE.L(I) = PE0(I); PEC.L(I) = PEC0(I); PER.L(I) = PER0(I);
 PECW.L(VER) = PECW0(VER) ;
 P.L(J) = P0(J); PD.L(J) = PD0(J); PM.L(J) = PM0(J); PY.L(I) = PY0(I);
 PC.L(J) = PC0(J); PR.L(J) = PR0(J); PV.L(I) = PV0(I); WAGESK.L(SK) = 1;
 WAGEUN.L(UN) = 1; WLSKI.L(I) = 1; WLUNK.L(I) = 1;
 RENT.L = 1; P.LO(J) = 0.01; PC.LO(J) = 0.01; PR.LO(J) = 0.01;
 PD.LO(J) = 0.01; PM.LO(J) = 0.01; PY.LO(I) = 0.01; PE.LO(I) = 0.01;
 PEC.LO(I) = 0.01; PER.LO(I) = 0.01; PECW.LO(VER) = 0.01; PV.LO(I) = 0.01;
 WAGESK.LO(SK) = 0.01; WAGEUN.LO(UN) = 0.01; WLSKI.LO(I) = 0.01;
 WLUNK.LO(I) = 0.01; RENT.LO = 0.01;


*CLOSURE RULES

    CPI.FX = CPI.L;
    PECW.FX(VER) = PECW.L(VER) ;
    PEC.FX(NVER) = PEC.L(NVER) ;
    PEC.FX('CONS') = PEC.L('CONS');
    TC.FX(J) = TC.L(J);
    TR.FX(J) = TR.L(J);
```

```
    TEC.FX(I) = TEC.L(I);
    TD.FX(J) = TD.L(J);
    THG.FX(HH) = THG.L(HH);
    THW.FX(HH) = THW.L(HH);
    TWG.FX = TWG.L;
    TGK.FX = TGK.L;
    TWK.FX = TWK.L;
    DEPREC.FX = DEPREC.L;
    IMP.FX(NT) = 0;
    ICEE.FX(NT) = 0;
    IROW.FX(NT) = 0;
    E.FX(NT) = 0;
    ECEE.FX(NT) = 0;
    EROW.FX(NT) = 0;
    LSK.FX(SK,I)$(DELTASK(SK,I) EQ 0) = 0;
    LUN.FX(UN,I)$(DELTAUN(UN,I) EQ 0) = 0;
    WS.FX = WS.L ;
    GS.FX = GS.L;
    INV.FX = INV.L;

****************************************
* Fixed wages

*    WAGESK.FX(SK) = WAGESK.L(SK);
*    WAGEUN.FX('Sale') = WAGEUN.L('Sale');
*    WAGEUN.FX('Serv') = WAGEUN.L('Serv');
*    WAGEUN.FX('Nfarm') = WAGEUN.L('Nfarm');
*    WAGEUN.FX('Other') = WAGEUN.L('Other');

*    UNLAB.FX('Farm') = UNLAB.L('Farm');

****************************************
* Flexible wages

    SKLAB.FX(SK) = SKLAB.L(SK);
    UNLAB.FX(UN) = UNLAB.L(UN);
****************************************

    AGCAP.FX = AGCAP.L;
    TGCON.FX = TGCON.L;

 MODEL TURKAG90 SQUARE BASE MODEL / ALL / ;

