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Reforming Hungarian Agricultural Trade Policy

A Quantitative Evaluation

Morris E. Morkre
and
David G. Tarr

Import protection, export subsidies, and a potential common agricultural policy (CAP) system are all shown to be costly to Hungary in terms of lost welfare. The proposed CAP system would also significantly increase the government's fiscal problems.

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This paper — a product of the Trade Policy Division, Policy Research Department — is part of a larger effort in the department to assess the impact of trade liberalization in transition economies. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Nellie Artis, room N10-013, extension 37947 (September 1993, 28 pages, plus 11 pages of appendix).

Morkre and Tarr quantitatively assess the consequences for Hungary of three types of policies:

- Removing quantitative import restraints in agriculture, both for all of agriculture and for each of five separate agricultural products.

- Removing the export subsidy program in agriculture.

- Adopting a European Community–type common agricultural policy (CAP) system in Hungary.

The authors estimate the consequences of all policies by using a small open-economy computable general equilibrium model for Hungary, calibrated to the year 1990.

They estimate the tariff equivalent of the import licenses through a detailed study of price comparisons, the first of its kind for Hungary.

Imposing a CAP system, they find, would be a costly step backward for Hungary, especially as the long-run trend in Hungarian agricultural policy has been toward less intervention and more reliance on the market. A CAP system would significantly increase the government's fiscal problems.

Import protection and export subsidies are costly, inefficient policies. The most important policy conclusion, they contend, has to do with the piecemeal sequencing of reforms in the presence of both export subsidies and import licenses. Removing import licenses while export subsidies remain would generate byproduct distortions in the export market and little gain in welfare. The piecemeal removal of export subsidies, however, would not generate byproduct distortion, so substantial gains could be expected — but at the expense of greater adjustment costs.

To facilitate understanding of this commonly used type of general equilibrium model, they explain the results by using supply-and-demand graphs of the agricultural sector.

REFORMING HUNGARIAN AGRICULTURAL TRADE POLICY: A QUANTITATIVE EVALUATION

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REFORMING HUNGARIAN AGRICULTURAL TRADE POLICY: A QUANTITATIVE EVALUATION

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I. INTRODUCTION

Hungary has made great strides in recent years in moving toward a market oriented economy, including reforming its external trade regime. Although all imports were subject to an import licensing requirement as of December 1988, by 1992 tariff lines corresponding to over 75 percent of industrial output were liberalized, i.e., free of import licensing. However, certain problems remain. Hungarian agricultural production remained fully protected through import licensing, and a significant share of the remaining industrial output protection was in the food sector, justified in part due to high cost agricultural output. Moreover, agricultural export subsidies have become a large share of total government subsidies.

Since Hungary has signed an Association Agreement with the European Community (EC), some are sanguine regarding the future of Hungary's trade policy, taking the view that long-term harmonization of Hungary's trade policies with the EC will correct remaining distortions. But the most significant remaining protected sectors in Hungary are those sectors termed "sensitive" by the EC,[1] in which policies of the EC itself are quite distorted. Thus, it cannot be presumed that EC pressure will correct these distortions. Worse still, harmonization of Hungarian policies to those of the EC in the agricultural sector (a policy informally suggested by some policymakers in Hungary) would mean the introduction of a "Common Agriculture Policy" (CAP) type system and the

*The authors would like to thank Mrs. Agnes Nagy of Kopint Datorg, Budapest Hungary for her extensive assistance in the price comparisons study; Gabor Oblath, Ulrich Thumm, Rory O'Sullivan, Csaba Csaki and Wayne Ringlein for their comments; officials too numerous to mention in the Ministries of International Economic Relations and Agriculture of Hungary for their assistance and informative discussions during several missions; and Jeff Hayden and Nellie Artis for their logistical support. The views expressed are those of the authors and do not necessarily reflect those of the U.S. Federal Trade Commission, the World Bank, the Government of Hungary or its Ministries, or those acknowledged.

[1]In addition to agriculture and a large share of the food sector, a significant share of the textiles and apparel and pharmaceuticals sectors remain subject to import licenses.

continuation of export subsidies. Given that GDP originating in Hungarian agriculture is about 12 of total GDP, compared to 3 percent in the EC, a CAP type system in Hungary would be expected to impose a more significant deadweight loss burden on tne rest of the relatively fragile Huungarian economy.

In its international negotiations, the Government of Hungary has taken a progressive position on these issues. It is a member of the Cairns group in the Uruguay Round of GATT negotiations, i.e., it supports the reduction of agricultural subsidies and increased transparency of import barriers through tariffication, which includes the elimination of licenses on imported products.[2] Hungary justifies its interventionist policies in agriculture due to the fear of dumping on the part of the EC, and prefers a multilateral rather than unilateral reduction in these policies (see GATT, 1991).[3]

In this paper we quantitatively assess the consequences of three categories of unilateral policy action by the Government of Hungary: (1) the costs to Hungary of its import restraints in agriculture, both in aggregate for all of agriculture and in each of five separate agricultural products: butter, pork, cheese, chicken and milk powder. The tariff equivalent of the import licenses was estimated through detailed empirical work based on price comparisons between the Hungarian and world markets; (2) the costs of the Hungarian export subsidy program; and (3) the costs of a CAP type system in Hungary. The consequences of all policies are estimated through the use of a small open economy computable general equilibrium model for Hungary, calibrated to the year 1990. We provide a thorough intuitive explanation of the results, however, through the use of partial equilibrium graphs of the agricultural sector (which itself is divided into three markets).

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[2]We show in the appendix, however, that agricultural import licensing in Hungary is more extensive than in OECD countries outside of the EC

[3]It should be noted that tariffication of non-tariff barriers retains protection against dumping, and, since about 80 percent of Hungary's agricultural tariff lines are not bound under the GATT, tariffication appears feasible. Tariffication offers a number of advantages including: its transparancy will tend to reduce the dispersion in the protection regime as less protected interests become aware of the level of protection received by the highly protected sectors; and since licenses provide rents to those who obtain the licenses, licensing could generate costly rent-seeking which would be significantly reduced by tariffication.

We find that import protection, export subsidies and a potential CAP program are all costly to the country in terms of lost welfare, and the CAP system would contribute significantly to the Government's fiscal problems. We also find that the benefits of import liberalization are considerably muted in the presence of an export subsidy program in the same industry, because, in response to the decrease in domestic demand, exporters substitute export sales (increasing the government's subsidy burden). This indicates from a sequencing perspective, it is important to concurrently reduce export subsidies in the process of import liberalization.

Although the magnitude of the costs of protective and interventionist policies in the agriculture sector in East and Central Europe will surely vary across the different economies, similar policies and proposals have been discussed in other countries in East and Central Europe (since most now have Association Agreements with the EC).[4] Thus, the information gained from this exercise should be relevant to the policies of some of these other East and Central European countries as well.

In section II we briefly survey the recent reforms in Hungarian agriculture policy as well as the principal remaining policy problems. In section III, the basic data of the model are presented. Most notably, this includes the details of a price comparisons study to determine the tariff equivalence of the import licensing regime. This price comparisons study is the first of its kind to our knowledge for Hungary, which is remarkable given the longstanding claim of the pre-1990 Government that the licenses do not represent a restraint to trade.[5] An overview of the model is presented in section III. The results are presented in sections IV and V. In section IV the results are interpreted through consumers' and producers' surplus using three ordinary supply-demand diagrams of

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[4]In 1992 a CAP type system was being discussed in Poland and Czechoslovakia, and in Romania in 1993.

[5]See Haus (1992) for a fascinating account of the negotiations in the early 1970s under which Hungary entered the GATT. Hungary maintained that with the introduction of the "New Econonmic Mechansim," it had departed sufficiently from central planning that the tariff was the principal import regualtory mechanism. The Hungarian representative steadfastly resisted quantitative import commitments characteristic of the accession agreements of Romania and Poland (due to their status as state trading countries), and insisted on (and received) tariff concessions as the "price" of its admission to GATT.

the agriculture sector. Despite the fact that they are partial equilibrium diagrams, since the linkages within the agriculture sector are incorporated, they are helpful for understanding the principal effects of the policy changes in general equilibrium models of this type. The equations of the model, as well as a comparison of the OECD countries import licensing regimes in agriculture are in the appendix.

II. RECENT POLICY CHANGES AFFECTING HUNGARIAN AGRICULTURE

The regulatory environment affecting Hungarian agriculture has changed dramatically in recent years. These changes include: removal of virtually all central controls on prices; reduction in government subsidies; unification of current account transactions and elimination of state trading (following the demise of the CMEA trading system); and an opening of the types and numbers of firms that can engage in external trade, i.e., removal of the state monopoly of foreign trade.

Regulatory Reform

Price Decontrol. Before 1989, 85 percent of the prices of Hungarian agricultural products were either set or regulated by the government. By January 1991, only consumer prices of white bread and one type of milk (2.9 percent milkfat) remained regulated.

Subsidies. Overall subsidies to the agriculture sector (such as export, production, input and investment subsidies) fell from 3.7 percent to 1.6 percent of GDP between 1988 and 1990 (GATT, 1991, vol I, 128). Plans called for a further slash in production subsidies and a complete elimination of input subsidies. In fact, the reduction of production and input subsidies combined with the removal of price controls had an offsetting effect which left farm income relatively unchanged.[6] Export subsidies, however, have not declined as significantly. For

[6]Tarr (1990, pp. 111-114), using 1988 conditions, estimates that similar results would have occurred in Poland for farmers producing butter. Tarr estimates that a policy of simultaneously lifting price controls and removing producer subsidies would have resulted in an improvement in producers' surplus of farmers.

most products, exports subsidies were available in 1990 at between 15 and 35 percent of the value of exports (see table 1); as a result, by 1990 export subsidies rose to about three-fourths of total subsidies to the agriculture sector.[7]

State Trading. With the demise of the CMEA the highly distortionary state trading structures involved in the massive intergovernmental barter agreements have been disbanded. All trade is settled on a similar basis, i.e., there is no separate transferable ruble balance of payments accounting for trade with the CMEA countries. While buffeted by an adverse terms-of-trade shock in the switch-over to world prices in its CMEA trade (Oblath and Tarr, 1991), Hungary has reoriented its agricultural exports so that by 1990 over two-thirds of its exports were to developed countries (up from 42 percent in 1985), with declines in exports to socialist markets accounting for almost all of the increase (Varga et al., 1991).

