A CONJECTURAL VARIATION COMPUTABLE GENERAL EQUILIBRIUM MODEL WITH FREE ENTRY

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ABSTRACT: This paper proposes a procedure to incorporate the conjectural variation approach in Computable General Equilibrium (CGE) analysis such that the strategic interaction among rival firms in international markets can be modelled. It shows how to calibrate the conjectured reactions of rival domestic and foreign firms. It also shows that the approach suggested by Harrison, Rutherford and Tarr (henceforth, HRT) is valid if Cournot competition prevails among domestic firms, among foreign firms, and between domestic and foreign firms. A conjectural variation CGE model applied to Turkey indicates that, if Cournot competition prevails between domestic and foreign firms, the results obtained under the HRT approach are very similar to those obtained under the conjectural variation approach. However, if foreign firms expect that rival domestic firms would react to their own action, then the results change dramatically. In a more competitive context, a large welfare gain from trade liberalisation can be generated.

KEYWORDS: Price cost margin, Conjectural variation, CGE analysis.
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1. Introduction

The CGE modelling literature has developed quite markedly in the last two decades. Initially, these models were constructed under the assumption of perfect competition and constant returns to scale (CRS). In the middle eighties, under the wave of the 'new trade theory',[1] models with industrial organisation features were used to study the impact of trade policy actions when industries are characterised by endogenous market structure, and the economies to scale are exploited at firm level. These models, with imperfect competition and increasing returns to scale (IRS) at firm level, usually employ the Lerner formula to set endogenously the price markup above the marginal cost. Examples of small open economy CGE models of this kind are those built by Harris (1984) and Devarajan and Rodrik (1989, 1991). Harris (1984) assumes that a firm of protected oligopolistic industries sets its price as a weighted average of the monopolistic Lerner price and the tariff-inclusive price of the importing competing goods. Devarajan and Rodrik define the inverse of the price cost margin in the domestic (export) market, as a product between the endogenous number of firms and the constant absolute value of the domestic (foreign) demand elasticity faced by the industry as a whole.[2] Examples of multicountry CGE models with industrial organisation features are those built by Gasiorek, *et al*. (1992) and by HRT (1996, 1997b). In these studies, the price cost margin is defined as an inverse function of the endogenous price elasticity of demand perceived by the representative firm. Gasiorek, *et al*. assume that the aggregate demand is isoelastic;[3] whilst HRT derive the perceived price elasticity of

[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, it is argued 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).

[2] Devarajan and Rodrik (1991) calibrate the price elasticity of domestic demand as a positive function of the ratio between the price of imports and the price of domestic goods.

[3] It must be stressed that the original algebraic formulation of the price elasticity of demand perceived by a firm with an isoelastic demand curve has been developed by Smith and Venables (1988), under the alternative Cournot and Bertrand conjectures. However, these models are of a partial equilibrium nature.

demand under the assumption that domestic goods and imports are imperfect substitutes. This latter finding is very important as, in order to capture intraindustry trade, most of CGE models employ the Armington specification, which states that goods produced by industries located in different countries, but which compete in the same market, are imperfect substitutes (Armington, 1969). The studies by HRT are based upon the assumption that firms compete in a quantity setting oligopoly with constant conjectures. The latter are endogenously calibrated. They express the optimal markup for each sector in each national market as a function of elasticities of substitution and firms' market share, and assume that the price elasticities of demand perceived by a firm in the domestic and export markets are independent of conjectural variations parameters (De Santis, 1999). In this paper, I suggest a way to use the conjectural variation approach in CGE models, where the price elasticities of demand perceived by a firm in the domestic and export markets do depend upon strategic expectations among firms.

The criticisms made by theoretical industrial economists to the conjectural variation approach are well known. It is argued that the notion of conjectural variation is *ad hoc* (Daughety, 1985), or that strategic responses require a temporal setting (Makowski, 1987). However, it is also understood that the conjectural variation approach is an approximation of the solution which emerges from the equilibrium of a dynamic oligopolistic game (Schmalensee, 1989; Ferrel and Shapiro, 1990).[4] Certainly, the conjectural variation models are used by empirical industrial economists because they can cover the entire range of market performance from competition to monopoly (Cowling, 1976; Cowling and Waterson, 1976; Slade, 1987; Machin and Van Reenen, 1993).

The conjectural variation approach is rarely used in CGE models for two main reasons: firstly, the demand tree of a typical CGE model is of a multi-stage type and the strategic behaviour of domestic and foreign firms can occur at different stages of the demand tree; secondly, the calibration of the key parameters of the markups equations can be tricky and is certainly demanding, causing problems associated with the convergence of the model.[5] In order to understand the problem, let me sketch a figure where the strategic interactions among domestic and foreign firms are clearly identifiable. Figure 1 depicts a typical three stage demand tree for the imperfect competitive good employed in the CGE literature (see for example HRT, 1996, 1997b). At the first stage, the final demand of the representative consumer and the intermediate demand of industries are satisfied by the supply of composite commodities. At the second stage, the aggregate demand for composite commodities is satisfied by the supply of domestic goods and imports, treated as imperfect substitutes. At the third stage, having decided the demand for domestic goods and for imports, consumers and industries purchase a variety of domestic goods and a variety of imports. Hence, domestic firms (as well as foreign firms) compete against each other at the third stage of the demand tree. Whereas domestic firms and foreign firms compete against each other at the second stage of the demand tree. This implies that the expectation of a domestic (foreign) firm about the action of other domestic (foreign) firms to their own actions is formed at the third stage of the demand tree; whereas the expectation of domestic (foreign) firms about the action of the foreign (domestic) firms to their own actions is formed at the second stage of the demand tree.

[Insert Fig. 1]

In this paper, I derive a general formulation for the price markup, where the price elasticity of demand is a function of the conjectured reactions of both the rival domestic and foreign firms. I show

[4] Note that, in linear oligopolies and for an open set of values of the discount factor, the conjectural variation solution is the reduced form of the equilibrium of a quantity-setting repeated game with minimax punishments during T periods (Cabral, 1995).

[5] By calibration procedure I mean the estimation of unknown parameters, such that the observed values of endogenous variables constitute an equilibrium of the CGE model.

that the price cost margin formula used by HRT can be obtained in the specific case when firms behave in a Cournot fashion. I also show how to calibrate the conjectural variation of the domestic (foreign) firm about the behaviour of the rival domestic (foreign) firms. In order to understand how welfare and output might be affected by the use of alternative conjectural variations, a single country open economy CGE model has been built for the Turkish economy, and the effects of a unilateral partial trade liberalisation policy are examined.

The remaining sections of this paper have been organised as follows: Section 2 describes the modelling framework; Section 3 derives the price elasticities of demand perceived by a representative firm in the domestic and export markets; Section 4 describes the numerical model, the benchmark data set and the calibration procedure, and discusses the numerical results obtained applying an CGE model to the Turkish economy; Section 5 presents a summary.

2. The structure of the model

Consider an open economy with a single representative consumer whose consumption decisions are taken by solving a multi-stage CES demand system. Assume that the industry is imperfectly competitive, the technology exhibits IRS at firm level and the equilibrium number of firms is determined by the zero profit condition. Finally, assume that the production function entails the use of intermediate inputs and primary inputs, such as labour and capital. This structure implies that final demand is equal to the sum between consumer demand and intermediate demand. The final demand is satisfied by the supply of domestic goods and imports, which are in turn assumed to be imperfect substitutes as in Armington (1969).