 SOLVE TURKAG90 MAXIMIZING UTILITY USING NLP;
```

Appendix 4.D Results of the sensitivity analysis

The figures reported in this appendix arise from the sensitivity analysis of the model to the elasticities values. The columns, which are stated "low", show the counterfactual in the case of all elasticities divided by factor two. The columns, which are stated "high", show the counterfactual in the case of all elasticities multiplied by factor two. The columns, which are stated "standard", show the counterfactual with the regular elasticities as reported in the main text.

Table 4.D1 The impact on output (Base year = 100)

	Fixed wages			Flexible wages		
Sectors	*Standard*	*Low*	*High*	*Standard*	*Low*	*High*
Agriculture	97.8	97.4	95.8	102.6	101.5	99.5
Mining	99.7	97.3	108.9	99.1	101.4	101.2
Food processed products	103.6	100.2	104.6	103.6	110.0	111.3
Beverages and tobacco	107.0	104.8	113.9	105.3	102.4	111.5
Textiles	115.0	111.2	94.1	98.8	96.7	102.9
Wearing apparel	94.3	108.4	109.7	121.5	94.6	98.5
Leather and fur products	138.1	120.6	177.5	175.6	138.2	146.5
Footwear	107.8	100.2	83.2	106.2	99.3	80.8
Wood and wood products	101.0	97.0	104.4	99.2	100.1	102.1
Chemical products	103.3	101.6	110.0	105.8	101.3	103.1
Petroleum and coal products	89.3	93.0	92.7	88.3	94.6	93.0
Non-metallic mineral products	103.9	99.8	108.0	101.8	97.7	104.4
Metal products	108.8	101.4	114.4	107.7	104.5	101.7
Machinery	101.3	100.6	104.8	100.6	98.5	99.2
Transport equipment	101.6	101.2	104.1	100.8	100.4	100.0
Electricity, gas and waterworks	99.2	98.5	100.0	96.6	96.0	96.6
Construction	100.0	100.0	100.0	100.0	100.0	100.0
Trade, restaurants and hotels	100.2	101.1	103.0	97.3	96.4	94.1
Transport and communication	101.2	102.2	102.4	100.3	105.9	108.2
Other services	99.1	99.2	98.1	97.4	97.0	96.9
Leysperes Quantity Index	101.7	100.5	101.8	100.7	100.5	100.8

Table 4.D2 The impact on exports to the EU (Base year = 100)

Sectors	Fixed wages Standard	Fixed wages Low	Fixed wages High	Flexible wages Standard	Flexible wages Low	Flexible wages High
Agriculture	84.6	91.2	64.9	110.1	102.4	84.6
Mining	126.6	104.5	175.1	128.3	124.7	126.5
Food processed products	110.4	100.3	112.9	109.9	124.7	145.2
Beverages and tobacco	154.1	112.3	396.8	150.7	108.5	387.2
Textiles	148.2	127.3	103.4	102.6	101.5	130.6
Wearing apparel	108.7	125.9	163.6	162.7	103.3	140.6
Leather and fur products	222.3	150.0	378.9	317.2	212.2	278.4
Footwear	186.1	107.3	394.2	182.2	106.5	378.9
Wood and wood products	137.1	97.0	298.2	130.5	111.2	276.0
Chemical products	136.4	111.6	217.6	146.1	111.6	189.7
Petroleum and coal products	44.4	68.7	86.8	41.7	70.5	84.0
Non-metallic mineral products	146.1	105.8	233.6	135.2	96.3	203.6
Metal products	129.0	104.2	147.9	126.4	116.3	111.1
