The Role of Country Size and Returns to Scale in Empirical Assessments of Economic Integration: The Case of Spain

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Abstract

Empirical assessments of trade policy in single-country models have addressed extensively the assumption of increasing returns to scale *versus* constant returns to scale, but the alternative assumption of small open economy *versus* large open economy has not received much attention. This paper provides an evaluation of the relevance of both assumptions (i. e., returns to scale and country size) when analyzing a process of economic integration for a medium-size economy. We conclude that the often neglected country-size assumption might be more relevant for the empirical results than returns to scale.

Key words: Applied general equilibrium, country size, returns to scale, trade policy.

JEL classification: D58, F15, F17.

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1 Introduction

As it is well known, last years have witnessed a growing internationalization of economic activities. This has resulted in a spectacular expansion in world trade figures, which has been accompanied more recently by the increasing role played by integration agreements among countries. As a consequence, attention to trade effects has been a central issue among trade policy modelers. In this way, different types of empirical models (e. g., partial and general equilibrium models, or endogenous trade policy models) have been developed to test for trade theories, as well as for the analysis of real and potential policies [see Baldwin and Venables (1995) for a review].

However, the huge difficulties involved with building multi-country models frequently forces to design single-country models with a simplified specification for the rest of the world. Although this simplification could bias the results, there can be good reasons (such as data availability, analytical complexity, and so on) for using single-country models.

In theoretical trade models, two assumptions are key for the results obtained: the presence of increasing returns, and country size. The sensitivity of the results to the first assumption has been studied empirically, among others, by Harris (1984), Nguyen and Wigle (1992), and Harrison, Rutherford and Tarr (1997), where comparisons of the effects of some liberalizing trade policies are made in alternative general equilibrium scenarios of constant *versus* increasing returns to scale.

But within the empirical analysis of trade policies in single-country models, discussing the large *versus* small country specification has not received much attention. And the same can be said about the combined analysis of both assumptions, returns to scale and country size. Our aim in this paper will be to analyze the extent of the bias that these two assumptions can introduce in trade policy simulations related with economic integration agreements.

The article presents an extension of the Arrow-Debreu model, through an applied general equilibrium model computed for the Spanish economy [see Shoven and Whalley (1992) for a survey of this kind of models]. As noted by Scarf and Shoven (1984), general equilibrium models trace the consequences of changes in a particular variable throughout the entire economy modeled. So, this type of framework provides a more complete analysis, as compared to partial equilibrium models.

The reference in our empirical analysis will be the Spanish economy, which may be relevant for three main reasons. First, Spain joined the now European Union (EU) in 1986, which was accompanied with the implementation of the Single Market Program, and followed by the adoption of a common currency, the Euro, currently under way. In short, a continued process of integration, at different stages, with other relatively more advanced countries.

Second, the relevant data for testing the two main assumptions mentioned above (i. e., increasing returns to scale and country size) are available for the Spanish economy, and computed indeed using recent data; the latter is important since this kind of models are often accused of using outdated data. In particular, we will make use of disaggregated concentration indexes for all sectors of the economy (i. e., including services), and econometric estimates of export demand elasticities for manufactures.

Finally, regarding size, the existence of sectoral export demand functions could lead to assume that Spain was a large economy in some sectors. The size of its GDP, exports, imports, and other macroeconomic variables could also support this assumption. In sum, the Spanish experience could be of interest for other medium-size economies expected to undertake a process of integration with other relatively more advanced countries.

The article is organized as follows. Our general equilibrium model is developed in section 2. The assumptions underlying the empirical analysis, together with the simulation results, are presented in section 3. Section 4 concludes.

2 The model

The model of this paper [based on Gómez (1998)] is static, and describes a single country, disaggregated in eleven production sectors, with eleven consumption goods, a single representative consumer, and a public sector.

As a general rule, the notation is as follows: endogenous variables are denoted by capital letters, exogenous variables by capital letters with a bar, and parameters by small Latin and Greek letters. There are n $(i, j = 1, \ldots, n)$ production sectors. The goods produced by these n sectors are transformed into $m - 1$ $(k = 1, \ldots, m - 2, m)$ consumption goods, of which good m is public final consumption; whereas good $m - 1$ is residents' consumption abroad.

2.1 Production

Effective production X_i in each sector i $(i = 1, \ldots, n)$ is obtained from a composite of primary factors (VA_i) and n composites of intermediate inputs $(II_{1i}, \ldots, II_{ni})$, according to a fixed-coefficients technology. Primary factors VA_i are CES aggregates of labor (L_i) and capital (K_i), and each intermediate input II_{ji} is also a CES aggregate whose inputs come from both domestic (IID_{ji}) and foreign sources (IIF_{jir}). This two-level technology is described by:

$$X_i = min\left(\frac{VA_i}{c_{0i}}, \frac{II_{1i}}{c_{1i}}, \ldots, \frac{II_{ni}}{c_{ni}}\right); \quad i = 1, \ldots, n \tag{1}$$

$$VA_i = \alpha_i \left(a_i L_i^{\frac{\sigma_i^{LK}-1}{\sigma_i^{LK}}} + (1-a_i) K_i^{\frac{\sigma_i^{LK}-1}{\sigma_i^{LK}}}\right)^{\frac{\sigma_i^{LK}}{\sigma_i^{LK}-1}}; \; i = 1, \ldots, n \tag{2}$$

$$II_{ji} = \beta_{ji} \left(b_{ji0} IID_{ji}^{\frac{\sigma_i^{A}-1}{\sigma_i^{A}}} + \sum_{r=EU,ROW} b_{jir} IIF_{jir}^{\frac{\sigma_i^{A}-1}{\sigma_i^{A}}}\right)^{\frac{\sigma_i^{A}}{\sigma_i^{A}-1}}; \; i, j = 1, \ldots, n \tag{3}$$

where $c_{0i}, \ldots, c_{ni}, a_i, b_{ji0,}$ and b_{jir} are share parameters; α_i and β_{ji} are scale parameters; σ_i^{LK} are the elasticities of substitution between labor and capital; and σ_i^A are Armington elasticities of substitution, so that goods are differentiated by their country or region of production [see Armington (1969)]. In our model, two regions are considered: the European Union (EU) and the rest of the world (ROW).