2.1. The supply behaviour

Assume that within an industry i a firm s faces fixed costs, f_i, and produces two differentiated commodities, one supplied in the domestic market, $\tilde{d}_{is}$, and the other exported, $\tilde{e}_{is}$. Note that i denotes the sectors facing IRS, whereas j denotes all economic sectors.

The profit function of a representative domestic firm, π_i, takes the following form:

(1) $$\pi_i = \tilde{p}^d_{is}\tilde{d}_{is} + \tilde{p}^e_{is}\tilde{e}_{is} - c_i\left(\tilde{d}_{is} + \tilde{e}_{is}\right) - f_i,$$

where $\tilde{p}^d_{is}$ and $\tilde{p}^e_{is}$ denote the brand prices of domestic output and exports, respectively; and c_i the marginal cost, which is assumed to be independent of output. The first order conditions yield the price cost margins in both the domestic and export markets

(2) $$\frac{\tilde{p}^d_{is} - c_i}{\tilde{p}^d_{is}} = \frac{1}{|\tau_{is}|}, \qquad \tau_{is} < -1,$$

(3) $$\frac{\tilde{p}^e_{is} - c_i}{\tilde{p}^e_{is}} = \frac{1}{|\delta_{is}|}, \qquad \delta_{is} < -1,$$

where τ_{is} and δ_{is} represent the price elasticities of domestic and export demands perceived by a domestic firm s, respectively. HRT (1997b) argue that $\left(\tilde{p}^d_{is} - c_i\right)/\tilde{p}^d_{is} = \left(1+\Omega^d_i\right)/|\tau_{is}|$ and $\left(\tilde{p}^e_{is} - c_i\right)/\tilde{p}^e_{is} = \left(1+\Omega^e_i\right)/|\delta_{is}|$, where Ω^d_i and Ω^e_i denote the conjectural variations in the domestic and export markets, respectively (with $\Omega^d_i = \Omega^e_i = 0$ representing the Cournot case). However, they implicitly assume that τ_{is} and δ_{is} are independent of conjectural variations parameters. Conversely, as suggested by Smith and Venables (1988), τ_{is} and δ_{is} also depend on the perceived effect of the firm's action on industry aggregate supply. More precisely, I show in the next section that τ_{is} and δ_{is} are each a function of two conjectural variations parameters, since domestic firms also have conjectures about how foreign firms respond.

2.2. The demand behaviour

A typical CGE model with imperfect competition and IRS is characterised by the three stage demand system as depicted in Figure 1. At the first stage, the final demand of the representative consumer, C_i, and the intermediate demand of industries, X_i, are satisfied by the supply of composite commodities, Q_i:

(4) $$C_i = \alpha_i \, I / p_i$$

(5) $$X_i = \sum_j a_{ij} Y_j$$

(6) $$Q_i = C_i + X_i = \left[\varphi_i D_i^{(\varepsilon_i - 1/\varepsilon_i)} + (1 - \varphi_i) M_i^{(\varepsilon_i - 1/\varepsilon_i)}\right]^{\varepsilon_i/(\varepsilon_i - 1)},$$

where α_i denotes household budget shares, I household income, p_i the price of the Armington goods, Y_j sectoral output, a_{ij} the input requirements by sectors *j* which are supplied by the IRS sectors, D_i domestic output, M_i imports, ε_i the elasticity of substitution between imports and domestic goods, and φ_i the share parameter of the Armington function. Equation (4) is derived by maximising the consumer's Cobb-Douglas utility function subject to his budget constraint, whereas the derivation of (5) is based upon the assumption that intermediate inputs are net complements (i.e. Leontief specification). Equation (6) gives the equilibrium in the goods market.

At the second stage, the aggregate demand for composite commodities is satisfied by the supply of domestic goods and imports, according to the CES Armington specification. At the upper level, the solution of the Armington-dual problem yield the demand for domestic goods, D_i, the demand for imports, M_i, and the Armington price, p_i:

(7) $$D_i = \varphi_i^{\varepsilon_i} p_i^{d \, -\varepsilon_i} p_i^{\varepsilon_i} Q_i,$$

(8) $$M_i = \left(1-\varphi_i\right)^{\varepsilon_i} p_i^{m^{-\varepsilon_i}} p_i^{\varepsilon_i} Q_i \,,$$

(9) $$p_i = \left\{\varphi_i^{\varepsilon_i} p_i^{d\,(1-\varepsilon_i)} + \left(1-\varphi_i\right)^{\varepsilon_i} p_i^{m(1-\varepsilon_i)}\right\}^{1/(1-\varepsilon_i)} ,$$

where p_i^d denotes the domestic price index and p_i^m the import price index.

At the third stage, having decided the demand for domestic goods and for imports, consumers and industries purchase a variety of domestic goods and a variety of imports, based again on CES functions:

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

(11) $$M_i = \left[\sum_{r=1}^{k} \tilde{m}_{ir}^{(\xi_i-1)/\xi_i}\right]^{\xi_i/(\xi_i-1)} , \qquad \xi_i > 1 ,$$

where ς_i and ξ_i represent the elasticities of substitution among *n* domestic varieties and *k* imported varieties, respectively; and $\tilde{m}_{ir}$ denotes output of each foreign brand *r*. Given (10) and (11), the solution of the dual problems yields

(12) $$\tilde{d}_{is} = p_i^{d\,\varsigma_i} \tilde{p}_{is}^{d\,-\varsigma_i} D_i \,,$$

(13) $$p_i^d = \left[\sum_{s=1}^{n} \tilde{p}_{is}^{d\,((1-\varsigma_i))}\right]^{1/(1-\varsigma_i)} ,$$

(14) $$\tilde{m}_{ir} = p_i^{m\,\xi_i} \left[\tilde{p}_{ir}^m \left(1+t_i\right)\right]^{-\xi_i} M_i \,,$$

(15) $$p_i^m = \left[\sum_{r=1}^{k} \left[\tilde{p}_{ir}^m \left(1+t_i\right)\right]^{(1-\xi_i)}\right]^{1/(1-\xi_i)} ,$$

where $\tilde{p}_{ir}^m$ denotes the price of the imported brand *r*, and t_i the *ad valorem* tariff rate.

3. The strategic interaction among firms

As suggested by Smith and Venables (1988), τ_{is} and δ_{is} also depend on the perceived effect of the firm's action on industry aggregate supply. In this section, I will show that τ_{is} and δ_{is} are each a function of two conjectural variation parameters, since a domestic firm also has conjectures about how rival domestic and foreign firms respond. Thus, assume that domestic and foreign firms do respond to rivals' output choices with constant conjectures.