Machinery	122.5	105.8	181.1	121.4	98.6	147.7
Transport equipment	149.2	115.1	253.2	148.3	113.3	227.6
Electricity, gas and waterworks	55.9	81.6	34.5	48.9	68.8	26.6
Trade, restaurants and hotels	98.1	101.8	108.8	89.2	90.7	68.8
Transport and communication	104.2	106.6	107.2	103.3	117.8	138.8
Other services	96.2	99.5	82.0	90.5	92.0	78.3
Leysperes Quantity Index	116.6	111.1	127.6	114.2	106.0	128.3

Table 4.D3 The impact on exports to the RoW (Base year = 100)

	Fixed wages			Flexible wages		
Sectors	*Standard*	*Low*	*High*	*Standard*	*Low*	*High*
Agriculture	84.6	91.2	64.9	110.1	102.4	84.6
Mining	126.6	104.5	175.1	128.3	124.7	126.5
Food processed products	110.4	100.3	112.9	109.9	124.7	145.2
Beverages and tobacco	154.1	112.3	396.8	150.7	108.5	387.2
Textiles	116.1	112.7	63.5	80.4	89.9	80.2
Wearing apparel	54.0	88.8	40.4	80.9	72.9	34.8
Leather and fur products	222.3	150.0	378.9	317.2	212.2	278.4
Footwear	186.1	107.3	394.2	182.1	106.5	378.9
Wood and wood products	137.1	97.0	298.2	130.5	111.2	276.0
Chemical products	136.4	111.6	217.6	146.1	111.6	189.7
Petroleum and coal products	44.4	68.7	86.8	41.7	70.5	84.0
Non-metallic mineral products	146.1	105.8	233.6	135.2	96.3	203.6
Metal products	129.0	104.2	147.9	126.4	116.3	111.1
Machinery	122.5	105.8	181.1	121.4	98.6	147.7
Transport equipment	149.2	115.1	253.2	148.3	113.3	227.6
Electricity, gas and waterworks	55.9	81.6	34.5	48.9	68.8	26.6
Trade, restaurants and hotels	98.1	101.8	108.8	89.2	90.7	68.8
Transport and communication	104.2	106.6	107.2	103.3	117.8	138.8
Other services	96.2	99.5	82.0	90.5	92.0	78.3
Leysperes Quantity Index	108.4	103.6	128.9	109.1	108.2	125.8

Table 4.D4 The impact on the value added (Base year = 100)

	Fixed wages			Flexible wages		
	Standard	Low	High	Standard	Low	High
GDP in real terms	100.9	100.5	102.2	100.5	100.3	101.2
- Agriculture	94.6	95.4	92.0	102.5	99.9	96.0
- Industry	105.4	102.4	108.0	104.1	101.9	106.3
- Services	99.1	100.5	100.5	96.8	99.1	98.6

Table 4.D5 The impact on the trade flows (Base year = 100)

	Fixed wages			Flexible wages		
	Standard	Low	High	Standard	Low	High
Trade balance deficit	100.0	100.0	100.0	100.0	100.0	100.0
Trade balance deficit with the EU	105.1	77.5	322.2	138.0	152.8	299.3
Trade balance deficit with the RoW	99.5	102.4	76.1	95.9	94.3	78.5
Trade volume/GDP	110.2	106.1	121.6	109.7	105.7	121.9
Volume of exports	113.0	107.7	128.2	111.9	107.0	127.1
Volume of exports to the EU	116.6	111.1	127.6	114.2	106.0	128.3
Volume of exports to the RoW	108.4	103.6	128.9	109.1	108.2	125.8
Volume of imports	109.8	105.8	121.3	109.0	105.3	120.5
Volume of imports from the EU	116.0	109.3	138.1	115.5	108.6	137.5
Volume of imports from the RoW	104.8	103.1	107.9	103.8	102.7	106.9
Volume of exports in agriculture	84.6	91.2	64.9	110.1	102.4	84.6