Demonopolization of Foreign Trade. Beginning in 1987, the state monopoly of foreign trade was relaxed for foreign trade settled in convertible currency, which now comprises all trade. The number of enterprises engaged in exporting (importing) of agricultural products exploded from 81 (39) in 1987 to 495 (205) in 1990. These developments have facilitated competition and removed a tool of regulatory control from the hands of the state.[8]

Remaining Policy Problems: Import Licenses, Export Subsidies and a Potential CAP.

Given this extensive progress, the principal regulatory problems that remain are, as discussed above, the import licenses and the export subsidies. In addition, Hungary introduced a new program in January 1991 that has elements of a CAP type program. This program runs counter to the reforms mentioned above as

[7]Gatt (1991, Vol II, p.40) estimated export subsidies at 73 percent of total subsidies.

[8]See GATT (1991) and Bognar et al. (1991) for further details.

well as 25 years of gradual deregulation of the agriculture sector in Hungary.[9] In particular, it set minimum prices for grains and some slaughter animals. In July 1991, in the face of large excess supply, the Government intervened in the domestic wheat market to support deteriorating prices. In the case of the EC, feed grains were the first products to be supported; but due to the increased cost of production for livestock and food products that use feed grains as inputs, many downstream products were soon added to the EC CAP system. Thus, the prospect of the introduction of a CAP raises concern for the costs of the regulatory environment in Hungary in the future.

III. BASIC DATA AND OVERVIEW OF THE MODEL

Basic Data

Import and Export Shares. In table 1, we summarize the basic data relevant to our investigation of the trade policy instruments in Hungarian agriculture. Column 1 reveals that imports are a very small share of domestic consumption in the individual agricultural products we have investigated; on the other hand, aggregate agricultural imports are a significant one-quarter of agricultural imports. This fact is important in the welfare analysis. On the other hand, exports of all agricultural products in the table are an important part of Hungarian output.

Export Subsidies. Export subsidy rates of column 4 are an average for the year. Export subsidy rates available at any point in time are announced by the Ministry of International Economic Relations and are publicly available in a number of Hungarian sources.[10]

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[9]Indeed, agriculture was the first sector to benefit from decentralizing reforms that began in the late 1960s. These reforms included abolishing obligatory plan targets, increasing prices paid to producers, and loosening controls over private plots. For a discussion of agricultural reforms by Hungary since 1965 see Marrese (1990).

[10]See Kereskedelmi Kozlony (Official Journal of the Ministry of Commerce), vol II, No. 1, p. 27 (Jan 25, 1990); vol II, No. 6, p. 194 (April 17, 1990); and Kulgazdasagi Kozlony (Official Journal of the Ministry of International Economic Relations), vol. 1, No. 1, p.7 (August 15, 1990).

Price Comparisons Estimate of Quota Premia. In column 3 of table 1, we report the premia rate (or tariff equivalent of the import license) for each of the products for which we conducted an empirical investigation. As elaborated fully in table 2, these data were obtained by a price comparisons investigation.[11] The percent increase in price induced by the license (after adjusting for transportation and tariff charges) is referred to as the license premium. For the products listed in the table we estimate that the import licenses represent a binding import constraint, and we therefore model the import licenses as quotas in our model. Although Hungarian products are generally viewed as being of lower quality, we have not adjusted for these quality differences; this implies that the license premium is higher than we have estimated to the extent of unadjusted quality differences.[12]

Model Overview

The model is a single-country, two sector, CGE model for a small open economy benchmarked to data for 1990. One sector is either the agricultural sector as a whole or a specific agricultural product (e.g., butter) while the second sector is the rest of the economy. The economy has a given endowment of productive resources and chooses from given technologies in the employment of these resources. There exists a given production possibility frontier that describes the tradeoff in production between the two sectors. Several CGE models with these supply side features have been constructed recently to examine trade policy issues for various products, including steel, textiles, and wheat.[13] As

[11]We thank Ms. Agnes Nagy of Kopint-Datorg of Budapest Hungary for her detailed work in providing these price comparisons.

[12]There were some agricultural products subject to licensing for which our price comparisons study did not show a positive licensing premium. We attribute this to the lack of adjustment for quality.

[13] For example, see Trela and Whalley (1990) and Trela, Whalley, and Wigle (1987).

is typical of small open economy models, we aggregate all other countries into the "rest of the world" and treat this aggregate parametrically.[14]

The model assumes that market prices are sufficiently flexible to ensure that demands from utility maximizing consumers are consistent with the supplies of cost minimizing producers, resulting in market equilibrium. This assumption would be of doubtful validity in Hungary prior to 1990, due to the widespread use of price controls for many products. In 1990, however, there was significant liberalization of prices as the country moved toward a market system, allowing us to reasonably employ a market clearing model.

A schematic diagram of the consumption and production structures is provided in figure 1. The demand side of the model assumes consumption decisions are made by a representative consumer with a Stone-Geary utility function leading to a linear expenditure system (LES). There are two composite consumption goods. The significant product differentiation between similar domestic and imported goods in Hungary (with Hungarian goods being of somewhat lower quality) is incorporated through the use of the Armington assumption, i.e., each composite consumption good is a constant elasticity of substitution (CES) function of domestic and imported goods.

The supply side of the model assumes that the economy's total endowment of productive resources is fixed and employed in the two sectors. Although productive resources are not modelled explicitly, it is assumed that at least one input (e.g., labor) is mobile between the two sectors. The degree of flexibility between sectors is indicated by the elasticity of the constant elasticity of transformation (CET) production possibility frontier for the two sectors. In addition, each domestically produced product is a composite product that is a CET function of two specific varieties or qualities, one for the domestic market and the other for the export market. This specification captures the important product differentiation feature between exports and domestic products. For

[14]The structure of our model draws extensively on de Melo and Tarr (1992), chapters 2 and 3. The reader may consult this source for an elaboration of the economics of models of this type.

example, in the case of meats, exported pork is commonly frozen while pork for the home market is typically fresh or chilled.

Although the Armingtom assumption has been the standard method of modelling sectors in applied general equilibrium models, one must be careful of its limitations in certain situations. In particular, what may not be apparent is that under the Armington assumption, in response to a change in trade policy (such as tariff or quota reductions) in a given sector, resource movement and the welfare impact will be extremely muted in sectors with a small initial import share. For example, with a point estimate Armington elasticity (elasticity of substitution) of 2, a fifty percent decline in the relative price of imports will induce a 100 percent increase in the ratio of imports to domestic sales in consumption. But if imports were less than 0.5 percent of consumption, they will remain under one percent after their relative price reduction, i.e., the absolute increase in the import share of consumption is less than 0.5 percent. With the same elasticity of substitution, if a sector has a significant initial share, the same relative price reduction will result in a much larger absolute increase in imports as a percent of total consumption in the sector. That is, ceterus paribus, the Armington assumption suggests that there would be dramatically less resource movement (and consequently less welfare impact) in the case of a small initial import share. In some of the agriculture sectors of Hungary, the licenses are regarded as quite important for the protection of the sector, and such a small change in imports (given the small share of imports as shown in table 1) from a large relative price decline of imports appears unrealistic.

On the other hand, the homogenous product assumption will tend to result in excessive resource movement, and is equally unrealistic. Our solution to this problem, has been to employ the Armington assumption, but to use elasticities that are rather high by the usual standards, since the share of imports is rather small in all individual sectors; this results in a change in quantity demanded for imports that, while still somewhat muted, is more realistic.

Finally, the balance of payments is constrained such that total exports minus total imports (expressed in world prices) is constant, i.e., there is no

free lunch either provided to or received from the rest of the world in response to a policy shift. The real exchange rate adjusts to satisfy the constraint. We measure the change in welfare by the Hicksian equivalent variation. The model is written and solved using the GAMS programming language; see Brooke et al. (1988).

IV. COSTS OF LICENSING OF IMPORTS AND EXPORT SUBSIDIES

In table 3, we present the results of our examination of trade policy changes in particular agricultural sectors; the scenarios consider the impact of eliminating export subsidies, eliminating import licensing and eliminating both. In the top part of table 4, we present similar results for the aggregate agriculture sector. In all cases, the two sector model is employed. The rest of the economy changes size depending on the size of the agriculture sector under consideration.

For each scenario, we consider the impact on four important variables: welfare (the Hicksian equivalent variation), composite output of the sector, net government revenue and the real exchange rate. In all cases, the results are presented in percentage terms. The central elasticity scenario presents the results with our best guess of the elasticities. In order to determine whether the results are robust, all scenarios are rerun with high and low elasticities, where the high and low elasticity cases generally are obtained by doubling and halving the elasticities.

The static welfare benefits are somewhat modest. In the central elasticity case for aggregate agriculture, the benefits are 74 thousandths of one percent for export subsidy removal (this equals 1.52 billion 1990 forint out of a GDP of 2070 billion forint), 51 thousandths of one percent for import license removal and 11 hundredths of one percent for removal of both. These results, however, should not be surprising to those who are familiar with previous estimates of the welfare effects of policy reform in constant returns to scale models without rent capture or rent seeking. Whether in partial or general equilibrium, measuring

"Harberger" triangles or its equivalent in general equilibrium models, has typically produced estimates similar to those of tables 3 and 4.[15] However, models that estimate the dynamic effects of trade liberalization suggest that the dynamic benefits of trade liberalization are many times the benefits suggested from static models (see e.g., Baldwin, 1989). These estimates of the dynamic benefits, however, are based on estimates derived from static models such as ours so that our estimates are an important step in the process of estimating the total benefits of trade liberalization.