From (12), the inverse demand function can be log-linearised as

(16) $$\ln \tilde{p}_{is}^{d} = 1/\varsigma_i \ln D_i - 1/\varsigma_i \ln \tilde{d}_{is} + \ln p_i^d .$$

By definition the derivative of (16) with respect to $\ln \tilde{d}_{is}$ yields the inverse of the price elasticity of domestic demand perceived by a firm:

(17) $$\frac{1}{\tau_{is}} = \frac{1}{\varsigma_i} \frac{d \ln D_i}{d \ln \tilde{d}_{is}} - \frac{1}{\varsigma_i} + \frac{d \ln p_i^d}{d \ln \tilde{d}_{is}} .$$

The appendix shows that under symmetry among domestic firms and constant conjectures

(18) $$\frac{1}{\tau_i} = -\frac{1}{\varsigma_i} - \frac{1}{n_i}\left\{\frac{1}{\varepsilon_i} - \frac{1}{\varsigma_i} + \Psi_i\left(\frac{1}{\chi_i} - \frac{1}{\varepsilon_i}\right)\left[1 + \frac{1-\varphi_i}{\varphi_i}\left(\frac{M_i}{D_i}\right)^{-1/\varepsilon_i}\mu_i\right]\right\}\left[1 + \frac{\sum_{t \neq s}\left(\tilde{d}_{it}^{\,-1/\varsigma_i}\right)}{\tilde{d}_{is}^{\,-1/\varsigma_i}}\lambda_i\right] ,$$

where $\Psi_i = p_i^d D_i \big/ \left[p_i^d D_i + p_i^m M_i\right]$ represents the domestic industry market share in the domestic market; χ_i is the absolute value of the price elasticity of aggregate demand; $\lambda_i = \partial \tilde{d}_{it} \big/ \partial \tilde{d}_{is}$ denotes the conjectured reaction of rival domestic firms, $t = 1, \ldots\ldots, n-1$; and $\mu_i = \partial M_i / \partial D_i$ can be interpreted as the conjectured reaction of foreign firms to the domestic firms' action in the domestic market. Regarding the price elasticity of aggregate demand, by using (4)-(6), it can be shown that $\chi_i = C_i / Q_i$ (see appendix). This implies that χ_i is endogenous and ranges between zero and one.

Similarly, the appendix shows that the inverse of the price elasticity of export demand perceived by a representative firm is:

$$\frac{1}{\delta_i} = -\frac{1}{\xi_i^*} - \frac{1}{n_i}\left\{\frac{1}{\varepsilon_i^*} - \frac{1}{\xi_i^*} + \Psi_i^*\left(\frac{1}{\chi_i^*} - \frac{1}{\varepsilon_i^*}\right)\left[1 + \frac{\varphi_i^*}{1-\varphi_i^*}\left(\frac{D_i^*}{E_i}\right)^{-1/\varepsilon_i^*}\mu_i^*\right]\right\}\left[1 + \frac{\sum_{t \neq s} \tilde{e}_{it}^{\;-1/\xi_i^*}}{\tilde{e}_{is}^{\;-1/\xi_i^*}}\lambda_i^*\right], \tag{19}$$

where $\Psi_i^* = p_i^e E_i \Big/ \left(p_i^e E_i + p_i^{d^*} D_i^*\right)$ denotes the domestic industry market share in the foreign market; p_i^e is the price index of exports, E_i; $p_i^{d^*}$ is the domestic price index of foreign goods, D_i^*; χ_i^* the absolute value of the price elasticity of aggregate demand in the foreign market; $\lambda^* = \partial\tilde{e}_{it} / \partial\tilde{e}_{is}$ denotes the conjectured reaction of rival domestic firms; $\mu^* = \partial D_i^* / \partial E_i$ can be interpreted as the conjectured reaction of foreign firms to the domestic firms' action in the foreign market; ε_i^* and φ_{is}^* are the foreign Armington elasticity of substitution and share parameter, respectively; and ξ_i^* is the elasticity of substitution among *n* exported brands.[6]

Also the foreign industry is assumed to be imperfectly competitive. It can be easily shown that the inverse of the price elasticity of import demand perceived by a representative foreign firm ($\gamma_i < -1$) is

$$\frac{1}{\gamma_i} = -\frac{1}{\xi_i} - \frac{1}{k_i}\left\{\frac{1}{\varepsilon_i} - \frac{1}{\xi_i} + \left(1-\Psi_i\right)\left(\frac{1}{\chi_i} - \frac{1}{\varepsilon_i}\right)\left[1 + \frac{\varphi_i}{1-\varphi_i}\left(\frac{D_i}{M_i}\right)^{-1/\varepsilon_i}\mu_i^m\right]\right\}\left[1 + \frac{\sum_{z \neq r}\left(\tilde{m}_{iz}^{\;-1/\xi_i}\right)}{\tilde{m}_{ir}^{\;-1/\xi_i}}\lambda_i^m\right], \tag{20}$$

[6] Note that in a multiregional framework, δ_i is also affected by the ratio between domestic firms' exports and total exports to a given region *r*. In a single country case, this ratio is obviously equal to one.

where $\lambda_i^m = \partial \tilde{m}_{iz} / \partial \tilde{m}_{is}$ denotes the conjectured reactions of rival foreign firms, $z = 1,.....,k-1$; and $\mu_i^m = \partial D_i / \partial M_i$ can be interpreted as the conjectured reactions of domestic firms to the foreign firms' action in the domestic market.

It is interesting to note that $\lim_{n\to\infty}(1/\tau_i) = -1/\varsigma_i$, $\lim_{n\to\infty}(1/\gamma_i) = -1/\xi_i^*$ and $\lim_{k\to\infty}(1/\gamma_i) = -1/\xi_i$. In other words, the price cost margin of a firm would be equal to the inverse of the elasticity of substitution among individual producers, as the number of brands converges to infinite. This result is in line with the monopolistic competitive literature (Dixit and Stiglitz, 1977; Krugman, 1979).

The absolute value of (18)-(20) correspond to the price cost margin formula employed by HRT (1997b) if, and only if, $\lambda_i = \mu_i = \lambda_i^* = \mu_i^* = \lambda_i^m = \mu_i^m = 0$ (Cournot competition). The formulas employed by HRT (1997b) are therefore a specific case of the general formulation presented in this study.

Equations (18)-(20) are consistent with the theory, which argues that a more collusive outcome is obtained for positive conjectural variations, if $\varsigma_i > \varepsilon_i > \chi_i$, $\xi_i^* > \varepsilon_i^* > \chi_i^*$ and $\xi_i > \varepsilon_i > \chi_i$.

In order to get further insights regarding the expressions which define the price markups in the domestic and foreign markets, it is very useful to compute the total differential of (18), (19) and (20). Since, they are very similar expressions, I report only the total differential of (18), which is:

$$(21) \qquad d\left(1/|\tau_i|\right) = \frac{(\lambda - 1)}{n_i^{\,2}} A_i dn_i + \frac{1}{n_i} G_i \left\{ B_i \left[\left(\frac{1}{\chi_i} - \frac{1}{\varepsilon_i} \right) d\Psi_i - \frac{\Psi_i}{\chi_i^2} d\chi_i \right] + C_i d\left(\frac{D_i}{M_i} \right) \right\},$$

where $G_i = (n_i - 1)\lambda_i + 1$, $A_i = 1/\varepsilon_i - 1/\varsigma_i + \Psi_i(1/\chi_i - 1/\varepsilon_i)B_i$, $B_i = 1 + (1 - \varphi_{ii})/\varphi_i (M_i/D_i)^{-1/\varepsilon_i} \mu_i$ and $C_i = \Psi_i(1/\chi_i - 1/\varepsilon_i)(1 - \varphi_i)/(\varepsilon_i \varphi_i)(M_i/D_i)^{\varepsilon_i/(1-\varepsilon_i)} \mu_i$. This exercise allows one to arrive at the following conclusions under the assumptions that $\varsigma_i > \varepsilon_i > \chi_i$:

- new entry of domestic firms leads to a fall in the domestic price markup if $(\lambda_i - 1)A_i < 0$;
- a larger aggregate price elasticity (in absolute value) in the domestic market implies a larger price elasticity of demand perceived by a domestic firm (in absolute value) in the domestic market if $B_i G_i > 0$;
- an increase in the market share of the domestic industry implies a rise in the price markup in the domestic market if $B_i G_i > 0$;
- a rise of domestic sales relative to the import volume implies a rise in the price markup in the domestic market if $C_i G_i > 0$.