Cost functions for each input are derived from production cost minimization subject to the above technology. From these cost functions, and using Shepard's Lemma, we obtain the demands for labor, capital, domestic intermediate inputs, and foreign intermediate inputs:

$$L_i = \alpha_i^{\sigma_i^{LK}-1} (PVA_i)^{\sigma_i^{LK}} \frac{a_i^{\sigma_i^{LK}}}{(1+ssw_i+sse_i)^{\sigma_i^{LK}-1} W^{\sigma_i^{LK}}} c_{0i} X_i \, ; \; i = 1, \ldots, n \tag{4}$$

$$K_i = \alpha_i^{\sigma_i^{LK}-1} (PVA_i)^{\sigma_i^{LK}} \frac{(1-a_i)^{\sigma_i^{LK}}}{R^{\sigma_i^{LK}}} c_{0i} X_i \, ; \quad i = 1, \ldots, n \tag{5}$$

$$IID_{ji} = \beta_{ji}^{\sigma_i^{A}-1} (PII_{ji})^{\sigma_i^{A}} \frac{b_{ji0}^{\sigma_i^{A}}}{PIID_{ji}^{\sigma_i^{A}}} c_{ji} X_i \, ; \quad i, j = 1, \ldots, n \tag{6}$$

$$IIF_{jir} = \beta_{ji}^{\sigma_i^{A}-1} (PII_{ji})^{\sigma_i^{A}} \frac{b_{jir}^{\sigma_i^{A}}}{PIIF_{jir}^{\sigma_i^{A}}} c_{ji} X_i \, ; \quad i, j = 1, \ldots, n; \; r = EU, ROW \tag{7}$$

where $PVA_i, PII_{ji}, PIID_{ji,}$ and $PIIF_{jir}$ are the average costs for aggregate value added, aggregate intermediate inputs, and domestic and foreign intermediate inputs, respectively; W and R are the wage and capital rental rates, respectively; and ssw_i and sse_i are the *ad valorem* social security contributions paid by workers and employers, respectively.

Data availability compels us to transform effective production (X_i) into distributed production ($DIST_i$) through the calibrated fixed coefficients q_{ij} [see Ballard, Shoven and Whalley (1985)]:

$$\begin{pmatrix} q_{11} & q_{12} & \dots & q_{1n} \\ q_{21} & q_{22} & \dots & q_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ q_{n1} & q_{n2} & \dots & q_{nn} \end{pmatrix} \times \begin{pmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{pmatrix} = \begin{pmatrix} DIST_1 \\ DIST_2 \\ \vdots \\ DIST_n \end{pmatrix} \tag{8}$$

The next step is to build an Armington aggregate (A_i) with production from domestic producers ($DIST_i$), and imports (IMP_i); this means that domestic producers are the only importers, and choose the optimal mix of domestic and imported goods which minimize their costs. This aggregate embodies total supply, i. e., production goods from domestic producers, and imports:

$$A_i = \left(e_{i0} DIST_i^{\frac{\sigma_i^A - 1}{\sigma_i^A}} + \sum_{r=EU,ROW} e_{ir} IMP_{ir}^{\frac{\sigma_i^A - 1}{\sigma_i^A}} \right)^{\frac{\sigma_i^A}{\sigma_i^A - 1}} ; \; i = 1, \dots, n \tag{9}$$

where e_{i0} and e_{ir} are share parameters.

From the left-hand side of Figure 1, we can see that, in order to get this Armington aggregate A_i, producers demand all the inputs needed to elaborate $DIST_i$, as well as imports; therefore, the derived demands to get A_i are $L_i, K_i, IID_{ji}, IIF_{jiEU}, IIF_{jiROW}$ (shown above), but also IMP_{iEU} and IMP_{iROW}. Both of them can be derived from (9) in the same way than equations (4) to (7):

$$IMP_{ir} = (PA_i)^{\sigma_i^A} \frac{e_{ir}^{\sigma_i^A}}{PIMP_{ir}^{\sigma_i^A}} A_i \, ; \quad i = 1, \dots, n; \; r = EU, ROW \tag{10}$$

where:

$$PA_i = \left(e_i^{\sigma_i^A} \left(PDIST_i (1 + tp_i)(1 + vatd_i)\right)^{1-\sigma_i^A} + (1 - e_i)^{\sigma_i^A} PIMP_i^{1-\sigma_i^A} \right)^{\frac{1}{1-\sigma_i^A}} ; \quad i = 1, \dots, n \tag{11}$$

$$PIMP_{ir} = \overline{PMIMP_i} FC (1 + tar_i)(1 + vati_i) \, ; \quad i = 1, \dots, n; \, r = EU, ROW \tag{12}$$

being PA_i the average cost of A_i, $PDIST_i$ the average cost of distributed production net of taxes, and $PIMP_{ir}$ the average cost of imports, including tariffs and value added taxes. As can be seen from equations (11) and (12), some *ad valorem* taxes are included: tp_i are net indirect taxes on production, $vatd_i$ are value added taxes on distributed production, $vati_i$ are value added taxes on imports, and tar_i are net tariffs. We also embody the small open economy assumption for imports, so that $\overline{PMIMP_i}$ are the (exogenous) world prices of imports, and FC is a foreign exchange factor between foreign and domestic units.

As shown in the right-hand side of Figure 1, producers differentiate this aggregate supply A_i into three types of commodities: those produced for the domestic market (O_i), and exports directed to the EU (EXP_{iEU}) and the ROW (EXP_{iROW}). These commodities are imperfect substitutes with an elasticity of transformation ϵ_i, as shown by the CET function:

$$A_i = \zeta_i \left(d_{i0} O_i^{\frac{\epsilon_i + 1}{\epsilon_i}} + \sum_{r=EU,ROW} d_{ir} EXP_{ir}^{\frac{\epsilon_i + 1}{\epsilon_i}} \right)^{\frac{\epsilon_i}{\epsilon_i + 1}} ; i = 1, \ldots, n \qquad (13)$$

where d_{i0} and d_{ir} are share parameters, and ζ_i are scale parameters. And sales to the domestic market O_i include final consumption (CF_i), intermediate consumption (IIP_{ij}), and investment (I_i):

$$O_i = CF_i + \sum_{j=1}^{n} IIP_{ij} + I_i ; \quad i = 1, \ldots, n \qquad (14)$$

To end this subsection, we transform final consumption from production goods ($CF_i; i = 1, \ldots, n$) into consumption goods ($QP_k; k = 1, \ldots, m-2, m$) through the calibrated fixed coefficients o_{ki}, following again Ballard, Shoven and Whalley (1985); notice that good $m-1$ is not included since it represents consumption by national tourists abroad:

$$\begin{pmatrix} o_{11} & o_{12} & \cdots & o_{1n} \\ o_{21} & o_{22} & \cdots & o_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ o_{m-2,\,1} & o_{m-2,\,2} & \cdots & o_{m-2,\,n} \\ o_{m1} & o_{m2} & \cdots & o_{mn} \end{pmatrix} \times \begin{pmatrix} CF_1 \\ CF_2 \\ \vdots \\ CF_n \end{pmatrix} = \begin{pmatrix} QP_1 \\ QP_2 \\ \vdots \\ QP_{m-2} \\ QP_m \end{pmatrix} \qquad (15)$$

2.2 Consumption

Private consumers are assumed to share homothetic and identical preferences, so that they can be represented as a single representative consumer.

This representative consumer maximizes a two-level Cobb-Douglas utility function (U) subject to a budget constraint. The first level shows the decisions between aggregate final consumption (Q_0) and savings or future consumption (Q_s) (since savings are taken in this static context as future consumption, which implies myopic expectations); and the second level shows how the consumer allocates her non-saved budget among several kinds of consumption goods (QC_k, for $k = 1, \ldots, m-1$):

$$U = Q_0^{\tau_0} Q_s^{\tau_s} \tag{16}$$

$$Q_0 = \prod_{k=1}^{m-1} QC_k^{\chi_k} \tag{17}$$

where τ_0, τ_s, and χ_k are share parameters.