Comparing the effects of removing export subsidies to removing import licenses reveals that the welfare benefits and sectoral adjustment of output are typically much larger with export subsidy removal. This may appear surprising, especially in the aggregate agriculture case, where the export subsidy and the import license premium are about equal.[16] The reason is that separate or piecemeal removal of the import quotas has important second best effects which reduce the welfare benefits and output adjustment of the agricultural sector.

We utilize figures 2, 3 and 4 to explain the results of the three policy type scenarios in table 2 and the top of table 3. These figures each have three ordinary supply-demand diagrams, and are partial equilibrium because they only picture the agricultural sector. Nonetheless, since the linkages within the agriculture sector are incorporated, they are helpful for understanding the principal effects of the policy changes in our general equilibrium model. The domestic product and the imported product are pictured separately since consumers regard the two varieties as heterogeneous (the Armington assumption). Thus, in addition to their own prices, the demand curves for imports and the domestic

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[15]For example, de Melo and Tarr (1990; 1992; 1993) found that the benefits of removing U.S. quotas were about 0.5 percent of GDP. But their estimates incorporated a rent transfer component of the quotas (which was about four-fifths of the costs) which is not present in the Hungarian context. Trella and Whalley (1990) found the benefits to the U.S. of global removal of the MFA would be about 0.3 percent of GDP, where again a rent transfer component was involved. Morkre (1990) found the benefits of agricultural liberalization in sugar and dairy products in the U.S. would be about 0.5 billion U.S. dollars, or about 0.01 percent of 1987 GDP. The above were general equilibrium studies, but Morkre and Tarr (1980) and Tarr and Morkre (1984) estimated the benefits of removing import restriction in numerous industries in partial equilibrium with similar results.

[16]Butter and pork have higher import quota premia relative to their export subsidy rates, so removing the import quota premium is more important in relative terms.

product depend on the price of their substitute. Similarly, for producers, the domestic product and the export product are heterogeneous, and are pictured separately. Since producers can switch markets subject to their technical possibilities expressed by the CET function, in addition to its own price, the export (domestic) supply curve is a function of the price of the domestic (export) good. Due to the small country assumption, the supply of imports is perfectly elastic at the world price of imports (WPM), and the demand for exports is perfectly elastic at the world price of exports (WPE). WPM includes transportation costs but excludes tariffs; the "tariff ridden" demand curve for imports is pictured, since the quota premia rate must be determined residually after the tariff is collected. The export subsidy rate, denoted s, allows producers to obtain WPE(1+s) per unit of exports.

Figure 2 illustrates, the effects of removing an import quota in the presence of an export subsidy in the same industry. In all three figures, variables in the initial equilibrium are denoted by the subscript 0; in the new equilibrium by 1. The initial impact of quota removal results in a decline in the price of imports to PM_1.[17] Since the demand for the domestic variety depends on the price of imports, the demand for the domestic variety shifts down and its price declines to PD_1. The lower price of the domestic variety induces two feedback effects: (1) consumers will reoptimize by shifting demand away from imports, i.e., the demand for imports shifts in to d_1. Thus, the triangle of benefits measured in the import market is the shaded area shown;[18] (2) producers will reoptimize by shifting production toward the export variety, which continues to sell at the world price times one plus the export subsidy rate (denoted WPE[1+s]), i.e., the export supply curve shifts out to the right. The government subsidy burden will increase by the size of the shaded rectangle in the export market. This rectangle in the export market is a second best type loss to the

[17]Since our model is a comparative statics model, the "dynamics" discussed in the context of figures 2, 3 and 4 is for pedagogical purposes only.

[18]See Burns (1974) for the justification of the measurement of the benefits of quota removal in the import market as the triangle created by connecting the equilibrium points.

economy which must be subtracted from the triangle of benefits in the import market to asses overall benefits to the economy;[19] It follows that the net benefits of quota removal are equal to the shaded triangle in the market for imports minus the shaded rectangle in the market for exports.[20] It is apparent from figure 2 why the results show very little increase in welfare from a reduction in the import quota alone in the presence of an export subsidy: producers substitute in the export market (and obtain increased government subsidies) for reduced demand in the domestic market.

Figure 3 illustrates the principal effects of removing an export subsidy on a piecemeal basis in the presence of an import quota on the substitute import variety. The height BC equals the difference between the marginal cost of production of the initial output E_0 and the price paid by foreigners. If we were to ignore the interaction effects involved in reaching a new equilibrium, the triangle ABC would equal the benefits to the economy of removing the export subsidy; but the interaction effects between the markets reduces the benefits of export subsidy removal.

Removal of the export subsidy causes the export price of producers to fall to the world price (PE_1 = WPE). Since the export price to producers falls, producers shift supply to the domestic market, which induces a fall in the price of the domestic variety. The drop in the price of the domestic variety induces a shift down in the demand for imports, which reduces the price of imports. There are further feedback effects as the lower import price induces a downward shift in the demand for domestic goods, which in turn induces an increase in the supply

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[19]The rectangle of losses to the economy in the export market follows from equation 8 (or its special case equation 5''') in Harberger (1971). Harberger considers the case where there is a change in the tax (broadly interpreted as any price-cost distortion) on good 1 (in our case the removal of the import quota) in the presence of taxes on other goods in the economy, say goods 2,...,n. In our case the most notable other tax is the export subsidy on exports in the same sector. Then the change in welfare is the change in surplus on good 1, plus the change in surplus on goods 2,...,n, where the latter is equal to the tax on the other goods times the change in quantity of those goods, summed over all such goods.

[20]There are additional second best effects not shown in figures 2 and 3 including the change in dead-weight losses due to change in demand in the presence of tariffs in agriculture or the rest of the economy. Most notably, import quota removal results in additional benefits in the agriculture sector equal to the tariff rate times the change in the quantity of imports. Since our approach is general equilibrium, which measures the welfare change by equivalent variation, we consider all second best effects, even though not depicted in the diagram.

of exports. Applying the Burns methodology again, the latter effect reduces the benefits of export subsidy reduction to the shaded triangle in the export market.[21] By contrast with figure 2, there are no welfare consequences other than in the market in which the distortion is changing. This follows from the Harberger principal mentioned in the footnote above: since there is no change in the quantity of imports, there is no welfare change in the import market.[22]

In figure 4 we depict the benefits of removing both the export subsidy and the import quota. Since distortions are removed in both markets, there are triangles of benefits in both the import market and the export market. What may appear puzzling is that despite the triangle of benefits in the import market in figure 4, in most of the cases in table 3 the welfare benefits of removing export subsidies alone are as large as the combined benefits of removing both export subsidies and import quotas. Comparing figures 3 and 4, one can observe that due to the greater decline in the price of the imported variety in figure 4, the decline in the price of the domestic good is greater in figure 4. Then the increase in export supply is greater in figure 4, which implies that the triangle of benefits in the export market alone is smaller in figure 4 than in figure 3, ceterus paribus. These reduced benefits in the export market are typically approximately just offset by the triangle of benefits in the import market.

The third column in tables 3 and 4 refers to the net change in tariffs minus subsidy expenditures as a percentage of initial government revenue. Export subsidy reduction improves the Government's fiscal position as expected in all cases--an important consideration given the Government's efforts to control inflation.[23] The removal of import licenses provides mixed results on the Government's fiscal position, depending on the elasticities. In table 4, where

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[21]Figure 3 is drawn for the case where the quota remains binding after the removal of the export subsidy. This holds for our results for aggregate agriculture and for most of the individual sectors as well. In the case of pork, however, the cross-elasticity effect is sufficiently strong that the import quota is no longer binding after the export subsidy is removed.

[22]That is, without resource movement, there are no gains from improved resource allocation.

[23]Formally in our model, any change in the fiscal position of the government is exactly offset by lump-sum taxes on or transfers to the consumer. To the extent that a reduction of export subsidies allows the government to reduce distortionary taxation, the benefits of export subsidy reduction would exceed the benefits we have estimated.

smaller elasticities of substitution in demand are employed, for reasons explained above, the Government's fiscal position worsens. As shown in figure 2, the Government will have to increase its expenditures on export subsidies when it removes import licenses. Another effect on government expenditures which is not pictured in figure 2, is that the Government increases its tariff collections as a result of the increase in the quantity of imports after the quota is removed. With high import demand elasticities, the increase in imports and the tariff collections are large, and these increased tariff collections exceed the increase in expenditures on export subsidies.

The fourth column in tables 3 and 4 show that the real exchange rate must depreciate when export subsidies or import licenses are removed. The removal of import licenses increases imports; the removal of export subsidies decreases exports. Thus, the price of traded goods must increase relative to non-traded goods in order to restore equilibrium in the balance of trade, i.e., a real depreciation.

V. COSTS OF A CAP TYPE SYSTEM

As mentioned above, the Government initiated a CAP type system in 1991. Since the amount budgeted was rather modest, the consequences of the program were minimal; thus the real concern is whether the system is a harbinger of a larger program to come. On the one hand, in the Uruguay Round negotiations at the GATT, Hungary is member of the "Cairns" group of nations. Many Government officials recognize that the establishment of a CAP runs counter to the international efforts of the Cairns group in the Uruguay Round (as well as the U.S.) to reduce agricultural subsidies. On the other hand, other officials anticipate that Hungary will eventually join the EC, and believe that they should harmonize their regulatory environment to the EC CAP system which they believe will continue to exist.

The objective of a CAP type system is to support agricultural prices. As mentioned above, due to input-output linkages in the agricultural sector, although the system often starts with feed grains, it quickly spreads to a wide range of products in agriculture. Thus, we shall counterfactually estimate the

impact of a price support system in all of agriculture. Moreover, a price support system requires import restraints, since otherwise imports would enter and undermine the price support program. That is, a CAP system would undermine the effort of Hungary to liberalize its trade regime. We simulate a system of price support at three different levels: 5 percent, 10 percent and 20 percent higher than the initial prices.