All these conditions are fulfilled if $\mu_i \geq 0$ and $(1-n_i)^{-1} < \lambda_i < 1$. However, a variety of possibilities are given to modellers, if they believe that the imperfect competitive industry behaves according to different strategic interactions. Similar results can be obtained by calculating the total differential of (19) and (20). Hence, a check on the value of λ_i, λ_i^*, λ_i^m, μ_i, μ_i^* and μ_i^m is very useful to understand and interpret the numerical results.

4. A CGE model for Turkey

The single country 3-sector CGE model presented in this section examines how robust is the model to alternative conjectural variation parameters. Given the fact that the model is working at an extremely aggregate level, one should interpret the results simply as numerical exercises to test the capacity of the model. Nevertheless, the outcome might result to have an useful empirical application, because Turkey has markedly reduced its trade barriers on industrial goods in the 1990's. Hence, the construction of a

CGE model with imperfect competition and scale economies, and the study of the elimination of Turkish tariffs on industrial goods can be empirically relevant.[7]

The CGE model contains two categories of industries: those where perfect competition and CRS are assumed to prevail (agriculture and services), and that which is characterised by IRS (industry). 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. The production possibility frontier of the industries facing perfect competition and CRS is a CET specification of domestic products and exports, treated as imperfect substitutes. On the demand side, the representative household demand, government spending, and the intermediate demand are satisfied by a composite of domestic and imported goods, as described in section 2.2. Government spending is set exogenously, so it does not play any role. The household demand is derived from a Cobb-Douglas utility function. The country is assumed to be price taker for the commodities traded internationally, with the exception of exports produced by sectors facing IRS, for which a downward sloping demand curve is supposed. The latter has been derived by assuming that an hypothetical foreign consumer purchases a variety of domestic goods and a variety of Turkish exports, treated as their substitutes (see the appendix). Foreign domestic production is set exogenously. The trade balance and the public budget balance are always in equilibrium. With regard to the sectors facing imperfect competition and IRS, expressions (1), (2), (3), (7), (10), (A8) and (A10) endogenously determine n_i, $\tilde{p}_{is}^d$, $\tilde{p}_{is}^e$, D_i, $\tilde{d}_{is}$, E_i and $\tilde{e}_{is}$. Similarly, the zero profit condition and the

[7] CGE studies, which have examined the economic implications of Turkish trade policies in the 1990's, are those of HRT (1997a), Mercenier and Yeldan (1997), and De Santis (2000).

price cost margin for the foreign firm, plus (8) and (11) determine k_i, $\tilde{p}_{ir}^m$, M_i and $\tilde{m}_{ir}$. I postulate that the Turkish trade liberalisation policy does not have any impact on foreign factor prices.

Regarding the numéraire of the model, the domestic price of agricultural goods is normalised to unity. It is well known that the choice of the numéraire matters in general equilibrium models with imperfect competition (Gabszewicz and Vial, 1972; Dierker and Grodal, 1986; Ginsburgh, 1994). However, as suggested by Ginsburgh (1994) and Ginsburgh and Keyzer (1997), in models where markets are competitive for some commodities, all agents take the prices on the competitive markets as given. Hence, a numéraire among the prices of these goods can be chosen. This choice does not solve the problem *per se*, but at least the behaviour of oligopolists would not be affected (Cripps and Myles, 1988).

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 variables constitutes an equilibrium of the numerical model. The main bulk of the data comes from the official 1990 Input-Output table for Turkey (see Table 1). The activities and commodities are disaggregated into 3 different types: agriculture, industry and services.

[Insert Table 1 here]

In order to calibrate the variables of the sector facing IRS, the algebraic structure of the model required further information on price-cost margin, fixed costs and the number of symmetric firms. I assume that labour and capital inputs used in fixed proportion are 60% of the primary factor inputs. This allows me to calibrate the marginal cost and the cost disadvantage ratio, which is equal to 16.3%. I also assume that the number of domestic and foreign firms is 50 each. The number of firms is large enough to avoid problems associated with integer values. The elasticity of substitution among domestic brands and among foreign brands is set equal to 7, such that $\left(1-n_i^0\right)^{-1} < \hat{\lambda}_i < 1$, $\left(1-n_i^0\right)^{-1} < \hat{\lambda}_i^* < 1$ and $\left(1-k_i^0\right)^{-1} < \hat{\lambda}_i^m < 1$, which yield $\hat{B}_i^v > 0$ and $\hat{C}_i^v \geq 0$ (v denotes the domestic market, the import market and the export market); except for the scenario labelled 'CV4', where I assume a more competitive behaviour among domestic and foreign rivals firms, $\mu_i^m < 0$, which yields $\hat{B}_i^m = 0$, $\hat{C}_i^m < 0$ and $\hat{\lambda}_i^m < \left(1-k_i^0\right)^{-1}$ if $\xi_i = 3$.[8] This permits the calibration of the firms' perceived price elasticities in each market.

The conjectural variation parameters Ω_i^v and λ_i^v are endogenously calibrated. Under the HRT formula, the conjectural variation parameters in the domestic ($\hat{\Omega}_i$), export market ($\hat{\Omega}_i^*$) and import market ($\hat{\Omega}_i^m$) are calibrated as follows: $\hat{\Omega}_i = \hat{\theta}_i\left|\hat{\tau}_i\right| - 1$, $\hat{\Omega}_i^* = \hat{\theta}_i\left|\hat{\delta}_i\right| - 1$, and $\hat{\Omega}_i^m = \hat{\theta}_i\left|\hat{\gamma}_i\right| - 1$, where $\hat{\theta}_i$ denotes the calibrated price cost margin, which is assumed equal to the cost disadvantage ratio for both domestic and foreign firms. Thus, $\hat{\theta}_i$ is equal to 0,163. Under the correct approach, the conjectural variation parameters in the domestic ($\hat{\lambda}_i$), export market ($\hat{\lambda}_i^*$) and import market ($\hat{\lambda}_i^m$) are calibrated as follows:

(21) $$\hat{\lambda}_i = \left\{ \frac{n_i^0\left(\hat{\theta}_i - 1/\varsigma_i\right)}{1/\varepsilon_i - 1/\varsigma_i + \hat{\Psi}_i\left(1/\hat{\chi}_i - 1/\varepsilon_i\right)\left[1 + \left(1-\hat{\varphi}_i\right)/\hat{\varphi}_i\left(M_i^0/D_i^0\right)^{-1/\varepsilon_i}\mu_i^0\right]} - 1 \right\}\left(n_i^0 - 1\right)^{-1},$$