The budget constraint is given by:

$$Y^H = W\overline{L^H}(1-u) + R\overline{K^H} + \overline{NTPS^H} + \overline{NTFS^H}FC - \overline{IT} \tag{18}$$

so that the consumer's income (Y^H) comes from the labor endowment ($\overline{L^H}$), which is affected by the unemployment rate (u); the capital endowment ($\overline{K^H}$); net transfers from the public sector ($\overline{NTPS^H}$); net transfers from the foreign sector, coming from both EU and ROW ($\overline{NTFS^H}$); and all this net of an exogenous income tax ($\overline{IT}$).

Utility maximization subject to the budget constraint gives the final demand functions:

$$Q_s = \frac{\tau_s Y^H}{P_s} \tag{19}$$

$$QC_k = \frac{\chi_k (Y^H - P_s Q_s)}{P_k}; \quad k = 1, \ldots, m-1 \tag{20}$$

where P_s and P_k are the prices of savings and the final goods, respectively.

2.3 Public sector

Public consumption demand of good m (QC_m) is derived from the maximization of a utility function defined over this consumption, subject to a budget constraint. Public sector's total income (Y^G) comes from the capital endowment ($\overline{K^G}$), plus *ad valorem* taxes ($SSE_i, SSW_i, VAT_i, TP_i, TAR_i$), plus income tax ($\overline{IT}$), less exogenous net transfers to the representative consumer ($\overline{NTPS^H}$), plus exogenous net transfers from the foreign sector

($\overline{NTFS^G}$). This income is devoted to consumption ($CPUB$) and to exogenous savings ($\overline{SAVPUB}$):

$$\begin{aligned} Y^G &= R\overline{K^G} + \sum_{i=1}^{n} SSE_i + \sum_{i=1}^{n} SSW_i + \sum_{i=1}^{n} VAT_i + \sum_{i=1}^{n} TP_i + \\ &\quad + \sum_{i=1}^{n} TAR_i + \overline{IT} - \overline{NTPS^H} + \overline{NTFS^G} FC \qquad (21) \\ SSE_i &= sse_i WL_i (1-u)\,; \quad i = 1, \ldots, n \qquad (22) \\ SSW_i &= ssw_i WL_i (1-u)\,; \quad i = 1, \ldots, n \qquad (23) \\ VAT_i &= \overline{PMIMP_i} FCIMP_i (1 + tar_i) vati_i + \\ &\quad + PDIST_i DIST_i (1 + tp_i) vatd_i\,; \quad i = 1, \ldots, n \qquad (24) \\ TP_i &= PDIST_i DIST_i tp_i\,; \quad i = 1, \ldots, n \qquad (25) \\ TAR_i &= \overline{PMIMP_i} FCIMP_i tar_i\,; \quad i = 1, \ldots, n \qquad (26) \\ CPUB &= Y^G - \overline{SAVPUB} \qquad (27) \end{aligned}$$

2.4 Foreign sector

The foreign sector in our model consists of two regions: EU and ROW. It is assumed that our country faces a perfectly elastic export demand function for goods sold to ROW, but has some market power for certain goods sold to EU. In these cases (sectors 3, 4, and 5; see below) we have used constant-elasticity demand functions such as:

$$DEXP_{iEU} = F\left(PEXP_{iEU}\right)\,; \quad i = 3, 4, 5$$

where $DEXP_{iEU}$ are EU demands for Spanish goods, as a function F of their prices $PEXP_{iEU}$.

On the other hand, import supply functions are assumed to be perfectly elastic, so that prices of goods bought to both EU and ROW are taken as given.

2.5 Increasing returns to scale and imperfect competition

There are many well-known ways of modelling competition among firms in applied general equilibrium models, following several alternative assumptions [see Francois and Roland-Holst (1997)]. However, a trade-off between theoretical complexity and empirical data availability is always present, since the lack of data usually prevents implementing many imperfect competition specifications, or forces using inadequate data (aggregated figures, old data, data belonging to another country, ...), which has been a common critique to deterministic applied general equilibrium models. For these reasons, we have chosen to represent competition among firms in our model in the following way.

The constant returns to scale version of the model is characterized by a competitive pricing rule (see subsection 2.1). We will present now an alternative version embodying a non-competitive pricing rule and increasing returns to scale, due to the existence of some fixed labor and capital requirements. The presence of fixed costs means that average costs are higher than marginal costs, so that firms set prices by charging a markup on marginal costs. This pricing rule is based on the idea that firms face demand functions with a negative slope and compete *à la Cournot*. There is free entry and exit of firms in each sector, so that in equilibrium firms just break even.

In this new version of the model, the derived demands for labor and capital (4) and (5) are replaced by:

$$\begin{aligned} L_i &= \alpha_i^{\sigma_i^{LK}-1}(PVA_i)^{\sigma_i^{LK}} \frac{a_i^{\sigma_i^{LK}}}{(1+ssw_i+sse_i)^{\sigma_i^{LK}-1}W^{\sigma_i^{LK}}} c_{0i}X_i + \\ &\quad + E_i\overline{LF_i}\,; \quad i=1,\ldots,n \qquad (28) \\ K_i &= \alpha_i^{\sigma_i^{LK}-1}(PVA_i)^{\sigma_i^{LK}} \frac{(1-a_i)^{\sigma_i^{LK}}}{R^{\sigma_i^{LK}}} c_{0i}X_i + E_i\overline{KF_i}\,; \quad i=1,\ldots,n \qquad (29) \end{aligned}$$

which include fixed factor requirements of labor ($\overline{LF_i}$) and capital ($\overline{KF_i}$) for the E_i existing firms. Also, the non-competitive pricing rule, obtained from the first-order condition for profit maximization should be added:

$$MARKUP_i = \frac{\Omega_i}{E_i \kappa_i^d}\,; \quad i=1,\ldots,n \qquad (30)$$

This equation defines the price-cost margin ($MARKUP_i$), or Lerner index in sector i, which depends on: the conjectural variations parameter (Ω_i; in our case: $\Omega_i = 1$, since firms compete *à la Cournot*); the share of the typical firm in sector i's output, which, under the assumption of symmetrical firms, equals the inverse of the number of firms in each sector ($1/E_i$), and can be proxied by the Herfindahl index; and the perceived elasticity of demand faced by sector i (κ_i^d).

2.6 Equilibrium conditions

2.6.1 Goods markets

Beginning with final goods, for goods k ($k = 1, \ldots, m-2$) supply (QP_k) equals consumption by the representative agent within the country (QC_k) plus consumption by foreign tourists ($\overline{FCNR_k}$). In its turn, for the good $m-1$, foreign supply (QP_{m-1}) equals consumption by the representative agent abroad (QC_{m-1}), and for the good m, supply (QP_m) equals public consumption (QC_m):

$$QP_k = QC_k + \overline{FCNR_k}\,; \quad k = 1, \ldots, m-2 \tag{31}$$

$$QP_{m-1} = QC_{m-1} \tag{32}$$

$$QP_m = QC_m \tag{33}$$

Next, for intermediate goods, supply also equals demand:

$$IIP_{ij} = II_{ij}\,; \quad i, j = 1, \ldots, n \tag{34}$$

and for investment (see below):

$$I_i = DI_i\,; \quad i = 1, \ldots, n \tag{35}$$

where I_i and DI_i are the supply and demand of gross capital formation, respectively.