We assume that the higher prices are achieved by increasing export subsidies and limiting imports to their initial level. That is, we implement the CAP by increasing the export subsidy to achieve a desired level of domestic prices, holding the import quotas in place, and allowing the quota premium on imports to vary endogenously. Then we may use figure 3 to analyze the effects of this policy (by inverting the subscripts 0 and 1 and interpreting the subsidy rate s of the figure as the increase in the subsidy rate) since figure 3 depicts the same type of policy in reverse.[24] The costs of the system therefore are an increase in the inefficiency costs in the export market as the costs of production exceed the value of the goods paid by foreigners.

The results are reported in table 4. As expected agricultural output expands due to the price support program. In the case of a 10 percent increase in price supports for example, production increases by about 21 percent, but government export subsidies increase by more than 100 percent and the government loses substantial revenue. The export subsidy rate increases from 16.7 percent (table 1) to 33.6 percent. Without an offsetting revenue increase or expenditure decrease, the government budget would move into deficit by almost 3 percent of its initial revenue. The loss in welfare is about 0.3 percent of GDP. The real exchange rate appreciates with the introduction of a CAP system because the initial effect is to increase exports.

The estimates would be expected to be lower bound estimates of the costs of the price support system for two reasons. First, the introduction of a CAP

[24]However, an additional rectangle of costs of a CAP, not shown in figure 3 but captured by our model, is the initial subsidy rate times the increase in the quantity of exports. This is analogous to the situation discussed above cf an additional rectangle of benefits due to the presence of an import tariff when the import quota is removed.

system increases the demand for imported agricultural products as consumers would like to substitute for the higher priced domestic products. Consumers are prevented from additional importing, however, by the quota restraints. The licensing premium on imports increases from 16.8 percent (table 1) to 26.5 percent. As a consequence, the rents on imported products under license increase. It would be expected that costly rent-seeking behavior to obtain the more valuable licenses would also increase. The costs to the economy of this likely increase in rent dissipating activity are an additional cost of the price support system, which are ignored in the estimates of table 4. Second, the government will have to obtain additional revenue (or reduce other expenditures) to compensate for the additional expenditures of the price support system. In practice, additional taxes would impose a dead-weight loss on the economy, but we have employed lump-sum non-distortionary taxes in our model.

VI. CONCLUSION

We have developed a computable general equilibrium model for the purpose of evaluating the consequences of reform of Hungarian agricultural policy. An important empirical step in the exercise was the price comparisons study, the results of which were presented in table 2. These results show that the import licenses were a binding constraint on imports for the products of the table. The results were interpreted through the use of graphs which should facilitate the understanding of models of this type.

The results show that the imposition of a CAP type system would indeed be a costly step backwards for Hungary, especially since the long run trend in Hungarian agricultural policy has been toward less intervention and greater reliance on the market. Import licenses and export subsidies are also shown to be costly inefficient policies. Perhaps the most important policy conclusion is in the area of the piecemeal sequencing of reforms in the presence of both export subsidies and import licenses. The removal of import licenses in the presence of export subsidies will generate byproduct distortions in the export market; little

gain in welfare may ensue. On the other hand, the piecemeal removal of export subsidies will not generate byproduct distortions so that substantial gains can be expected. These greater gains will come, however, at the expense of greater adjustment costs.

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Table 1. Basic policy and industry data, 1990

	Product						
	Butter	Cheese	Chicken	Milk Powder	Pork	Agriculture (aggregate)	Rest of Economy (nonagriculture)
				Percent			
Import licensing premium	23.4	12.3	8.8	7.1	19.2	16.6	na a/
Export subsidy	37.5	37.5	37.5	37.5	18.75	16.7	0
Tariff	66.0	31.0	26.0	26.0	21.0	9.5	8.3
Imports/consumption	0.1	0.7	1.5	1.8	0.8	27.8	32.5
Exports/production	10.3	27.2	57.6	25.3	25.6	46.5	30.1
				Billion Forint			
Imports	0.01	0.04	0.04	0.04	0.40	52.8	610.2
Exports	0.75	2.56	7.97	0.91	17.04	139.3	545.8
Consumption	6.26	5.92	2.91	2.40	46.76	190.2	1879.8
Production	7.29	9.40	13.82	3.61	66.61	299.9	1815.4

a/ Not available.

Source: Licensing premia are calculations by the authors and Mrs. Agnes Nagy of Kopint-Datorg, Budapest. Other data are from official government publications.

Table 2. Calculation of licensing premium for certain Hungarian agricultural products, 1990

	Butter	*Cheese*	*Chicken*	*Milk Powder*	*Pork*
1. World price ($ per metric ton) a/	$1,363	$1,700	$1,225	$1,458	$1,499
2. Transportation & handling charges to the Hungarian border ($ per metric ton) b/	$87	$91	$34	$65	$86
3. Border Price. 1 + 2a ($ per metric ton)	$1,450	$1,791	$1,259	$1,523	$1585
4. *Tariff Rates & Levies*					
MFN tariff	60%	25%	20%	20%	15%
Other levies c/	6%	6%	6%	6%	6%
Total levies in percent	66%	31%	26%	26%	21%
Total levies in dollars	$957	$555	$327	$395	$333
5. Delivered Price including levies ($)	$2,407	$2,346	$1,586	$1,918	$1,918
6. Delivered price including levies in Hungarian Forint d/	151,689Ft	147,845Ft	99,950Ft	120,872Ft	120,872Ft
7. Domestic market farmgate (fob) price e/	187,253Ft	165,946Ft	108,700Ft	129,509Ft	144,050Ft
8. Estimated license premium [(7/6) -1] * 100	23.4	12.3	8.8	7.1	19.2

Notes:

a/ World Prices: Butter, Milk (whole) Powder, and Cheese (hard cheese): The 1990 world price is taken as the average price fob in North-European ports and selected world ports, including New Zealand. Butter is 82 percent butter and requires refrigeration in transportation. Chicken: Average 1990 price for frozen whole carcass chicken broiler, weighing 900-1200 grams (giblet included) delivered to Mideast port in refrigerated container. Pork: Average 1990 price for extra EC exports of fresh or chilled swine carcasses and half carcasses, HTS #02031110 of Eurostat.

b/ Transportation Costs: Transportation costs vary depending on the city of origin and method of transportation; in all cases the low cost source was selected. Butter is from Rotterdam by refrigerated truck, which is cheaper than refrigerated rail; milk powder is from Amsterdam by truck; cheese is from the Parisien Basin by refrigerated truck; chicken is from the north Yugoslavian port of Koper by refrigerated rail; pork is from Rotterdam by refrigerated truck.

c/ The six percent levies are decomposed into two percent customs clearance fee; three percent statistical fee; and one percent licensing fee for licensed products.

d/ The exchange rate used was the average exchange rate for 1990: 63.02 Forint = $1.

e/ Domestic Prices: The domestic price of cheese, butter and milk powder is the average producers' price for the year.

Sources: World Prices: butter, milk powder and cheese: United States Department of Agriculture, Foreign Agricultural Service; chicken: National Broiler Council, Washington, D.C. and Goldkist, Atlanta, Georgia; pork: data of the Statistical Office of the European Community. Transportation costs: estimates were provided by the Hungarian General Forwarding Enterprise (Magyar Általános Szállítmányozási Vállalat - MASPED). Tariff rates: MFN rates are from Kereskedelmi Vámtarifa, 1988-89 (Commercial Tariff Rates 1988-89 published by the Chamber of Commerce of Hungary). These rates were valid in 1990. Exchange rate: GATT (1991). Domestic prices: butter, milk powder and cheese: sales statistics of the Central Statistical Office; Chicken: poultry slaughtering and processing factory in Budapest; Pork: meat slaughtering and processing factory in Székesfehérvár.

Table 3: Effects of removing export subsidies and import licenses in agricultural sectors
(Based on 1990 data, in percent change in variable)

Product & policy a/	Welfare (% of GDP)			Sector ouput (% of initial output)			Government revenue (% of initial gov't. revenue)			Real exchange rate b/		
	H	C	L	H	C	L	H	C	L	H	C	L
Butter, remove: c/												
Export subsidy	.003	.002	.001	-15.02	-14.39	-12.30	.026	.027	.027	-.035	-.040	-.037
	(13.0)	(11.6)	(13.8)									
Import licenses	.007	.001	.0003	-6.44	-1.82	-0.68	.011	.002	.0005	-.019	-.006	-.003
Both	.005	.002	.001	-16.92	-14.87	-12.81	.030	.028	.027	-.041	-.042	-.038
Cheese, remove:												
Export subsidy	.012	.007	.004	-26.45	-22.18	-19.22	.087	.089	.090	-.051	-.059	-.062
	(4.7)	(3.7)	(3.2)									
Import licenses	.004	.001	.0004	-3.47	-1.37	-0.76	.007	.002	.0008	-.015	-.008	-.005
Both	.013	.007	.004	-27.20	-22.45	-19.38	.088	.089	.090	-.054	-.060	-.063
Chicken, remove:												
Export subsidy	.028	.015	.008	-46.81	-36.87	-30.91	.272	.276	.279	-.128	-.135	-.138
	(0)	(0)	(0)									
Import licenses	.001	.0004	.0001	-0.86	-0.40	-0.25	.002	.0008	.0005	-.013	-.009	-.007
Both	.028	.015	.008	-46.81	-36.87	-30.91	.272	.276	.279	-.128	-.135	-.138
Milk powder, remove:												
Export subsidy	.005	.003	.001	-26.36	-21.56	-18.09	.031	.032	.032	-.016	-.019	-.021
	(2.0)	(1.2)	(0.7)									
Import licenses	.001	.0004	.0002	-3.06	-1.55	-1.00	.002	.0007	.0004	-.004	-.003	-.003
Both	.005	.003	.001	-26.99	-21.77	-18.18	.031	.032	.032	-.017	-.019	-.021
Pork, remove:												
Export subsidy	.017	.009	.005	-14.26	-11.69	-10.23	.287	.296	.301	-.244	-.259	-.266
	(13.0)	(12.7)	(12.5)									
Import licenses	.046	.017	.006	-6.09	-3.43	-1.85	.061	.025	.010	-.199	-.143	-.090
Both	.045	.020	.008	-17.69	-13.54	-11.30	.333	.315	.309	-.348	-.332	-.316

Notes:

a/ The benchmark export subsidy and license premium for each product and the rest of the economy is taken from table 1.

b/ A negative sign indicates a depreciation of the real exchange rate.

c/ Value in parentheses equals the endogenously determined import license premium (in percent) in the new equilibrium.