(22) $$\hat{\lambda}_i^* = \left\{ \frac{n_i^0\left(\hat{\theta}_i - 1/\xi_i^*\right)}{1/\varepsilon_i^* - 1/\xi_i^* + \hat{\Psi}_i^*\left(1 - 1/\varepsilon_i^*\right)\left[1 + \hat{\varphi}_i^*/\left(1-\hat{\varphi}_i^*\right)\left(D_i^{0^*}/E_i^0\right)^{-1/\varepsilon_i^*}\mu_i^{0^*}\right]} - 1 \right\}\left(n_i^0 - 1\right)^{-1},$$

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[8] Variables and parameters with ^ mean that they are calibrated, whilst variables with ^{0} are observed in the base year.

$$(23)\qquad \hat{\lambda}_i^m = \left\{ \frac{k_i^0\left(\hat{\theta}_i - 1/\xi_i\right)}{1/\varepsilon_i - 1/\xi_i + \left(1-\hat{\Psi}_i\right)\left(1/\hat{\chi}_i - 1/\varepsilon_i\right)\left[1+\hat{\varphi}_i/\left(1-\hat{\varphi}_i\right)\left(D_i^0/M_i^0\right)^{-1/\varepsilon_i}\mu_i^{0\,m}\right]} - 1 \right\}\left(k_i^0 - 1\right)^{-1}.$$

The conjectural variation parameters μ_i, μ_i^* and μ_i^m are set exogenously. It is important to note that (21) can be re-arranged as $\hat{G}_i = n_i^0\left(\hat{\theta}_i - 1/\varsigma_i\right)\Big/\hat{A}_i$. If $\hat{\theta}_i > 1/\varsigma_i$, $\hat{G}_i$ has the same sign of $\hat{A}_i$. Hence, if $\hat{A}_i$ is required to be positive and $\hat{G}_i$ is required to be negative, then $\hat{\theta}_i < 1/\varsigma_i$. This result can be extended to the other markets. This is the reason why the elasticity of substitution among imported brands is set equal to 3 in 'CV4'. Note also that if the benchmark values of the relative prices are equal to one, as it is often postulated in the literature, then (21)-(23) reduce to

$$(21a)\qquad \hat{\lambda}_i\Big|_{p_i^{d0}=p_i^{m0}} = \left\{ \frac{n_i^0\left(\hat{\theta}_i - 1/\varsigma_i\right)}{1/\varepsilon_i - 1/\varsigma_i + \hat{\Psi}_i\left(1/\hat{\chi}_i - 1/\varepsilon_i\right)\left[1+\mu_i^0\right]} - 1 \right\}\left(n_i^0 - 1\right)^{-1},$$

$$(22a)\qquad \hat{\lambda}_i^*\Big|_{p_i^{d*0}=p_i^{e0}} = \left\{ \frac{n_i^0\left(\hat{\theta}_i - 1/\xi_i^*\right)}{1/\varepsilon_i^* - 1/\xi_i^* + \hat{\Psi}_i^*\left(1/\chi_i^* - 1/\varepsilon_i^*\right)\left[1+\mu_i^{0*}\right]} - 1 \right\}\left(n_i^0 - 1\right)^{-1},$$

$$(23a)\qquad \hat{\lambda}_i^m\Big|_{p_i^{d0}=p_i^{m0}} = \left\{ \frac{k_i^0\left(\hat{\theta}_i - 1/\xi_i\right)}{1/\varepsilon_i - 1/\xi_i + \left(1-\hat{\Psi}_i\right)\left(1/\hat{\chi}_i - 1/\varepsilon_i\right)\left[1+\mu_i^{0\,m}\right]} - 1 \right\}\left(k_i^0 - 1\right)^{-1}.$$

Table 2 shows the calibrated quantity conjectures [(21a)-(23a)] and the price elasticities perceived by domestic and foreign firms under the HRT approach and the correct approach. The conjectural variation parameters are very close to the Cournot case, though those under the HRT approach are slightly larger. The price elasticities are also very similar among the two approaches. Note that the approach proposed in this study permits one to set the absolute value of the price elasticity perceived by firms equal to the inverse of the price cost margin, and to calibrate the conjectured reactions of rival firms. The study considers four alternative constant quantity conjectures:

$\mu_i^0 = \mu_i^{0^*} = \mu_i^{0^m} = 0$ (i.e. CV1 scenario); $\mu_i^0 = \mu_i^{0^*} = 6$ and $\mu_i^{0^m} = 0$ (i.e. CV2 scenario); $\mu_i^0 = \mu_i^{0^*} = 0$ and $\mu_i^{0^m} = 30$ (i.e. CV3 scenario); $\mu_i^0 = \mu_i^{0^*} = 0$ and $\mu_i^{0^m} = -1$ (i.e. CV4 scenario).

[Insert Table 2 here]

Table 3 reports the sign of the calibrated expressions, which affect the price markups in the three markets. Note that $\varsigma_i > \varepsilon_i > \hat{\chi}_i$, $\varsigma_i^* > \varepsilon_i^* > 1$ and $\xi_i > \varepsilon_i > \hat{\chi}_i$. As a result, the individual producer can charge a larger price cost margin in the three markets if: (i) the conjectural variations parameters are positive; (ii) its industry concentrates; (iii) the market share of its industry increases; (iv) the sales of its industry rise relative to the sales of the rivals; (v) the absolute value of the price elasticity of aggregate demand becomes smaller.

[Insert Table 3 here]

4.2. Scenarios: Partial trade liberalisation in Turkey

The policy experiment consists of eliminating the tariff rate levied on Turkish industrial imported goods (i.e. the benchmark *ad valorem* tariff rate is 20.74%), under the hypothesis that the firm's output choice on how to react to its rivals' output choices is given *a priori* and is independent of the trade policy impact. As public revenues decline with a tariff fall, endogenously determined net transfers to the representative consumer ensure that the government budget is in equilibrium. The CGE 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. Four alternative constant quantity conjectures have been employed: $\mu_i^0 = \mu_i^{0^*} = \mu_i^{0^m} = 0$ (i.e. CV1 scenario); $\mu_i^0 = \mu_i^{0^*} = 6$ and $\mu_i^{0^m} = 0$ (i.e. CV2 scenario); $\mu_i^0 = \mu_i^{0^*} = 0$ and $\mu_i^{0^m} = 30$ (i.e. CV3 scenario); $\mu_i^0 = \mu_i^{0^*} = 0$ and $\mu_i^{0^m} = -1$ (i.e. CV4 scenario). The results are shown in Table 4.

[Insert Table 4 here]

Firstly, I run a scenario where all sectors are perfectly competitive and have CRS (i.e. CRS scenario). In accordance with the CGE literature, the welfare gains (measured by the Hicksian income equivalent variation) are very small: 0,3% of the consumer income. According to the benchmark data set, 36% of industrial imported goods are used as intermediate inputs by the industry. Hence, despite the rise of the import volume in industrial goods by 11,6%, industrial production rises by 0,5%, driven by cheaper imported intermediate inputs and by a large increase in exports.