Regarding imports and exports, we have assumed in most cases perfectly elastic export demands and import supplies. However, in those manufacturing sectors in which our reference country is assumed to have some market power, the equilibrium condition would be:

$$EXP_{iEU} = DEXP_{iEU}\,; \quad i = 3, 4, 5 \tag{36}$$

2.6.2 Factor markets

Homogenous labor and capital are the only primary factors. Demand equations for both factors are shown in equations (4) and (5) for the constant returns to scale version of the model, and in equations (28) and (29) for the alternative version embodying increasing returns to scale.

The representative consumer owns the fixed labor endowment ($\overline{L^H}$). We assume wage rigidity:

$$WREAL \geq WREAL_{min} \tag{37}$$

so that the real wage ($WREAL$) would be above a minimum requested ($WREAL_{min}$), which allows for the presence of classical unemployment. Labor is internationally immobile, and perfectly mobile across domestic sectors. Equilibrium in the labor market is given by:

$$\overline{L^H}(1-u) = \sum_{i=1}^{n} L_i \tag{38}$$

The representative consumer and the public sector own their fixed endowments of capital ($\overline{K^H}$ and $\overline{K^G}$, respectively). Unlike labor, capital returns are assumed to adjust to clear the market, so that is fully employed. Capital is also internationally immobile but mobile across domestic sectors, and equilibrium is given by:

$$\overline{K^H} + \overline{K^G} = \sum_{i=1}^{n} K_i \tag{39}$$

2.6.3 Public sector

From the public sector's utility function we have assumed that public consumption is determined endogenously by the public sector ($CPUB = P_m QC_m$). Since public investment ($\overline{INVPUB}$) and the public surplus (or deficit) ($\overline{BALPUB}$) are both taken as exogenous, it follows that public savings ($\overline{SAVPUB}$) are also exogenous. Public sector closure is given by equation (27) and:

$$\overline{BALPUB} = \overline{SAVPUB} - \overline{INVPUB} \tag{40}$$

2.6.4 Investment and Savings

Investment should affect productive capacity in the following periods, so that a dynamic framework should be more appropriate. Since this is not the objective of this paper, in our static framework investment shows its influence on the economy as a component of final demand.

As we have seen, the public sector saves and invests, the representative consumer saves, and gross capital formation is the economy's investment. Given domestic savings ($SAVNAT$) and total investment ($TOTINV$), the macro balance is given by:

$$SAVNAT - TOTINV = \overline{NLB}FC \tag{41}$$

where $\overline{NLB}$ is the economy's net lending/borrowing.

Following Dervis, de Melo and Robinson (1981), total investment is distributed among sectors according to the calibrated fixed coefficients ψ_i in the following way:

$$PO_iDI_i = \psi_i TOTINV\,;\; i = 1, \ldots, n \tag{42}$$

where DI_i is the sectoral gross capital formation demanded at average cost PO_i.

2.6.5 Foreign sector

Foreign sector closure [see de Melo and Tarr (1992)] is given by:

$$\sum_{r=EU,ROW} \sum_{i=1}^{n} PEXP_{ir}EXP_{ir} + \frac{\sum_{k=1}^{m-2} P_k\overline{FCNR_k}}{FC} + \overline{NTFS^H} + \overline{NTFS^G} -$$

$$- \sum_{r=EU,ROW} \sum_{i=1}^{n} \overline{PMIMP_i}IMP_{ir} - \overline{PM_{m-1}}QC_{m-1} = \overline{NLB} \tag{43}$$

where $\overline{PM_{m-1}}$ is the world price of good $m-1$. This equation shows that the difference between receipts (from exports of goods, consumption of foreign tourists, and net transfers from abroad) and payments (from imports of goods, and consumption by the representative agent abroad) is the economy's net lending/borrowing.

2.6.6 Zero profits

Zero-profit conditions in domestic sectors hold in both versions of the model, i. e., the competitive and constant returns to scale version, and the non competitive and increasing returns to scale version. Market prices just cover costs, that is:

$$PA_iA_i = PO_iO_i + \sum_{r=EU,ROW} PEXP_{ir}EXP_{ir}\,; \quad i = 1, \ldots, n \tag{44}$$

where PO_i and $PEXP_{ir}$ are the unit prices of domestic production sold in the domestic market and abroad, respectively.

3 Empirical analysis

3.1 Scenarios and data

In this section we will analyze to which extent the assumptions on returns to scale and country size might bias the results obtained from trade policy models, when evaluating a process of economic integration for a medium-size economy. To this purpose, the model developed in the previous section was calibrated and simulated using Spanish data. Our main data set is the most recent Spanish Social Accounting Matrix, elaborated by Uriel, Beneito, Ferri and Moltó (1997) from the Spanish National Accounts, and reshaped to fit our model as explained in Gómez (1998). Elasticities are taken from econometric evidence: elasticities of substitution between labor and capital, and Armington elasticities come from SALTER (1991), whereas elasticities of transformation come from de Melo and Tarr (1992). The Herfindahl indices, computed with recent Spanish data for all economic sectors, including services, are taken from Bajo and Salas (1998). Finally, regarding export demand elasticities, we have made use of Collado's (1992) estimates within a highly disaggregated macroeconometric model for the Spanish economy, after aggregating them into 3 sectors (*Non-energy minerals and chemicals, Metal and machinery, Other manufacturing*) using export flows as weights.

Notice that, once a single-country model with a simple rest of the world representation has been adopted, modelers have to determine the role of the country as trader. Two cases can be considered. First, a small open economy (SOE) acting as a price-taker, which would explain trade based on comparative advantage, but not cross-hauling trade; an exception would be to incorporate an Armington (1969) specification, where goods are differentiated by country or region of origin, so that intra-industry trade could take place. Second, a large open economy (LOE) with the country acting as a price-setter, which can be implemented, for instance, by including export demand functions.

Incorporating the Armington assumption is common in applied general equilibrium modelling, but this could be misleading since in some cases countries might enjoy some additional market power and set prices in world markets. Modelers may check if the country is a price-setter by estimating export demand functions and testing price elasticities. So, regarding the Spanish case, Moreno (1997) found evidence on the significance of price elasticities in sectoral export demand equations.

The other assumption we want to test is the extent of competition among firms. As stated in the previous section, the model is presented in two versions: a first one where firms set prices in a competitive way and technology exhibits constant returns to scale (CRS), and a second one with a non-competitive pricing rule under a technology of increasing returns to scale (IRS).

On the other hand, the increase in firm concentration and the fall in price-cost margins have been reported as some *ex-post* effects of the SMP. So, for instance, Allen, Gasiorek and Smith (1998) estimated an average decrease of 3.9% in the margins of some sensible sectors, as well as a decrease of 3.6% in the whole manufacturing sector, in a study for the four biggest EU countries (Germany, France, the United Kingdom, and Italy), although the differences among them make this decrease to range between 1.4% for Germany and 9.4% for France. We have embodied this pro-competitive effect of integration as an extension of the non-competitive version of the model so that, considering the most sensible case, simulations in some non-competitive scenarios include an exogenous decrease of 10% in the markups of manufacturing sectors.