Table 4: Effects of removing licenses and export subsidies and implementing a cap system in aggregate agriculture sector

	Welfare (% of GDP)			Sector ouput (% of initial output)			Government revenue (% of initial gov't. revenue)			Real exchange rate c/		
	H	C	L a/	H	C	L	H	C	L	H	C	L
Policy change c/												
Remove export subsidies b/	.144 (7.2)	.074 (6.9)	.037 (6.8)	-26.1	-18.7	-14.5	2.07	2.15	2.19	-1.96	-2.06	-2.10
Remove import licenses	.107	.051	.025	-3.7	-2.4	-1.7	-0.04	-0.01	0.004	-0.80	-0.74	-0.71
Remove both	.225	.112	.055	-28.2	-19.9	-15.3	2.19	2.21	2.23	-2.30	-2.35	-2.38
CAP System												
Increase prices by:												
5%	-.253 (25.0; 21.5)d/	-.124 (25.1; 21.5)d/	-.061 (25.1; 21.6)d/	15.5	10.1	7.5	-1.68	-1.39	-1.24	1.05	1.04	1.03
10%	-.624 (33.4; 26.5)d/	-.301 (33.6; 26.5)d/	-.148 (33.7; 26.5)d/	32.2	20.7	15.2	-3.77	-2.96	-2.58	2.11	2.07	2.05
20%	-1.717 (50.3; 36.6)d/	-.802 (50.8; 36.6)d/	-.387 (51.2; 36.6)d/	69.2	43.0	31.1	-9.15	-6.63	-5.48	4.31	4.15	4.07

Notes:

a/ H, C and L are the estimates for high, central and low elasticity scenarios, respectively.

b/ Initial export subsidies and license premium in effect in all scenarios are taken from data in table 1. Value in parentheses equals the endogenously determined import license premium (in percent) in the new equilibrium.

c/ A negative sign indicates a depreciation in the real exchange rate.

d/ Values in parentheses equal the endogenously determined export subsidy and import license premium (in percent), respectively, in the new equilibrium.

Source: Model estimates.

Figure 1 Consumption and Production Structures

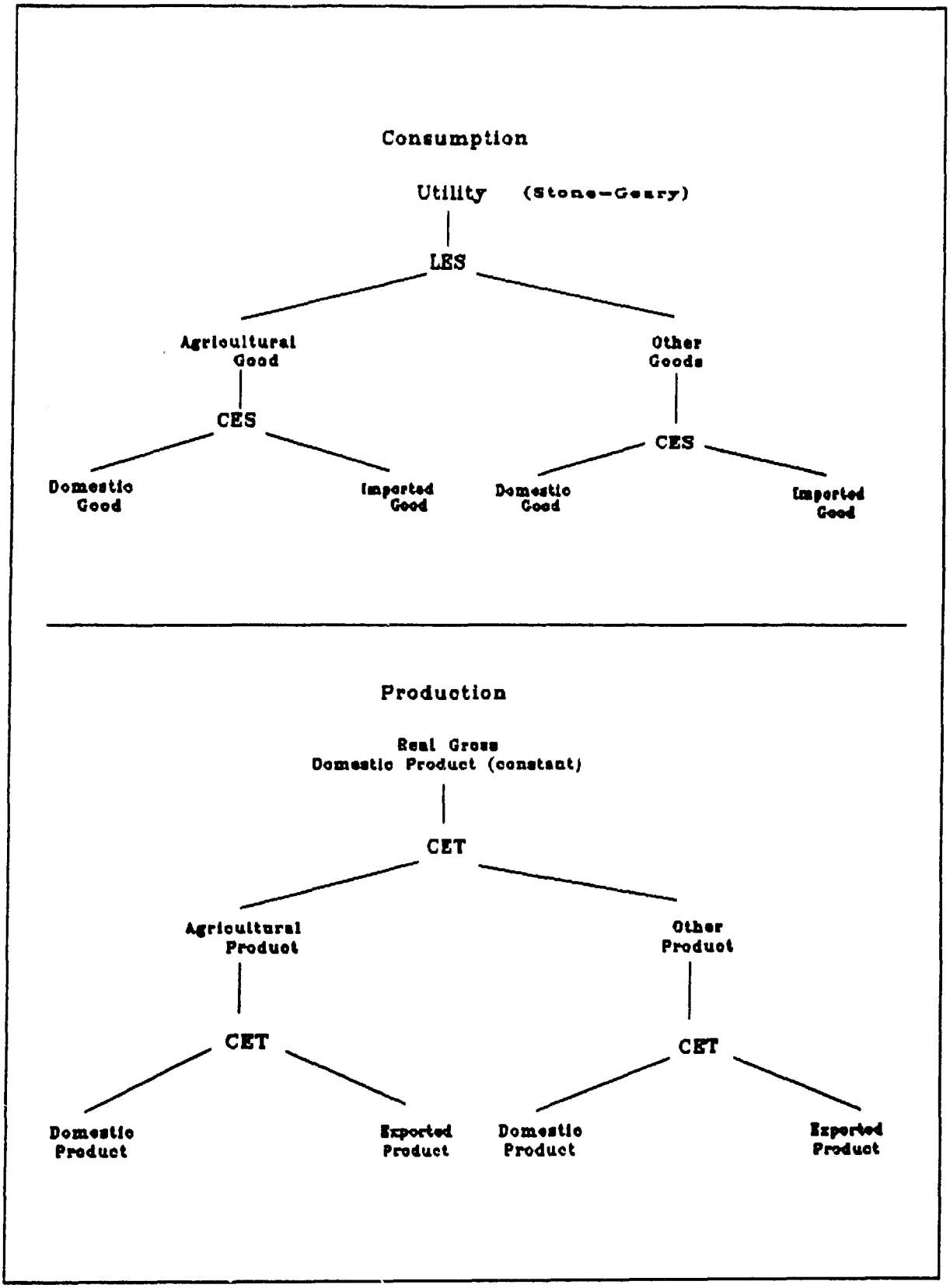


FIGURE 2 Benefits of piecemeal removal of an import quota are reduced by increased export subsidies

Removal of the import quota lowers the tariff exclusive price of imports to PM_1, which induces a downward shift in the demand for the domestic variety (to D_1) and lowers its price (to PD_1); due to the lower price of the domestic variety, producers then shift supply to the export market (E_1). The subsidy provided by the government increases by the size of the rectangle in the export market. Net Benefits: The triangle of benefits in the market for imports minus the rectangle of increased subsidies in the export market.

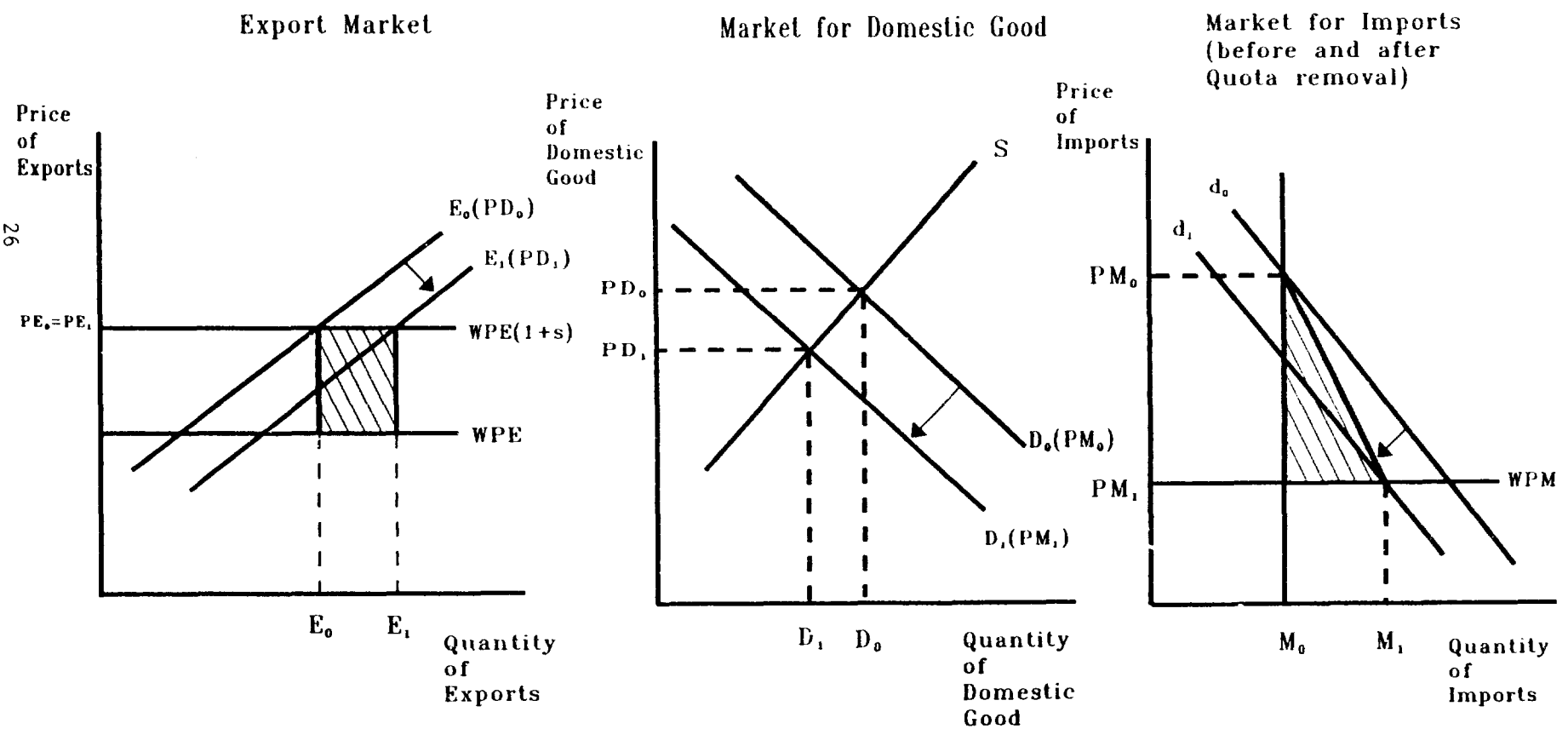


FIGURE 3 Benefits of piecemeal removal of an export subsidy

Removal of the export subsidy causes the export price of producers to fall to the world price ($PE_1 = WPE$). The export price reduction induces producers to increase supply to the domestic market. The lower price of domestic goods induces a downward shift in the demand for imports and a lower import price, which induces a downward shift in the demand for domestic goods and lower domestic price and an increase in the supply of exports. The latter effect reduces the benefits of export subsidy reduction to the shaded triangle in the export market.