The imperfect competitive models (i.e. HRT, CV1, CV2, CV3 and CV4) present a completely different picture compared to the CRS scenario with regard to both welfare and sectoral production. The results indicate that the approach suggested by HRT, which implicitly assumes Cournot competition among domestic and foreign firms, produce similar findings compared to those obtained with the conjectural variation approach, where Cournot competition is explicitly postulated (CV1). However, if domestic firms believe that foreign firms will increase their production as they growth (CV2), or if foreign firms believe that domestic firms will change production as they expand, that is $\mu_i^m \neq 0$ (CV3 and CV4), then the results can change even dramatically.

Firstly, let me discuss the scenario HRT and CV1, as the results are very similar. A fall in tariff in industrial goods leads to an increase in industrial imports by 14,7-14,9% and reduces the protection enjoyed by domestic firms. As a result, the equilibrium number of domestic firms declines by 5,3-5,5%, while the number of foreign firms increases by 13,5-14,2%. However, a fall in the protection rate does not imply a large output contraction, because of the scale effect due to the use of intermediate imported goods in the production process of industrial goods. The welfare level, however, remains constant because market concentration leads to two opposite effects which seem to offset each other: a more efficient use of the economic resources, but higher domestic prices. Given the revealed comparative advantage in industry and services compared to agriculture, the trade balance equilibrium is achieved via an increase in exports in these two sectors. Resources are therefore pulled out from both agriculture and industry, and shifted to services which expands by 3,6%. It must be stressed that an increase in output per firm in the domestic market (1,6-2,1%) does not imply a decline in the price cost margin (as suggested by Horstmann and Markusen, 1986), because the negative impact on the number of firms (which leads to an increase in the price cost margin) dominates both the negative impact on the domestic industry market share and the positive impact on the aggregate price elasticity (which lead to a decrease of the price cost margin). With regard to the export market, since the number of firms declines and the market share increases, then the price cost margin in the export market increases, despite firm's exports rise by 26,9-27,1%. In the import market, the market structure effect seems to dominate slightly the industry market share effect. As a result, the price cost margin of the foreign firms declines.

If, by contrast, some form of collusion between domestic and foreign firms is hypothesised (CV2 and CV3), then a welfare loss can be generated, as a result of the trade liberalisation policy. The scenario 'CV2' is based upon the assumption that domestic firms believe that foreign firms will expand their output if they growth. This more collusive behaviour is reflected in a higher price cost margin in the domestic market, which rises by 3,2%, and a smaller output per firm, which declines by 1,1%. Technically this is due to the fact that $\hat{A}_i$ is almost six times that in 'CV1' (see Table 3). Hence, the negative market structure effect plays a bigger role in determining the higher equilibrium price markup in the domestic market. The consequent fall in domestic sales in the industrial sector by 4,8% is the main reason why welfare declines by 0,2%. The scenario 'CV3' is based upon the assumption that foreign firms expect the rival domestic firms to expand their production, as imports increase due to a tariff fall. This conjecture limits entry of foreign firms, whose number rises by only 4,3% and causes a large expansion of the size of existing firms by 13,4%. The fact that $\mu_i^m > 0$ implies that $\hat{B}_i^m > 1$ and $\hat{C}_i^m > 0$. Hence, the foreign industry market share effect and the effect of the import volume relative to domestic sales play a bigger role compared to the previous scenarios. This is the reason why the price cost margin of the foreign firms declines by 10,1%. As a result of a fall in foreign prices, domestic demand is satisfied by a larger volume of industrial imports, which increases by 18,4%. Despite that, welfare declines by 0,1%.

If foreign firms expect the rival domestic firms to reduce their output as they expand (i.e. $\mu_i^m < 0$), then the results change dramatically (CV4). This conjecture favours the entry of new foreign brands in the domestic economy. The equilibrium number of foreign firms increases by 35,3%. The scale effect on industrial production is so large that manufacturing output expands by 3,2%. The fact that $\mu_i^m = -1$ implies that $\hat{B}_i^m = 0$ and that $\hat{A}_i^m$ is very small. Hence, if the market structure effect has a small role in affecting the price markup, the foreign industry market share effect does not play any role to explain the 28,6% increase in the price cost margin. What matters is the effect of the import volume relative to domestic sales, which contracts. As a consequence of the scale and variety effects, and of the better allocation of resources within the Turkish economy (i.e. domestic firm's output increases by 8,1% and the number of domestic firms declines by 4,5%), welfare rises by 2,7% of the consumer income, a large increase compared to the previously discussed scenarios.

5. Summary

This study proposes a procedure to embody the conjectural variation approach in CGE models, which are characterised by scale economies and free entry in order to capture the strategic interactions among rival firms in international markets. The model is similar to that used by HRT (1997b) to examine the regional impact on output and welfare of the reforms of the Uruguay Round, when firms compete in a quantity setting oligopoly with calibrated constant conjectures. It assumes that the price cost margin faced by national firms is endogenous, and derives the price elasticities of demand perceived by a firm in a multistage demand system.

I show that the price elasticities of demand perceived by a firm in the domestic and export markets are a function of the conjectured reactions of the rival domestic and foreign firms. I show also that the formulas suggested by HRT can be obtained under the hypothesis of Cournot competition. I indicate an approach to calibrate the conjectural variation parameters, and I set up a CGE model for Turkey for the empirical analysis. The numerical simulations indicate that the HRT approach, which implicitly assumes Cournot competition among domestic and foreign firms, leads to the same outcome produced with the conjectural variation approach of this study, when Cournot competition is explicitly postulated. However, if foreign firms believe that domestic firms reduce their output as they expand due to trade liberalisation, then the results change dramatically, and a large welfare gain can be generated. One of the contributions of this study is that the conjectural variation of domestic and foreign firms can be modelled within large-scale applied general equilibrium models. This would allow modellers to assess better the effects of economic policies once the strategic interactions among domestic and foreign firms are known.

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Appendix

- *Derivation of (18)*

Given (10)

(A1) $$\frac{\partial D_i}{\partial \tilde{d}_{is}} = D_i^{1/\varsigma_i}\tilde{d}_{is}^{-1/\varsigma_i}\left[1+\frac{\sum_{t\neq s}\left(\tilde{d}_{it}^{-1/\varsigma_i}\right)}{\tilde{d}_{is}^{-1/\varsigma_i}}\lambda\right],$$

Since from (12) $D_i^{1/\varsigma_i}\tilde{d}_{is}^{-1/\varsigma_i} = \tilde{p}_{is}^d / p_i^d$, then

(A2) $$\frac{d\ln D_i}{d\ln \tilde{d}_{is}} = \frac{\tilde{p}_{is}^d \tilde{d}_{is}}{p_i^d D_i}\left[1+\frac{\sum_{t\neq s}\left(\tilde{d}_{it}^{-1/\varsigma_i}\right)}{\tilde{d}_{is}^{-1/\varsigma_i}}\lambda\right].$$

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

(A3) $$\frac{d\ln p_i^d}{d\ln \tilde{d}_{is}} = \frac{\tilde{p}_{is}^d \tilde{d}_{is}}{p_i^d D_i}\frac{D_i}{p_i^d}\frac{\partial p_i^d}{\partial D_i}\left[1+\frac{\sum_{t\neq s}\left(\tilde{d}_{it}^{-1/\varsigma_i}\right)}{\tilde{d}_{is}^{-1/\varsigma_i}}\lambda\right].$$