Volume of exports in industry	125.8	112.3	153.1	125.1	108.7	147.9
Volume of exports in services	101.1	104.2	106.1	96.8	105.5	107.5
Volume of imports in agriculture	108.7	102.2	127.3	97.3	100.9	112.1
Volume of imports in industry	110.5	106.4	122.4	110.0	105.9	122.1
Volume of imports in services	100.1	98.9	100.8	100.7	98.0	100.5

Table 4.D6 The impact on the welfare of urban households

Unit of measure	Income class	Fixed wages			Flexible wages		
		Standard	*Low*	*High*	*Standard*	*Low*	*High*
	1st group	16.3	2.1	52.8	2.8	- 0.5	11.2
	2nd group	215.5	116.3	448.4	103.0	26.2	228.2
	3rd group	180.5	79.1	481.2	- 0.2	- 82.9	152.1
B	4th group	185.8	103.1	506.9	- 33.0	- 93.2	158.5
i	5th group	166.3	101.2	467.1	- 66.6	- 91.2	147.0
l	6th group	145.0	99.9	422.5	- 79.0	- 85.1	132.4
l	7th group	114.2	89.8	414.0	- 142.5	- 129.9	109.9
i	8th group	61.7	48.9	332.1	- 163-3	- 150.9	64.7
o	9th group	106.0	96.6	360.0	- 107.8	- 102.6	102.6
n	10th group	84.5	77.8	290.1	- 91.9	- 83.4	88.8
s	11th group	111.8	111.0	547.6	- 278.8	- 247.7	120.6
	12th group	127.7	122.3	482.4	- 176.1	- 172.0	137.0
o	13th group	13.2	25.7	323.5	- 242.6	- 224.3	45.2
f	14th group	38.1	36.9	297.6	- 187.9	- 181.4	45.8
	15th group	33.1	31.6	217.0	- 132.9	- 146.3	22.9
T	16th group	189.2	210.4	754.0	- 317.3	- 308.3	181.1
L	17th group	161.7	146.0	448.9	- 95.7	- 119.7	154.6
	18th group	635.7	595.2	1246.8	24.1	- 68.9	503.5
	19th group	31.4	50.3	203.7	- 155.7	- 144.7	- 0.8
	20th group	141.7	138.3	252.1	6.2	- 26.3	82.2
	1st group	101.3	100.2	104.1	100.2	100.0	100.9
%	2nd group	102.9	101.6	106.0	101.4	100.4	103.1
	3rd group	101.4	100.6	103.8	100.0	99.3	101.2
H	4th group	101.4	100.8	103.8	99.8	99.3	101.2
o	5th group	101.3	100.8	103.6	99.5	99.3	101.1
u	6th group	101.2	100.9	103.6	99.3	99.3	101.1
s	7th group	100.9	100.7	103.4	98.8	98.9	100.9
e	8th group	100.6	100.5	103.2	98.4	98.5	100.6
h	9th group	101.1	101.0	103.9	98.8	98.9	101.1
o	10th group	101.1	101.1	103.9	98.8	98.9	101.2
l	11th group	100.7	100.7	103.7	98.1	98.3	100.8
d	12th group	101.0	101.0	103.9	98.6	98.6	101.1
	13th group	100.1	100.3	103.3	97.5	97.7	100.5
i	14th group	100.5	100.5	103.8	97.6	97.7	100.6
n	15th group	100.6	100.5	103.8	97.7	97.5	100.4
c	16th group	101.1	101.2	104.2	98.2	98.3	101.0
o	17th group	101.9	101.7	105.2	98.9	98.6	101.8
m	18th group	103.6	103.4	107.0	100.1	99.6	102.8
e	19th group	100.5	100.8	103.4	97.4	97.6	100.0
	20th group	104.4	104.3	107.9	100.2	99.2	102.6

Table 4.D7 The impact on the welfare of rural households

Unit of measure	Income class	Fixed wages			Flexible wages		
		Standard	*Low*	*High*	*Standard*	*Low*	*High*
Billions of TL	1st group	3.2	- 12.2	20.8	31.6	25.3	18.0
	2nd group	- 1.8	- 52.6	46.3	127.7	95.4	65.5
	3rd group	58.1	- 27.6	151.8	222.6	152.6	168.2