Therefore, the following scenarios will be simulated:

1. **Scenario SOE-CRS**. All tradable goods are Armington-differentiated in a small open economy framework. Firms follow a marginal cost pricing rule, and technology exhibits constant returns to scale.

2. **Scenario SOE-IRS**. All tradable goods are Armington-differentiated in a small open economy framework. Firms set prices as a markup on marginal costs, and technology exhibits increasing returns to scale.

3. **Scenario SOE-IRS-M**. All tradable goods are Armington-differentiated in a small open economy framework. Firms set prices as a markup on marginal costs, and this markup drops exogenously 10% in manufacturing sectors.

4. **Scenario LOE-CRS**. All tradable goods are Armington-differentiated, but manufacturing sectors face export demand functions with a finite elasticity. Firms follow a marginal cost pricing rule, and technology exhibits constant returns to scale.

5. **Scenario LOE-IRS**. All tradable goods are Armington-differentiated, but manufacturing sectors face export demand functions with a

finite elasticity. Firms set prices as a markup on marginal costs, and technology exhibits increasing returns to scale.

6. **Scenario LOE-IRS-M**. All tradable goods are Armington-differentiated, but manufacturing sectors face export demand functions with a finite elasticity. Firms set prices as a markup on marginal costs, and this markup drops exogenously 10% in manufacturing sectors.

Some simulations have been carried out in these scenarios, representing several aspects of the process of integration of the Spanish economy into the EU, in particular the *ex-post* effects of the Single Market Program (SMP), as well as the effects of adopting a single currency. The SMP was launched as a set of directives to be adopted for the EU members in order to ease movements of both goods and productive factors. Although the complete legislative ratification had to finish on 1st January 1993, in November 1999 12.6% of EU directives had not been yet endorsed in the whole EU member countries; however, both the EU Commission and some researchers have produced empirical results measuring *ex-post* SMP effects. Although it is clear that is not possible to measure all the likely effects, we have selected a set of facts widely representative of the potential changes associated with integration. Recall that we are not trying to quantify exactly the effects of integration on the Spanish economy, but rather to show whether some relevant assumptions (usually embodied in economic integration analysis) might bias the results obtained from trade policy-oriented models.

The set of effects incorporated into the simulations include:

- **Removal of trade barriers**, including:
  - *Removal of tariff barriers.* Spain joined the then European Community in 1986, which meant the full elimination of tariffs on the other member countries' imports. Since in our reference year some tariffs remained, all tariffs and subsidies on EU imports were set to zero.
  - *Decrease in transport costs.* The SMP directives changed custom formalities (new value added tax system, removal of a number of forms, and so on). The savings for the whole EU have been estimated in 5223 million ECUs, which represents 0.66% of intra-EU trade [see Price Waterhouse (1997, pp. 89-94)]. Hence, costs related to both Spanish imports from the EU, and exports to the EU, were reduced by 0.66%.

– *Harmonization of technical barriers*. National regulations on some aspects such as health, security, environment, and so on, mean traditional trade barriers. The SMP implied the adoption of some common standards for mutual recognition, so that the process of harmonization involved a greater similarity among EU goods. This change was included, following Harrison, Rutherford and Tarr (1996), through an increase in the elasticities of substitution and transformation among goods from or to EU countries, so that benchmark elasticities were doubled.

- **Reduction in transaction costs**. Collado, Sánchez and Alonso (1999) surveyed the costs experienced by firms from managing multiple currencies, and quantified the sectoral reductions in their demand for banking and insurance inputs following the adoption of a common currency. These sectoral reductions have been aggregated in order to fit our sectoral classification, and then applied in the simulations for every sector.

3.2 Simulation results

The results from all the above simulations appear in tables 1 through 5, for our six scenarios. Together with the removal of trade barriers and reduction in transaction costs, we also present the results from simulating both effects simultaneously, termed as *total effect*[1]. Table 1 shows the effects on the main aggregate variables: GDP, employment, prices (proxied by the consumption price index), wage and capital rental rates, exports, imports, trade deficit, and the ratios exports-GDP and imports-GDP. In its turn, tables 2 to 5 show the effects on some selected variables (employment, exports, imports, and final consumption, respectively), disaggregated according to the sectors included in our model.

Beginning with the effects on aggregate variables in Table 1, we can state a first clear conclusion: among the different assumptions analyzed in this paper, that of small *versus* large open economy would be the most relevant. Although there are some differences in the results for each of the six scenarios, there appears a common pattern in the three SOE scenarios, on the one hand, and in the three LOE scenarios, on the other.

[1] It should be noticed that, since the model of this paper is an extension of the Arrow-Debreu framework, aggregating the individual effects does not have to be equal to the total effect.

In general, SOE scenarios show a higher GDP; a small job creation (unlike LOE scenarios, where employment would show a slight decrease); a higher decrease in prices, and wage and capital rental rates; and a strong increase in both exports and imports, together with an almost unchanged trade deficit. On the other hand, as expected, the removal of trade barriers would drive the effects on trade variables, whereas the reduction in the demand for financial services would have stronger effects on the rest of variables.

A second conclusion would be the remarkable similarity of the results between the CRS and IRS scenarios. This result would agree with that in Harrison, Rutherford and Tarr (1997), who justified it on their use of lower markups than in previous studies, which came mainly from 50's and 60's data. Our markups are calculated with recent Spanish data, and are also smaller than those older estimates.

Scenarios including an additional decrease in markups in manufacturing sectors (denoted as IRS-M) could provide us with some information about the effects when a non-competitive framework approaches to the competitive one. The results are in general closer to those in the IRS scenarios rather than to the CRS scenarios, although they are similar in both absolute and relative terms. Even so, it is worth noting that aggregate GDP and employment show a more favorable evolution, so we might infer that a competition policy addressed to limit market power might be beneficial in terms of these macro variables.

A third conclusion would be that the trade variables are the most sensible to the different scenarios assumed, a result in line with that in de Melo and Tarr (1992). As these authors point out, the closure equation for the foreign sector prevents, for example, a strong increase in exports without any change in imports, which would be unrealistic since it would imply a permanent capital outflow to the rest of the world. This problem is avoided in the model by fixing an exogenous net lending/borrowing.

As shown in Table 1, aggregate exports would increase more than aggregate imports, with a similar difference between export and import growth rates in SOE and LOE scenarios of around 5 and 1.8 percentage points, respectively. On the other hand, the removal of trade barriers would tend to raise trade growth in SOE scenarios; whereas assuming an elastic export demand function would tend to reduce exports growth, with imports growth also falling due to the closure equation.

Turning now to the sectoral results, and beginning with the effects on employment in Table 2, *Finance and insurance* shows a strong decrease due to the reduction in sectoral demands for banking and insurance services following the implementation of the single currency. Other unfavorable results in terms of employment would appear, following a reduction in trade barriers, for *Metal and machinery,* and *Other services*, which in the latter case might be explained by the fall in public revenues (from indirect taxes and tariffs), leading to a contraction in public spending and a smaller labor demand by the public sector.