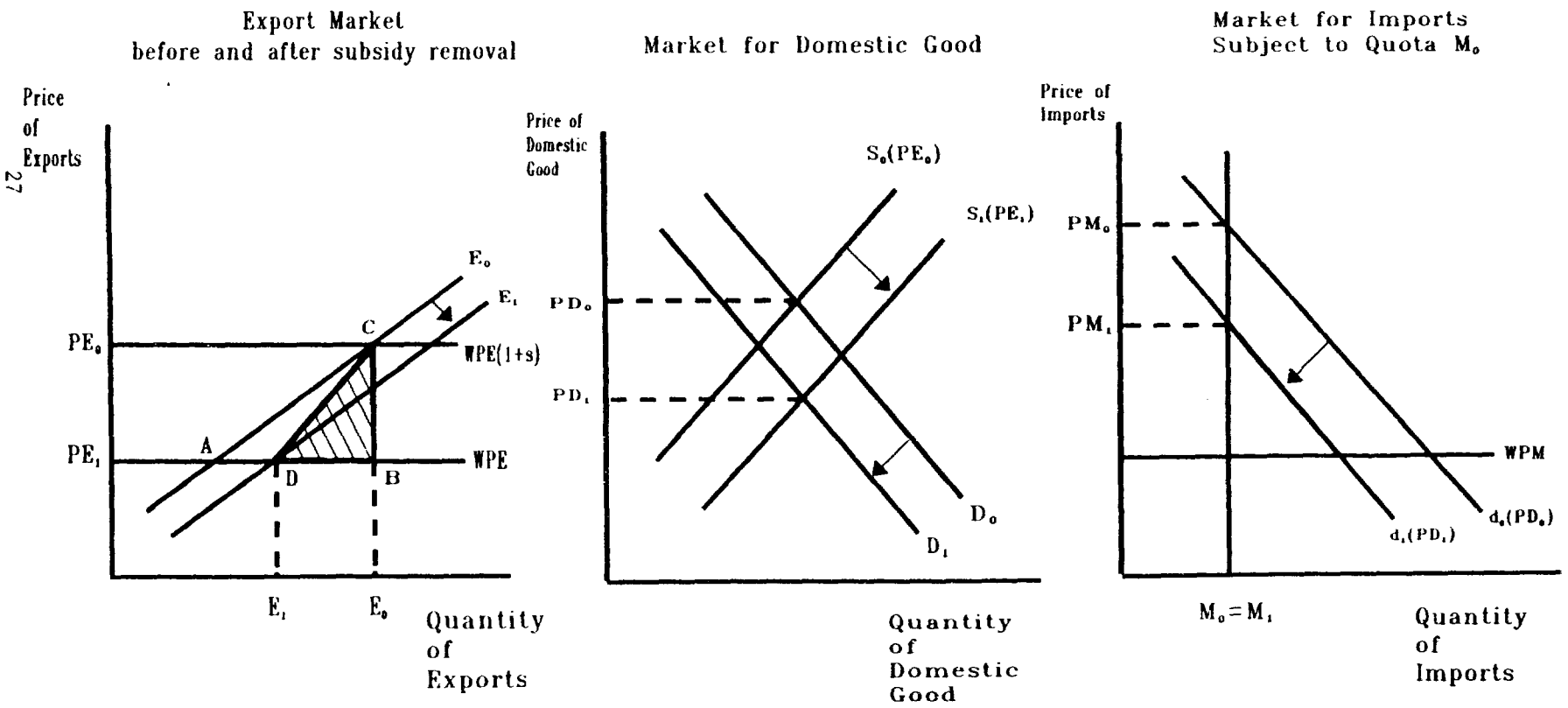
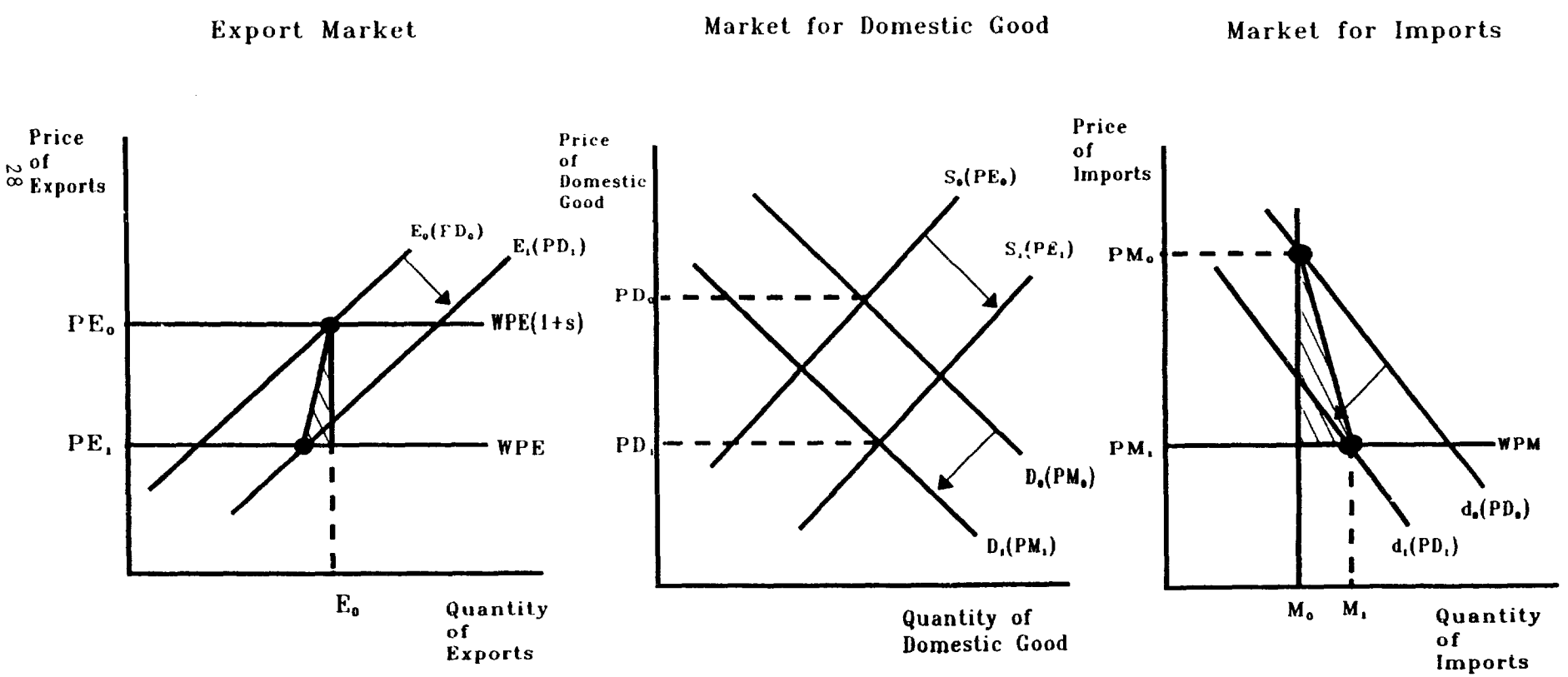


FIGURE 4 Benefits of simultaneous remvoal of an export subsidy and an import quota

Removal of the export subsidy causes the export price to fall to the world price (PE_1=WPE) and removal of the import quota causes the tariff exclusive import price to fall to PM_1=WPM. Producers increase their supply to the domestic market and consumers decrease their demand for the domestic product, resulting in a lower domestic price PD_1. This results in an increase in supply to the export market and a decrease in import demand, reducing the triangles of benefits in these markets. Net Benefits: The sum of the two triangles in the export and import markets.



APPENDIX TO:

REFORMING HUNGARIAN AGRICULTURAL TRADE POLICY: A QUANTITATIVE EVALUATION

Morris E. Morkre and David G. Tarr

Contents of Appendix

APPENDIX

This appendix briefly describes the model equations, variables and parameters, and elasticities and lists them in in tables A.1, A.2, and A.3, respectively. In table A.4, we present the results of our comparison of the extent of non-tariff barriers to trade in agriculture in OECD countries.

I. Description of Model Equations

Table A.1 lists the equations of the model. There are 32 equations arranged into six groups. Table A.2 lists the variable and parameter names. Table A.3 specifies the elasticity values.