	4th group	29.7	- 78.1	78.1	311.2	213.2	191.6
	5th group	- 32.1	- 114.0	- 19.4	285.2	200.4	141.3
	6th group	- 22.7	- 107.9	- 35.6	302.2	208.2	140.7
	7th group	- 4.0	- 92.5	- 49.6	301.0	218.9	136.5
	8th group	- 38.1	- 91.9	- 92.2	232.7	190.3	89.3
	9th group	- 58.8	- 107.8	- 113.2	214.6	181.4	67.6
	10th group	- 38.7	- 73.7	- 91.1	162.0	117.3	50.0
	11th group	- 113.0	- 160.1	- 231.3	346.1	301.3	88.6
	12th group	- 43.8	- 89.6	- 89.9	206.9	165.4	72.7
	13th group	31.3	14.3	42.9	102.0	83.2	69.8
	14th group	76.0	41.4	114.6	98.5	65.3	96.2
	15th group	25.5	10.1	40.9	60.5	46.9	51.3
	16th group	38.6	30.5	53.7	98.6	90.6	71.6
	17th group	16.0	- 14.1	- 21.6	168.1	104.3	57.3
	18th group	50.8	31.9	59.3	97.3	51.0	56.4
	19th group	14.8	16.8	20.1	- 7.3	- 2.5	3.2
% Household income	1st group	100.2	99.2	101.4	102.1	101.7	101.2
	2nd group	100.0	99.2	100.7	102.0	101.5	101.0
	3rd group	100.5	99.7	101.4	102.1	101.4	101.6
	4th group	100.2	99.4	100.6	102.4	101.7	101.5
	5th group	99.8	99.1	99.8	102.2	101.6	101.1
	6th group	99.8	99.0	99.7	102.7	101.9	101.3
	7th group	100.0	99.0	99.5	103.1	102.3	101.4
	8th group	99.5	98.9	98.9	102.8	102.3	101.1
	9th group	99.2	98.6	98.5	102.8	102.4	100.9
	10th group	99.2	98.5	98.1	103.4	102.4	101.0
	11th group	99.0	98.6	97.9	103.1	102.7	100.8
	12th group	99.4	98.7	98.7	102.9	102.3	101.0
	13th group	100.7	100.3	101.0	102.4	102.0	101.6
	14th group	101.5	100.8	102.2	101.9	101.3	101.9
	15th group	101.0	100.4	101.6	102.3	101.8	102.0
	16th group	100.6	100.5	100.9	101.6	101.5	101.2
	17th group	100.3	99.7	99.6	103.5	102.2	101.2
	18th group	101.1	100.7	101.2	102.0	101.1	101.2
	19th group	101.9	102.1	102.5	99.1	99.7	100.4

Table 4.D8 The impact on aggregate welfare

Unit of measure	Region	Fixed wages			Flexible wages		
		Standard	*Low*	*High*	*Standard*	*Low*	*High*
Billions of 1990 TL	Turkey	2750.3	1405.5	8433.3	1226.3	75.4	4123.5
	Urban	2759.3	2282.5	8548.6	- 2135.2	- 2433.2	2487.6
	Rural	- 9.1	- 877.0	- 115.3	3361.4	2508.6	1635.9
% of household income	Turkey	100.8	100.4	102.6	100.4	100.0	101.3
	Urban	101.4	101.1	104.2	99.1	98.9	101.3
	Rural	100.0	99.3	100.0	102.5	101.9	101.2

Table 4.D9 The impact on the size distribution of income
(Base year = 100)

Generalised Entropy Index	Inequality	Fixed wages			Flexible wages		
		Standard	*Low*	*High*	*Standard*	*Low*	*High*
	Overall inequality	100.5	101.3	101.5	98.0	98.4	99.8
- 1	Within urban group	99.9	100.8	100.8	98.2	98.7	99.8
	Within rural group	99.7	100.2	98.1	100.7	100.7	99.7
	Between groups	107.5	109.8	123.8	82.3	84.5	100.1
	Overall inequality	100.7	101.4	101.8	98.2	98.6	100.0
0	Within urban group	100.3	100.9	101.0	98.8	99.1	100.1
	Within rural group	100.1	100.6	99.0	100.4	100.4	99.8
	Between groups	107.4	109.7	123.3	82.5	84.7	100.1