Given the symmetry assumption, (A3) and (A2) into (17) yield

(A4) $$\frac{1}{\tau_i} = -\frac{1}{\varsigma_i} + \frac{1}{n_i}\left(\frac{1}{\varsigma_i} + \frac{D_i}{p_i^d}\frac{\partial p_i^d}{\partial D_i}\right)\left[1+\frac{\sum_{t\neq s}\left(\tilde{d}_{it}^{-1/\varsigma_i}\right)}{\tilde{d}_{is}^{-1/\varsigma_i}}\lambda\right].$$

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

(A5) $$\frac{D_i}{p_i^d}\frac{\partial p_i^d}{\partial D_i} = -\frac{1}{\varepsilon_i} + \Psi_i\left(\frac{1}{\varepsilon_i} - \frac{1}{\chi_i}\right)\left[1+\frac{1-\varphi_i}{\varphi_i}\left(\frac{M_i}{D_i}\right)^{-1/\varepsilon_i}\mu\right],$$

where $\chi_i = -\left(p_i / Q_i\right)\left(\partial Q_i / \partial p_i\right)$. Equation (A5) into (A4) yields expression (18).

- *Derivation of t*he price elasticity of aggregate demand

The price elasticity of aggregate demand can be derived by using (4)-(6), as follows:

$$\chi_i = -\frac{\partial Q_i}{\partial p_i}\frac{p_i}{Q_i} = -\frac{p_i}{Q_i}\left(\frac{\partial X_i}{\partial p_i}+\frac{\partial C_i}{\partial p_i}\right) = -\frac{p_i}{Q_i}\frac{\partial X_i}{\partial p_i}+\frac{C_i}{Q_i}\,.$$

Under a Leontief specification $\partial X_i / \partial p_i = 0$. To show this assume that production is undertaken by using intermediate inputs only, which are substitutes. Then, the intermediate demand can be written as $X = a^b p^{-b} q^b Y$, where $q = \left[a^b p^{1-b} + (1-a)^b \,\overline{p}^{1-b}\right]^{1/(1-b)}$, p is the price of intermediate goods X, $\overline{p}$ the price of other intermediate good, a a share parameter, and b the elasticity of substitution among inputs. In this case, $\partial X / \partial p = -ba^b Y p^{-1-b} q^b \left[1 - a^b (p/q)^{1-b}\right]$, which means that $\lim_{b\to 0}(\partial X/\partial p) = 0$. Since I assume a Leontief specification between value added and intermediate inputs, which are in turn assumed to be net complements, then $\partial X_i / \partial p_i = 0$. Given the Cobb-Douglas utility function, the price elasticity of aggregate demand reduces to $0 \le \chi_i = C_i / Q_i \le 1$.

- *Derivation of (19)*

Assume that an hypothetical foreign consumer purchases a variety of domestic goods, $\tilde{d}^*_{ir}$, and a variety of goods exported by the country under analysis, $\tilde{e}_{is}$, which are treated as their substitutes. I can describe the three-stage foreign utility function (U^*) as follows:

(A6) $$U^* = \Pi_j \left(Q_j^{*\alpha^*_j} \right), \qquad \sum_j \alpha^*_j = 1$$

(A7) $$Q^*_i = \left[\varphi^*_i D_i^{*\left(\varepsilon_i^* - 1/\varepsilon_i^*\right)} + \left(1-\varphi^*_i\right) E_i^{\left(\varepsilon_i^* - 1/\varepsilon_i^*\right)}\right]^{\varepsilon_i^* / \left(\varepsilon_i^* - 1\right)},$$

(A8) $$E_i = \left[\sum_{s=1}^{n} \tilde{e}_{is}^{\left(\xi_i^* - 1\right)/\xi_i^*}\right]^{\xi_i^* / \left(\xi_i^* - 1\right)}, \qquad \xi^*_i > 1,$$

(A9) $$D_i^* = \left[\sum_{r=1}^{k} \tilde{d}_{ir}^{*\left(\varsigma_i^* - 1\right)/\varsigma_i^*} \right]^{\varsigma_i^*/\left(\varsigma_i^* - 1\right)}, \qquad \varsigma_i^* > 1 .$$

Q_i^* denotes foreign total sectoral demand and ς_i^* the elasticity of substitution among k varieties produced and consumed abroad.

The first order condition of the second-stage utility maximisation problem yields the vector of the export demand functions, which is employed in the numerical model:

(A10) $$E_i = \left(\frac{\varphi_i^*}{1 - \varphi_i^*} \right)^{-\varepsilon_i^*} \left(\frac{p_i^{d\,*}}{p_i^e} \right)^{\varepsilon_i^*} D_i^* .$$

The first order conditions of the third-stage utility maximisation problem yield the lower level demands:

(A11) $$\tilde{e}_{is} = p_i^{e\,\xi_i^*} \tilde{p}_{is}^{e\,-\xi_i^*} E_i , \qquad p_i^e = \left[\sum_{s=1}^{n} \tilde{p}_{is}^{e\left(1 - \xi_i^*\right)} \right]^{1/\left(1 - \xi_i^*\right)},$$

(A12) $$\tilde{d}_{ir}^{\;*} = p_i^{d\,*\,\varsigma_i^*} \tilde{p}_{ir}^{d\,*\,-\varsigma_i^*} D_i^* , \qquad p_i^{d\,*} = \left[\sum_{r=1}^{k} \tilde{p}_{ir}^{d\,*\left(1 - \varsigma_i^*\right)} \right]^{1/\left(1 - \varsigma_i^{\sim}\right)} .$$

By using the same technique shown to derive (18), one gets expression (19).