Demand Equations

Equations (2) through (5) represent domestic demand conditions. Equation (1) is a Stone-Geary utility function in composite goods, TCD_i, with parameters λ_i and β_i. The parameters λ_i are minimal or subsistence expenditures. Thus $(TCD_i-\lambda_i)>0$. The parameters β_i ($\beta_i>0$ and $\Sigma\beta_i=1$) are related to the own price elasticities of demand. Equation (1) is important in the model only insofar as it forms the basis of the system of demand equations (2) through (6), and for the purpose of calculating the Hicksian equivalent variation. It is not used for the purpose of calculating the equilibrium.

In the first stage, the consumer determines the budgets for the composite consumption goods by maximizing utility subject to the aggregate national income constraint and using appropriately defined average prices for the composite goods.[1] This yields equation (2).

In the second stage, the consumer determines the amounts to consume of the domestic and imported goods (CD_i and CM_i respectively) that comprise the composite consumption good. This problem can be characterized as solving for the CD_i and CM_i that maximize composite consumption given prices of the domestic and imported goods, PD_i and PM_i respectively, and given the budget for the composite good from stage one. This gives equations (4) and (5).

Finally, for consistency between the two stages, the prices for composite goods, $PTCD_i$, in equation (3), are the dual prices obtained from the optimization problem that gives equations (4) and (5).

Supply Equations

Equations (6) through (11) represent domestic supply conditions. In equation (6), real aggregate output of the economy, XT, is a CET function of composite domestic products XD_i. The parameter ρtd ($\rho td>1$) is related to the elasticity of transformation, σtd, where $\rho td=1-(1/\sigma td)$. A graph of equation (6) would show the familiar "bowed-out" production possibility curve for the economy.

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[1] As is well known, it is sufficient for two stage budgeting that the utility function of the representative consumer be weakly separable and that subutility be homothetic. Our specifications satisfy these restrictions.

Domestic producers allocate resources between sectors so as to maximize the sum of the values of the composite products subject to a fixed level of XT in equation (6). The solution to this optimization problem gives equation (7). The optimal ratio of composite agricultural product to composite domestic product for the rest of the economy, (XD_A/XD_R), is directly related to the ratio of prices of the composite products, (PX_A/PX_R). Equations (6) and (7) together give the optimal levels of XD_A and XD_R. Equation (8) gives the price of XT, PXT, which is the dual price of the unit revenue function when composite products are sold optimally.

Each composite domestic product, XD_i, is a CET function of the quantity supplied to the domestic market and to foreign markets (exports), where E_i and S_i are export market and domestic market products respectively. The parameters ρt_i ($\rho t_i > 1$) are related to the elasticities of transformation, σt_i, where $\rho t_i = (1-1/\sigma t_i)$. Domestic producers find optimal domestic and export supply by maximizing the revenue subject to a given quantity of composite product. This gives equations (9) to (11). The prices of composite domestic products, PX_i, are dual prices obtained from the maximization of revenue subject to composite output.

Domestic Prices of Traded Goods

Equations (12) and (13) express the relationships between domestic prices and world prices of traded goods. The equations all have an exchange rate, ER, that converts world prices to domestic prices. Given our choice of numeraire (see below), the proportional change in ER equals the proportional change in the real exchange rate. Domestic prices of exported products, PE_i, are based on world prices, PWE_i, and increased by the factor $(1+TE_i)$ when there are export subsidies. The export subsidy rate is $100*TE_i$ percent. Domestic prices of imported products, PM_i, are based on world prices, PWM_i, and increased by the factor $(1+TM_i)$ when there are tariffs on imports. The import tariff rate is $100*TM_i$ percent. If there are effective quantitative restraints on imports due to import licensing, then the domestic price of imports is higher than the price that would result if the only restriction on imports were a tariff. The additional effect on prices due to licensing is indicated by the factor $(1+PRC0_i)$. The tariff equivalent rate for import licensing is $100*PRC0_i$ percent.

Equilibrium for Domestic Goods

It is assumed that equilibrium in the markets for domestic goods can be characterized by setting demand equal to supply. This gives equation (14).

Tariffs, Subsidies, Government Revenue, Import Premiums

Equation (15) is the revenue collected by the government from tariffs on imports and equation (16) is the government outlay for subsidies on exports. The net effect on the government budget of tariff revenues and export subsidies is indicated by equation (17). All other government revenues and outlays are outside the scope of the model and assumed to be constant lump sum collections and disbursements.

Effective quantitative restraints due to import licensing create a scarcity value or premium for import licenses. The total value of import premiums for each imported product is given by equation (18).

Trade Balance, National Income and Expenditure, Numeraire

Equation (19) states that the country's balance of payments on trade account with the rest of the world, in world prices, is constant. This equation embodies the assumption that the country faces a budget constraint with the rest of the world and cannot, by changing its own trade policies, influence its preexisting trade balance.

Equation (20) gives the relationship between national income and expenditure. It is readily shown that consumers spend all their income on the two composite goods. The sum of TCD_i, equation (2), which is total expenditure on composite goods, equals GDP. The TCD_i are CES functions of CD_i and CM_i, and CES functions are linear homogeneous. Therefore the sum of consumer expenditures on CD_i and CM_i also equals GDP. This demonstrates that Walras Law holds.

The terms on the rhs of equation (20) are total income of the economy, and explained as follows. The first term on the rhs of (20) is payments by domestic producers to factors of production (e.g., suppliers of labor and capital). This follows from the fact that the CET function in equation (6) is linear homogeneous plus the assumption that payments to productive factors exhaust total receipts by producers in each sector. The other terms on the rhs relate to trade policies and the balance of payments. (These terms would be zero absent tariffs, export subsidies, import licensing, and a deficit or surplus in the current account.) The second term adds tariff revenue less export subsidies; the third term adds total import licensing premiums; the fourth term is the adjustment to the economy's income from the trade balance.

Finally, the price variables must be normalized in some manner. CGE models typically do not have money so that absolute price levels have no meaning: only relative prices matter. In this model prices are normalized by equation (21). As explained by Tarr (1989), this normalization procedure has the advantage that the percent change in the nominal exchange rate equals the percent change in the real exchange rate (i.e., percent change in the relative price of traded goods to nontraded (domestic) goods.

II. Model Variables and Parameters

Table A.2 lists all the variables and parameters in the model. There are 31 endogenous variables and equations (recall equation (1) is not employed in the model). Due to Walras' Law, however, one of the equations is redundant, which allows us to drop an equation or add a variable. The model has seven exogenous variables. The values of these variables are fixed at 1990 levels. Most notably, the exogenous variables include the real aggregate output of the economy, XT, and the trade balance, TRB.

The major policy parameters are: the ad valorem export subsidy rate for an agricultural product, TE_A, the ad valorem import tariff rate for an agricultural product, TM_A, and the ad valorem premium rate attributable to import licensing for an agricultural product, $PRMC0_A$. The values of the policy parameters for 1990 are given in the text, in table 1. The derivation of the licensing premia is explained in table 2 of the text.

Finally, the model has 12 parameters that are obtained when the model is benchmarked to our 1990 data set. For a discussion and illustration of benchmarking and the calibration of parameters in a CGE model, see de Melo and Tarr (1992).

Data for Elasticity Parameters

The model has four types of elasticity parameters specified in table A.3. In any simulation, seven elasiticity values must be specified: three in the agriculture sector, three in the rest of the economy and one shared elasticity of transformation between the agriculture sector and the rest of the economy.

Data for Production, Exports, and Imports

These data were obtained from official Hungarian sources with the assistance of Ms. Agnes Nagy, Kopint-Datorg, Budapest. In some instances, it was necessary to form estimates based on consultation with experts in Hungary.

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Table A.1
Model Equations

Welfare Indicator and Demand Equations
Stone-Geary utility function

$$UTILITY = \prod_{i \in s} (TCD_i - \lambda_i)^{\beta_i} \quad (1)$$

Demand for composite goods

$$PTCD_i * TCD_i = PTCD_i * \lambda_i + \beta_i * (GDP - \sum_{j \in s} \lambda_j * PTCD_j) \quad (2)$$

Price (dual) of composite goods

$$PTCD_i = \overline{ACC}_i^{-1} * [\delta c_i^{1/(1-\rho c_i)} * PM_i^{\rho c_i/(1-\rho c_i)} + (1-\delta c_i)^{1/(1-\rho c_i)} * PD_i^{\rho c_i/(\rho c_i - 1)}]^{(\rho c_i - 1)/\rho c_i} \quad (3)$$

Demand for domestic goods

$$CD_i = \overline{ACC}_i^{-\rho c_i/(\rho c_i - 1)} * (1-\delta c_i)^{-1/(\rho c_i - 1)} * (PD_i/PTCD_i)^{1/(\rho c_i - 1)} * TCD_i \quad (4)$$

Demand for imported goods

$$CM_i = \overline{ACC}_i^{-\rho c_i/(\rho c_i - 1)} * \delta c_i^{-1/(\rho c_i - 1)} * (PM_i/PTCD_i)^{1/(\rho c_i - 1)} * TCD_i \quad (5)$$

Supply Equations

Real aggregate output of economy

$$\overline{XT} = \overline{ATD} * [\gamma d * XD_A^{\rho td} + (1-\gamma d) * XD_R^{\rho td}]^{1/\rho td} \quad (6)$$

Supply of composite domestic products

$$XD_A/XD_R = [\gamma d/(1-\gamma d)]^{-1/(\rho td - 1)} * (PX_A/PX_R)^{1/(\rho td - 1)} \quad (7)$$

Price of aggregate output of economy

$$PXT = \overline{ATD}^{-1} * [\gamma d^{1/(1-\rho td)} * PX_A^{\rho td/(\rho td - 1)} + (1-\gamma d)^{1/(1-\rho td)} * PX_R^{\rho td/(\rho td - 1)}]^{(\rho td - 1)/\rho td} \quad (8)$$

Supply of domestic products

$$S_i = \overline{AT}_i^{-\rho t_i/(\rho t_i - 1)} * (1-\gamma_i)^{-1/(\rho t_i - 1)} * (PD_i/PX_i)^{1/(\rho t_i - 1)} * XD_i \quad (9)$$