The results for sectoral trade in tables 3 and 4 confirm that the most important changes between SOE and LOE scenarios occur in manufacturing sectors, i. e., those modelled using elastic export demand functions. These sectors accounted in our base year for 71% of total exports and 76% of total imports. So, for instance, *Metal and machinery* exports would increase by roughly 28% in SOE scenarios and fall by 0.6% in LOE scenarios; with imports increasing by 22% and 6% in SOE and LOE scenarios, respectively. Notice that there would be no symmetry in the sectoral behavior of export and import growth rates, so that changes in sectoral trade balances would appear, even though the foreign sector closure equation prevents that huge overall trade imbalances arise. In general, exports and imports would be more sensible to the removal of trade barriers, rather than to a reduction in transaction costs.

To conclude, we present in Table 5 the effects on sectoral final consumption, in order to check whether the different scenarios simulated affect not only those variables directly related with production, but also consumption patterns. Again, the assumption of SOE *versus* LOE would seem to be more relevant than that of CRS *versus* IRS for the results, with stronger effects following a reduction in transaction costs than a removal of trade barriers.

4 Concluding remarks

Empirical research on trade policy is based on a set of assumptions, which might be key for the results obtained. Two of these assumptions are returns to scale and country size. But, even though the relevance of the former has been extensively examined in the literature, the latter has not hardly addressed, and the same can be said about the combined analysis of both assumptions.

In this paper we have tried to analyze the extent of the bias that these two assumptions can introduce in trade policy simulations related with economic integration agreements. To this end, we used a computable general equilibrium model, where several changes related to a process of integration (i. e., the removal of trade barriers -tariffs, transport costs, and harmonization of technical barriers- and reduction in transaction costs following the adoption of a common currency), were simulated in six different scenarios, combining constant and increasing returns to scale, price-taking behavior and market power for manufacturing exports, as well as an exogenous decrease of 10% in the markups of manufacturing sectors in non-competitive scenarios. We focused on the Spanish case, a medium-size economy experiencing a process of integration with other relatively more advanced countries in a short period of time.

We concluded that the country size assumption really matters and would play a key role in simulation results. So, the overall effects on the main economic variables would be magnified in small open economy scenarios as compared to the large open economy scenarios; this result would hold for both aggregate and sectoral variables, and would be very significant for trade variables. On the other hand, the results in constant returns to scale scenarios would differ only slightly from those found in the case of increasing returns to scale.

Finally, we would like to point out that empirical trade policy modelers should be careful when choosing assumptions for empirical single-country models. In particular, in the case of medium-size economies, the often neglected country-size assumption might be more relevant for the results obtained than the more frequently analyzed assumption of returns to scale.

References

[1] Allen, C.; Gasiorek, M.; Smith, A. (1998). The competition effects of the Single Market in Europe. *Economic Policy* **27**, 441-486.

[2] Armington, P. S. (1969). A theory of demand for products distinguished by place of production. *International Monetary Fund Staff Papers* **16**, 159-176.

[3] Bajo, O.; Salas, R. (1998). Índices de concentración para la economía española: Análisis a partir de las fuentes tributarias. *Economía Industrial* **320**, 101-116.

[4] Baldwin, R. E.; Venables, A. J. (1995). Regional Economic Integration. In Grossman, G. M.; Rogoff, K. (eds.) *Handbook of International Economics*, volume 3. North-Holland, Amsterdam, 1597-1644.

[5] Ballard, C. L.; Shoven, J. B.; Whalley, J. (1985). General Equilibrium Computation of the Marginal Welfare Costs of Taxes in the United States. *American Economic Review* **75**, 128-138.

[6] Collado, J. C. (dir.) (1992). *Efectos del Mercado Único sobre los sectores productivos españoles*. Instituto de Estudios Económicos, Madrid.

[7] Collado, J. C.; Sánchez, M.; Alonso, E. (1999). *Impact of the Single Currency in the Spanish Economy using a Dynamic Multisectoral Model*. Mimeo, Centre for Economic Studies. Fundación Tomillo. Madrid.

[8] de Melo, J.; Tarr, D. (1992). *A general equilibrium analysis of US foreign trade policy*. The MIT Press, Cambridge, MA.

[9] Dervis, K.; de Melo, J.; Robinson, S. (1981). A General Equilibrium Analysis of Foreign Exchange Shortages in a Developing Economy. *Economic Journal* **91**, 891-906.

[10] Francois, J. F.; Roland-Holst, D. W. (1997). Scale Economies and Imperfect Competition. In Francois, J. F.; Reinert, K. A. (eds.) *Applied Methods for Trade Policy Analysis: A Handbook*. Cambridge University Press, Cambridge, 331-363.

[11] Gómez, A. (1998). *Efectos del Mercado Único europeo sobre la economía española: un análisis a través de un modelo de equilibrio general aplicado*. Ph. D. Thesis. Universidad Pública de Navarra, Pamplona.

[12] Harris, R. G. (1984). Applied general equilibrium analysis of small open economies with scale economies and imperfect competition. *American Economic Review* **74**, 1016-1032.

[13] Harrison, G. W.; Rutherford, T. R.; Tarr, D. G. (1996). Increased Competition and Completion of the Market in the European Union: Static and Steady State Effects. *Journal of Economic Integration* **11**, 332-365.

[14] Harrison, G. W.; Rutherford, T. R.; Tarr, D. G. (1997). Quantifying the Uruguay Round. *Economic Journal* **107**, 1405–1430.

[15] Moreno, L. (1997). The determinants of Spanish industrial exports to the European Union. *Applied Economics* **29**, 723-732.

[16] Nguyen, T. T.; Wigle, R. M. (1992). Trade liberalisation with imperfect competition. The large and small of it. *European Economic Review* **26**, 17–35.

[17] Price Waterhouse (1997). *Customs and fiscal formalities at frontiers*. The Single Market Review. Subseries III, volume 3. Office for Official Publications of the European Communities, Luxembourg.

[18] SALTER (1991). *SALTER. A General Equilibrium Model of the World Economy. Model Structure, Database and Parameters.* Industry Commission, Canberra.

[19] Scarf, H. E.; Shoven, J. B. (eds.)(1984). *Applied general equilibrium analysis.* Cambridge University Press, Cambridge.

[20] Shoven, J. B.; Whalley, J. (1992). *Applying general equilibrium.* Cambridge University Press, Cambridge.

[21] Uriel, E.; Beneito, P.; Ferri, F. J.; Moltó, M. L. (1997). *Matriz de Contabilidad Social de España 1990 (MCS-90).* Instituto Nacional de Estadística, Madrid.