Fig. 1 The Demand System

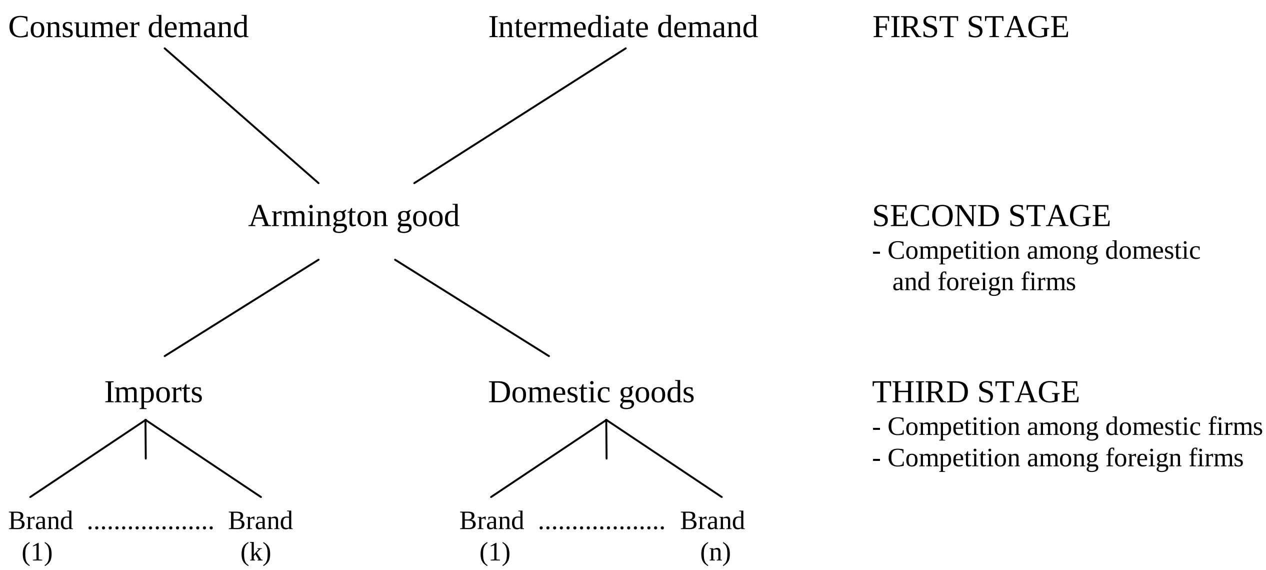

Table 1: The benchmark data set for Turkey

	Billion of 1990 TL	Share Agriculture	Industry	Services
Domestic sales	514105	0,177	0,360	0,463
Exports	52060	0,048	0,513	0,439
Imports	69033	0,038	0,903	0,059
Import duties	13396	0,035	0,965	0,000
Labour	96257	0,316	0,134	0,551
Capital	178661	0,180	0,250	0,570
Intermediate demand for agricultural goods	40060	0,373	0,554	0,074
Intermediate demand for industrial goods	158654	0,053	0,588	0,358
Intermediate demand for services	92533	0,083	0,420	0,498
Private consumption	262204	0,204	0,368	0,427
Government spending	43083	0,012	0,118	0,870
			Elasticities	
Labour / Capital		1,4	1,4	1,4
Domestic goods / Imports		2,0	2,0	2,0
Domestic goods / Exports		2,0	-	2,0
Domestic brands			7,0	
Foreign brands			7,0 (3,0)	

Source: SIS (1994) for the national account statistics.

Table 2: Calibrated conjectures and firms' price elasticities

	Conjectural variation parameters			Price elasticities		
	Domestic market	Export market	Import market	Domestic market	Export market	Import market
HRT	0,036	0,085	0,065	- 6.365	- 6.664	- 6.541
CV1	-0,010	0,036	0,000	- 6,144	- 6,144	- 6,144
CV2	-0,019	0,033	0,000	- 6,144	- 6,144	- 6,144
CV3	-0,010	0,036	- 0.019	- 6,144	- 6,144	- 6,144
CV4	-0,010	0,036	- 1.065	- 6,144	- 6,144	- 6,144

HRT: Harrison-Rutherford-Tarr approach;

CV1: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = \mu_i^{0^m} = 0$;

CV2: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = 6$ and $\mu_i^{0^m} = 0$;

CV3: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = 0$ and $\mu_i^{0^m} = 30$;

CV4: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = 0$ and $\mu_i^{0^m} = -1$.

Table 3: The sign and the size of $\hat{G}_i^v$, $\hat{A}_i^v$, $\hat{B}_i^v$ and $\hat{C}_i^v$

	$\hat{G}_i$	$\hat{A}_i$	$\hat{B}_i$	$\hat{C}_i$	$\hat{G}_i^*$	$\hat{A}_i^*$	$\hat{B}_i^*$	$\hat{C}_i^*$	$\hat{G}_i^m$	$\hat{A}_i^m$	$\hat{B}_i^m$	$\hat{C}_i^m$
CV1	+ 0,52	+ 1,92	+ 1,00	0,00	+ 2,76	+ 0,36	+ 1,00	0,00	+ 1,03	+ 0,99	+ 1,00	+ 0,00
CV2	+ 0,09	+ 11,28	+ 7,00	18,06	+ 2,62	+ 0,38	+ 7,00	0,00	+ 1,03	+ 0,99	+ 1,00	+ 0,00
CV3	+ 0,52	+ 1,92	+ 1,00	0,00	+ 2,76	+ 0,36	+ 1,00	0,00	+ 0,05	+ 20,02	+ 31,00	+ 2,47
CV4	+ 0,52	+ 1,92	+ 1,00	0,00	+ 2,76	+ 0,36	+ 1,00	0,00	- 51,2	+ 0,17	0,00	- 0,08

CV1: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = \mu_i^{0^m} = 0$;

CV2: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = 6$ and $\mu_i^{0^m} = 0$;

CV3: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = 0$ and $\mu_i^{0^m} = 30$;

CV4: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = 0$ and $\mu_i^{0^m} = -1$.

Table 4: The impact of the elimination of tariffs on industrial imported goods

	CRS			HRT			CV1			CV2			CV3			CV4		
Welfare		0,003			0,000			0,000			-0,002			-0,001			0,027	
	Agr	Ind	Ser	Agr	Ind	Ser	Agr	Ind	Ser	Agr	Ind	Ser	Agr	Ind	Ser	Agr	Ind	Ser
Output	-0,019	0,005	0,005	-0,056	-0,006	0,036	-0,058	-0,008	0,036	-0,061	-0,017	0,036	-0,063	-0,014	0,040	-0,009	0,032	0,009
Domestic sales	-0,020	-0,017	-0,005	-0,056	-0,036	0,015	-0,058	-0,038	0,014	-0,061	-0,048	0,013	-0,063	-0,047	0,016	-0,009	0,015	0,005
Export volume	0,046	0,158	0,108	-0,056	0,201	0,248	-0,058	0,202	0,251	-0,061	0,199	0,256	-0,063	0,214	0,278	-0,009	0,144	0,050
Import volume	-0,058	0,116	-0,067	0,056	0,147	-0,175	-0,058	0,149	-0,177	-0,061	0,151	-0,183	-0,063	0,184	-0,192	-0,009	-0,006	-0,039
Domestic industry market share		-0,056			-0,078			-0,079			-0,080			-0,083			-0,069	
Export industry market share		0,157			0,090			0,091			0,091			0,096			0,065	
Foreign industry market share		0,165			0,233			0,234			0,238			0,245			0,205	
Number of domestic firms					-0,055			-0,053			-0,037			-0,058			-0,045	
Number of foreign firms					0,142			0,135			0,136			0,043			0,353	
Domestic firm’s domestic output					0,021			0,016			-0,011			0,012			0,064	
Domestic firm’s exports					0,271			0,269			0,246			0,289			0,198	
Domestic firm's aggregate output					0,052			0,048			0,021			0,047			0,081	
Foreign firm's output					0,004			0,013			0,013			0,134			-0,265	
PCM in the domestic market					0,004			0,008			0,032			0,008			0,007	
PCM in the export market					0,003			0,002			0,003			0,003			0,002	
PCM in the import market					-0,003			-0,011			-0,011			-0,101			0,286	
Aggregate demand price elasticity					0,016			0,016			0,017			0,016			0,047	

Agr: Agriculture; Ind: Industry; Ser: Services. PCM: Price cost margin.

CRS: All sectors have constant returns to scale and are perfect competitive; HRT: Harrison-Rutherford-Tarr approach; CV1: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = \mu_i^{0m} = 0$; CV2: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = 6$ and $\mu_i^{0m} = 0$; CV3: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = 0$ and $\mu_i^{0m} = 30$; CV4: Correct approach under the assumption that $\mu_i^0 = \mu_i^{0^*} = 0$ and $\mu_i^{0m} = -1$.