	Overall inequality	101.5	102.1	103.1	98.2	98.4	100.3
+ 1	Within urban group	101.0	101.5	101.7	99.5	99.5	100.5
	Within rural group	100.7	101.2	100.1	99.9	100.0	99.9
	Between groups	106.5	107.9	115.3	89.7	91.5	100.6
	Overall inequality	103.6	104.4	106.4	97.8	97.7	101.0
+ 2	Within urban group	102.7	103.2	103.5	100.4	99.0	101.2
	Within rural group	101.7	102.5	101.7	98.8	99.0	99.7
	Between groups	107.3	109.6	123.0	82.7	84.9	100.1

Table 4.D10 The impact on the functional distribution of income
(Base year = 100)

	Fixed wages			Flexible wages		
	Standard	*Low*	*High*	*Standard*	*Low*	*High*
A -Capital income	**100.7**	**101.0**	**101.2**	**99.1**	**99.6**	**100.2**
- Agricultural income	97.2	96.8	94.0	103.7	102.4	99.6
- Non-agricultural income	101.5	101.9	102.8	98.1	99.0	100.3
B - Labour income	**100.4**	**99.0**	**102.3**	**99.9**	**99.2**	**100.0**
B.1 - Skilled labour income	**100.6**	**100.2**	**102.1**	**98.2**	**96.5**	**99.6**
- Professional workers	100.3	100.0	101.5	97.9	95.8	99.4
- Managerial workers	101.5	100.7	103.4	99.0	97.9	100.1
- Clerical workers	100.6	100.3	102.5	98.2	96.8	99.6
B.2 - Basic skilled labour income	**101.8**	**101.0**	**104.7**	**99.5**	**98.8**	**100.2**
- Sales workers	101.2	101.7	106.2	98.5	96.7	99.2
- Service workers	100.2	100.0	102.8	99.0	97.6	99.6
- Non agricultural workers	102.4	101.2	105.2	99.7	99.6	100.6
- Other workers	102.1	101.1	104.4	99.4	98.6	100.3
B.3 - No-skilled labour income	**97.4**	**93.2**	**97.8**	**103.2**	**104.2**	**100.0**
- Agricultural workers	97.4	93.2	97.8	103.2	104.2	100.0
Basic skilled / Skilled labour income	*101.2*	*100.8*	*102.6*	*101.3*	*102.5*	*100.7*
No-skilled / Skilled labour income	*96.8*	*93.0*	*95.7*	*105.2*	*108.0*	*100.4*
Basic skilled labour / Capital income	*101.1*	*100.0*	*103.4*	*100.4*	*99.2*	*100.1*
No-skilled labour / Capital income	*96.7*	*92.3*	*96.6*	*104.2*	*104.6*	*99.8*

Table 4.D11 The impact on employment

	Relative change (Base year = 100)			Number of new workers			Share		
	Standard	*Low*	*High*	*Standard*	*Low*	*High*	*Standard*	*Low*	*High*
Labour Input	101.0	100.5	102.8	147505	86117	431658	1.000	1.000	1.000
- Professional workers	100.3	100.0	101.5	2827	- 242	15836	0.019	- 0.003	0.037
- Managerial workers	101.5	100.7	103.4	4901	2168	10901	0.033	0.025	0.025
- Clerical workers	100.6	100.3	102.5	5255	2373	21726	0.036	0.028	0.050
- Sales workers	101.2	101.7	106.2	18606	25232	94017	0.126	0.293	0.218
- Service workers	100.2	100.0	102.8	3050	595	41334	0.021	0.007	0.096
- Agricultural workers	100.0	100.0	100.0	0	0	0	0.000	0.000	0.000
- Non agricultural workers	102.4	101.2	105.2	110251	54617	242397	0.747	0.634	0.562
- Other workers	102.1	101.1	104.4	2615	1376	5445	0.018	0.016	0.013

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