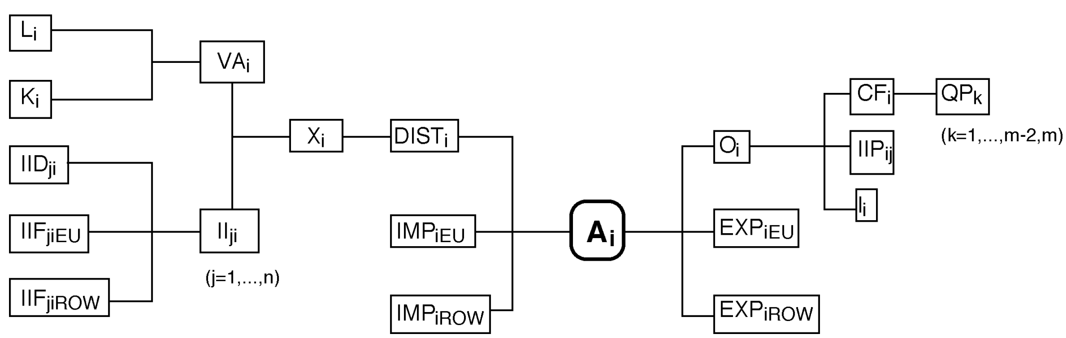

Figure 1: Production nesting in sector i

Table 1: Simulation results: Effects on aggregate variables (% change from base year)

Table 1A. Total effect						
Variable	**SOE-CRS**	**SOE-IRS**	**SOE-IRS-M**	**LOE-CRS**	**LOE-IRS**	**LOE-IRS-M**
GDP	1.12	1.20	1.30	0.30	0.54	0.63
Employment	0.54	0.61	0.73	-0.76	-0.23	-0.12
Prices	-2.25	-2.35	-2.48	-1.56	-1.35	-1.46
Wage rate	-1.67	-1.74	-1.84	-1.15	-0.99	-1.07
Capital rental rate	-0.89	-0.94	-1.02	-0.62	-0.36	-0.43
Exports	15.03	15.17	15.49	2.10	2.04	2.00
Imports	10.18	10.26	10.47	0.24	0.20	0.13
Trade deficit	-0.10	-0.13	-0.17	-3.70	-3.69	-3.82
Exports/GDP	13.77	13.80	14.01	1.08	1.49	1.36
Imports/GDP	8.97	8.96	9.05	-0.06	-0.34	-0.49

Table 1B. Removal of trade barriers						
Variable	**SOE-CRS**	**SOE-IRS**	**SOE-IRS-M**	**LOE-CRS**	**LOE-IRS**	**LOE-IRS-M**
GDP	-0.16	-0.12	-0.03	-0.62	-0.66	-0.58
Employment	-0.47	-0.41	-0.29	-0.93	-1.10	-1.00
Prices	-0.39	-0.43	-0.56	0.47	0.43	0.33
Wage rate	-0.26	-0.30	-0.40	0.38	0.35	0.27
Capital rental rate	-0.01	-0.06	-0.14	1.01	1.00	0.36
Exports	13.32	13.41	13.71	2.38	2.29	2.25
Imports	9.13	9.19	9.39	0.71	0.64	0.57
Trade deficit	0.26	0.25	0.21	-2.83	-2.86	-2.98
Exports/GDP	13.51	13.55	13.75	3.02	2.98	2.85
Imports/GDP	9.32	9.33	9.42	1.33	1.31	1.17

Table 1C. Reduction in transaction costs						
Variable	**SOE-CRS**	**SOE-IRS**	**SOE-IRS-M**	**LOE-CRS**	**LOE-IRS**	**LOE-IRS-M**
GDP	1.19	1.23	1.32	0.73	1.10	1.16
Employment	0.87	0.88	0.99	0.06	0.69	0.77
Prices	-1.80	-1.85	-1.97	-1.83	-1.60	-1.68
Wage rate	-1.35	-1.39	-1.48	-1.38	-1.20	-1.27
Capital rental rate	-0.81	-0.80	-0.88	-1.00	-0.67	-0.73
Exports	1.48	1.52	1.80	-0.29	-0.28	-0.30
Imports	0.90	0.91	1.10	-0.67	-0.65	-0.74
Trade deficit	-0.35	-0.36	-0.39	-1.48	-1.44	-1.67
Exports/GDP	0.29	0.28	0.47	-1.01	-1.36	-1.45
Imports/GDP	-0.30	-0.32	-0.22	-1.39	-1.73	-1.88

Table 2: Simulation results: Effects on sectoral employment (% change from base year)

	Table 2A. Total effect					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Agriculture	2.08	1.83	1.58	4.01	3.79	3.63
Energy and water	-0.09	0.25	-0.12	1.65	1.47	1.10
Nonenergy minerals, chemicals	3.46	3.19	4.45	2.45	2.30	3.23
Metal and machinery	2.17	2.87	3.33	-1.34	-0.84	-0.36
Other manufacturing	2.30	2.24	2.34	1.92	1.85	2.00
Construction	0.72	0.72	0.72	0.63	0.69	0.68
Commerce and hotel trade	2.00	2.01	2.04	1.73	1.62	1.64
Transport and communications	2.61	1.89	1.76	2.18	1.68	1.55
Finance and insurance	-4.40	-4.13	-4.09	-4.94	-4.45	-4.42
House renting	0.96	1.01	1.04	0.60	0.59	0.60
Other services	-0.63	-0.52	-0.43	-3.31	-1.76	-1.70

	Table 2B. Removal of trade barriers					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Agriculture	2.20	2.01	1.77	3.60	3.61	3.45
Energy and water	-0.20	-0.28	-0.64	1.33	0.73	0.38
Nonenergy minerals, chemicals	1.23	0.92	2.14	0.36	0.11	1.02
Metal and machinery	-3.62	-2.64	-2.22	-6.02	-5.41	-4.97
Other manufactures	0.45	0.39	0.50	-0.08	-0.09	0.06
Construction	0.07	0.05	0.05	0.07	0.02	0.01
Commerce and hotel trade	0.53	0.52	0.54	0.21	0.18	0.20
Transport and communications	1.30	0.96	0.84	1.06	0.79	0.66
Finance and insurance	0.52	0.53	0.57	0.37	0.26	0.30
House renting	-0.06	-0.07	-0.04	-0.36	-0.41	-0.40
Other services	-1.54	-1.48	-1.40	-2.00	-2.51	-2.46

	Table 2C. Reduction in transaction costs					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Agriculture	0.48	0.44	0.28	0.97	0.81	0.75
Energy and water	0.42	0.69	0.33	0.73	0.95	0.62
Nonenergy minerals, chemicals	2.24	2.25	3.30	1.88	1.95	2.67
Metal and machinery	4.32	4.14	4.54	3.43	3.39	3.77
Other manufactures	2.07	2.06	2.20	2.02	1.97	2.13
Construction	0.66	0.68	0.67	0.57	0.66	0.65
Commerce and hotel trade	1.47	1.49	1.52	1.46	1.38	1.39
Transport and communications	1.36	0.95	0.85	1.12	0.87	0.75
Finance and insurance	-4.94	-4.68	-4.64	-5.33	-4.77	-4.74
House renting	0.96	1.01	1.03	0.89	0.91	0.91
Other services	0.75	0.79	0.86	-1.34	0.53	0.55

Table 3: Simulation results: Effects on sectoral exports (% change from base year)

	Table 3A. Total effect					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Agriculture	9.70	8.83	7.86	18.67	18.01	17.25
Energy and water	5.02	5.57	4.83	9.42	9.18	8.46
Nonenergy minerals, chemicals	11.70	11.46	13.24	1.57	1.54	1.85
Metal and machinery	27.41	28.10	28.51	-0.62	-0.61	-0.60
Other manufacturing	13.54	13.38	13.44	1.90	1.87	1.92
Commerce and hotel trade	2.01	1.93	1.83	2.97	2.75	2.67
Transport and communications	2.59	2.54	2.36	3.13	3.00	2.82
Finance and insurance	-5.46	-5.49	-5.58	-4.89	-4.76	-4.83
Other services	-0.09	-0.09	-0.15	-1.94	-0.27	-0.32

	Table 3B. Removal of trade barriers					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Agriculture	14.44	13.77	12.78	21.84	21.80	21.05
Energy and water	6.74	6.48	5.74	10.49	9.59	8.88
Nonenergy minerals, chemicals	9.92	9.43	11.19	0.99	0.91	1.22
Metal and machinery	22.26	23.07	23.43	-0.74	-0.73	-0.73
Other manufacturing	12.21	12.02	12.10	1.37	1.38	1.42
Commerce and hotel trade	1.87	1.80	1.70	2.48	2.50	2.42
Transport and communications	2.25	1.98	1.81	2.73	2.38	2.20
Finance and insurance	1.85	1.77	1.67	2.58	2.44	2.38
Other services	0.16	0.12	0.07	0.61	-0.01	-0.07

	Table 3C. Reduction in transaction costs					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Agriculture	-1.47	-1.59	-2.06	-0.03	-0.37	-0.58
Energy and water	-0.66	-0.17	-0.70	0.15	0.44	-0.00
Nonenergy minerals, chemicals	1.88	2.03	3.36	0.27	0.29	0.43
Metal and machinery	3.42	3.35	3.67	-0.43	-0.44	-0.48
Other manufacturing	1.70	1.71	1.85	0.24	0.22	0.25
Commerce and hotel trade	0.54	0.55	0.50	0.85	0.64	0.63
Transport and communications	0.62	0.75	0.67	0.63	0.78	0.71
Finance and insurance	-7.07	-7.03	-7.06	-7.17	-6.94	-6.94
Other services	-0.02	0.01	-0.01	-2.08	-0.06	-0.09

Table 4: Simulation results: Effects on sectoral imports (% change from base year)

	Table 4A. Total effect					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Agriculture	-9.10	-8.86	-8.54	-12.31	-12.27	-12.03
Energy and water	0.69	0.72	1.32	-2.94	-2.82	-2.36
Nonenergy minerals, chemicals	-0.06	0.16	0.52	-5.86	-5.65	-5.70
Metal and machinery	22.42	22.18	21.96	6.99	6.64	6.13
Other manufacturing	11.94	12.39	12.75	2.84	2.91	3.03
Commerce and hotel trade	-5.97	-5.42	-4.64	-11.47	-11.38	-10.81
Transport and communications	-5.93	-5.33	-3.82	-11.04	-10.45	-9.16
Finance and insurance	-15.13	-14.59	-13.67	-20.34	-20.01	-19.29
Other services	-8.38	-7.81	-7.00	-15.86	-14.37	-13.79

	Table 4B. Removal of trade barriers					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Agriculture	-12.09	-11.90	-11.60	-14.82	-14.73	-14.50
Energy and water	-2.36	-2.18	-1.60	-5.32	-5.11	-4.67
Nonenergy minerals, chemicals	-2.80	-2.55	-2.21	-7.66	-7.42	-7.49
Metal and machinery	23.67	23.30	23.09	10.51	10.01	9.52
Other manufactures	8.65	9.05	9.37	0.88	1.04	1.15
Commerce and hotel trade	-11.60	-11.22	-10.51	-16.03	-15.95	-15.43
Transport and communications	-10.14	-8.99	-7.58	-14.24	-13.18	-11.96
Finance and insurance	-10.78	-10.15	-9.21	-15.25	-14.99	-14.25
Other services	-13.68	-13.26	-12.52	-18.12	-18.48	-17.95

	Table 4C. Reduction in transaction costs					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Agriculture	2.51	2.54	2.76	1.90	1.81	1.93
Energy and water	2.38	2.32	2.77	1.51	1.49	1.76
Nonenergy minerals, chemicals	2.13	2.17	2.71	1.06	1.10	1.19
Metal and machinery	-0.31	-0.27	-0.43	-2.55	-2.48	-2.92
Other manufactures	2.15	2.19	2.39	0.81	0.75	0.72
Commerce and hotel trade	3.97	4.08	4.59	2.98	2.92	3.21
Transport and communications	3.14	2.77	3.94	1.99	1.69	2.64
Finance and insurance	-5.98	-6.00	-5.36	-7.20	-7.08	-6.64
Other services	3.50	3.60	4.14	0.29	2.29	2.58

Table 5: Simulation results: Effects on sectoral final consumption (% change from base year)

	Table 5A. Total effect					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Food and non-alcoholic beverages	2.48	2.58	2.74	1.74	1.53	1.66
Tobacco and alcoholic beverages	2.66	2.78	2.96	1.85	1.65	1.80
Clothing and footwear	2.34	2.44	2.58	1.64	1.43	1.55
Housing	1.58	1.66	1.74	1.15	0.92	0.99
Home appliances	2.62	2.73	2.90	1.71	1.51	1.65
Health services	2.30	2.40	2.58	1.53	1.33	1.47
Transport services	2.41	2.54	2.66	1.57	1.39	1.47
Recreational services	2.37	2.47	2.61	1.60	1.40	1.52
Other services	1.76	1.83	1.93	1.25	1.06	1.14

	Table 5B. Removal of trade barriers					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Food and non-alcoholic beverages	0.42	0.47	0.62	-0.45	-0.41	-0.29
Tobacco and alcoholic beverages	0.50	0.55	0.72	-0.44	-0.40	-0.25
Clothing and footwear	0.39	0.43	0.57	-0.45	-0.41	-0.30
Housing	0.13	0.16	0.24	-0.50	-0.46	-0.39
Home appliances	0.60	0.66	0.82	-0.40	-0.36	-0.23
Health services	0.41	0.44	0.62	-0.48	-0.45	-0.31
Transport services	0.51	0.55	0.66	-0.42	-0.41	-0.33
Recreational services	0.49	0.55	0.68	-0.39	-0.35	-0.24
Other services	0.23	0.26	0.36	-0.43	-0.38	-0.31

	Table 5C. Reduction in transaction costs					
Sector	SOE-CRS	SOE-IRS	SOE-IRS-M	LOE-CRS	LOE-IRS	LOE-IRS-M
Food and non-alcoholic beverages	1.97	2.03	2.18	2.00	1.76	1.87
Tobacco and alcoholic beverages	2.08	2.13	2.30	2.08	1.85	1.98
Clothing and footwear	1.87	1.92	2.06	1.91	1.67	1.77
Housing	1.38	1.42	1.50	1.50	1.24	1.29
Home appliances	1.93	1.98	2.15	1.91	1.68	1.79
Health services	1.82	1.87	2.04	1.82	1.60	1.71
Transport services	1.82	1.89	2.00	1.80	1.61	1.67
Recreational services	1.80	1.84	1.97	1.80	1.58	1.66
Other services	1.46	1.50	1.59	1.53	1.31	1.37