Supply of export products

$$E_i = \overline{AT}_i^{-\rho t_i/(\rho t_i - 1)} * \gamma_i^{-1/(\rho t_i - 1)} * (PE_i/PX_i)^{1/(\rho t_i - 1)} * XD_i \quad (10)$$

Price of composite domestic products

$$PX_i = \overline{AT}_i^{-1} * [\gamma_i^{1/(1-\rho t_i)} * PE_i^{\rho t_i/(\rho t_i - 1)} + (1-\gamma_i)^{1/(1-\rho t_i)} * PD_i^{\rho t_i/(\rho t_i - 1)}]^{(\rho t_i - 1)/\rho t_i} \quad (11)$$

Domestic Prices of Traded Goods

Domestic price of export products

$$PE_i = \overline{PWE}_i * (1 + TE_i) * ER \quad (12)$$

Domestic price of import products

$$PM_i = \overline{PWM}_i * (1 + TM_i) * (1 + PRC0_i) * ER \quad (13)$$

Equilibrium for Domestic Goods

Demand equals supply for domestic goods

$$CD_i = S_i \quad (14)$$

Tariffs, Subsidies, Government Revenue, Import Premiums

Tariff Revenue

$$TARIFF = \sum_{i \in s} TM_i * CM_i * \overline{PWM}_i * ER \quad (15)$$

Export Subsidies

$$SUBSIDY = \sum_{i \in s} TE_i * E_i * \overline{PWE}_i * ER \quad (16)$$

Government Revenue

$$GOVR = TARIFF - SUBSIDY \quad (17)$$

Import Licensing Premiums

$$PRMC_i = PRC0_i * \overline{PWM}_i * (1 + TM_i) * CM_i * ER \quad (18)$$

Trade Balance, National Income and Expenditure, Numeraire

Trade Balance

$$\overline{TRB} = \sum_{i \in s} (\overline{PWE}_i * E_i - \overline{PWM}_i * CM_i) \quad (19)$$

National Income and Expenditure

$$GDP = PXT * \overline{XT} + GOVR + \sum_{i \in s} PRMC_i - \overline{TRB} * ER \quad (20)$$

Numeraire

$$\overline{PNORM} = \sum_{i \in s} (PD_i * \overline{XD0}_i / \sum_{i \in s} \overline{PD0}_i * \overline{XD0}_i) \quad (21)$$

NOTE: s = {A(griculture sector), R(est of Economy)} i,j = A,R. Total equations in model: 32.

Table A.2

Model Variables and Parameters

Endogenous Variables

Consumption

UTILITY	utility
TCD_i	total consumption of composite goods
CD_i	consumption of domestic products
CM_i	consumption of imported products

Production

XD_i	outputs of composite domestic products
S_i	outputs of products for domestic market
E_i	outputs of products for export markets

Prices

PXT	price of aggregate output of economy
$PTCD_i$	prices of composite consumption goods
PX_i	prices of composite domestic products
PD_i	prices of domestic products
PM_i	prices of imported products
PE_i	prices of exported products
ER	'nominal' exchange rate

Other variables

TARIFF	total tariff revenue
SUBSIDY	total export subsidies
GOVR	net government revenue from tariffs and subsidies
$PRMC_i$	premia from imports due to import licensing
GDP	gross domestic product

Total endogenous variables: 31

Exogenous Variables

XT	real aggregate output of economy
PWE_i	world prices of exported products
PWM_i	world prices of imported products
TRB	balance of payments (trade balance)
PNORM	average domestic price

Policy Parameters

TE_A	export subsidy rates (ad valorem)
TM_A	import tariff rates (ad valorem)
$PRMC0_A$	premium rates on imports (ad valorem)

Elasticity Parameters

β_i	from own price elasticities of demand
ρc_i	from elasticities of substitution in consumption
ρtd	from elasticity of transformation between composite domestic products
ρt_i	from elasticities of transformation between domestic product and export product

Parameters from Calibration

λ_i	subsistence consumptions in LES functions
ACC_i	constant terms in CES functions for composite goods
δc_i	share terms in CES functions for composite goods
ATD	constant term in CET function for real aggregate output of economy
γd	share term in CET function for real aggregate output of economy
AT_i	constant terms in CET functions for composite domestic products
γ_i	share terms in CET functions for composite domestic products

Table A.3. Central elasticities used in CGE model

Product or sector	*Demand*	*Elasticity of transformation*		*Elasticity of Substitution*
		Gross output	*Exports vs Domestic*	*Imports vs. Domestic*
		(σtd)	*(σti)*	*(σci)*
Beef	-0.4 [a]	0.3 [b]	2.0 [c]	15 [c]
Butter	-0.15 [b]	0.25 [b]	2.0 [c]	15 [c]
Cheese	-0.5 [a]	0.65 [b]	2.0 [c]	15 [c]
Chicken	-0.5 [a]	0.70 [b]	2.0 [c]	15 [c]
Corn	-0.2 [a]	1.0 [b]	4.0 [c]	15 [c]
Milk powder	-0.4 [b]	0.9 [a]	2.0 [c]	15 [c]
Pork	-0.4 [a]	0.45 [b]	2.0 [c]	15 [c]
Sugar	-0.3 [b]	0.6 [a]	2.0 [c]	15 [c]
Sunflower	-0.3 [b]	1.8 [a]	4.0 [c]	15 [c]
Agriculture	-0.29 [e]	1.0 [e]	4.6 [e]	4 [c]
Rest of economy	(1)	NA	2.9 [d]	3 [e]

Notes: NA = not applicable
(1) the own demand elasticity was found using the LES system

Sources: Interpolated based on:
[a] Borszeki, Meszaros, and Varga, p. 82.
[b] Gardiner, Roningen, and Liu (1989), p. 45.
[c] See text for explanation
[d] Harrison, Rutherford, and Tarr (1993)
[e] Morkre (1990), p. 18-22

Table A.4: Agricultural Products Requiring Import Licenses in Certain OECD Countries: Status as of End of Year 1990

Country	Dairy	Meat	Cereals	Sugar	Other Products	Other Issues
Australia	No import licensing	No import licensing	Import permits required for wheat, rye, oats, maize, sorghum, millet	Import embargo removed and replaced by specific rate tariff from 1 July 1989		
Austria	Discretionary licensing applies to imports of dairy products of cow's milk and to certain cheeses from EC	Imports of poultry, live sheep and goats, and their meats are liberalized. Other meats have quota	Discretionary licensing applies to virtually all cereals and meals (except e.g., rice)	Import permits required		
Canada	Import permits used in administration of quotas on cheese and dry buttermilk. Import permits also used for other dairy products that do not have an explicit quota	Import licenses on chickens, turkeys, and chicken eggs in administration of import quotas. Note, global quota on beef and veal does not appear to be binding in most years	Import permits required for wheat and wheat products, and for barley and barley products	No import licensing		
European Community (EC-10)	Import license and security deposit required to import milk or milk products. A variable levy is applied to all dairy imports (except products for which the EC has concluded special agreements or arrangements). The variable levy is based on the difference between the threshold price (i.e., the price at which a product originating in a non-member country may enter the Community market -- delivered-free-to wholesaler stage) and the free-at-frontier price (i.e., the most favorable buying price on the world market)	No licenses required. Imports are subject to a variable levy mechanism. However, most imports of beef and veal, and mutton, are subject to quotas or VERs and are exempt from certain aspects of variable levy mechanism	Import licenses required. Licenses are issued to anyone upon application but require lodging of security, which is retained if the applicant does not carry out the import transaction within the stipulated period. Imports are subject to a variable levy mechanism	Import license required. Imports are subject to a variable levy mechanism	Import security deposit required for oilseeds; import certificate required for fruit and vegetables; import license required for wine	

Country	Dairy	Meat	Cereals	Sugar	Other Products	Other Issues
Japan	Mixed. No import licenses or import quotas for processed cheese (abolished in 1989 and replaced by higher tariffs -- went up from 35 to 60 percent in 1989, 50 percent in 1990, 40 percent from 1991) and on frozen yogurt, whipped cream, and ice cream (liberalized between 1988 and 1990). Licenses and import quotas remain on four designated dairy products: butter, skim milk powder, sweetened condensed whole milk, and sweetened condensed skim milk. For designated dairy products, Livestock Industry Promotion Corp. (LIPC), which is a Government agency, has been granted the exclusive right to import	No import license required. Beef quota increased in 1989/90 and replaced by ad valorem tariff in April 1991. The tariff rate will go from 25 percent to 70 percent in 1991, to 60 percent in 1992, and to 50 percent beginning 1993	Import licensing and import quotas for food grains: rice, wheat, and barley. No licensing or quotas for sorghum or corn for feed. Tariff quota applies to corn used for industrial purposes	No import license required. Sugar imports subject to a specific tariff, variable levy, and a surcharge		
New Zealand	Import license not required	Imports of most meat and meat products have been free from import licensing since mid-1980s. However, imports of eggs and poultry are prohibited	No restrictions on imports; licenses granted on demand. However, import licensing on wheat and flour abolished from 1 January 1990	No import licenses required. Controls on importations and pricing of sugar removed from 31 August 1986	Wine imports are subject to import licensing as part of domestic industry plan. Principal mechanism for issuing licensing is tendering. Import licenses are freely transferable between importers	By end of 1989, imports of all products covered by food industry plans (canned fruit, starches, and margarine) had been freed from license controls
United States	Import licensing used to administer quotas on dairy products. Most dairy products subject to import quotas	No import licensing. However, for certain years fresh and frozen beef, veal, mutton, and goatmeat are subject to VRAs (Voluntary Restraint Agreements) under the Meat Import Act. Pork and lamb not subject to VRAs	No import licensing	No import licensing. In October 1990 global import quota replaced by tariff quota. Within quota imports allocated by country and subject to low tariff. Imports beyond the quota open to all sources but subject to very high duty (16 cents per pound)		

Sources: (1) OECD (1990), Agricultural Policies, Markets, and Trade: Monitoring and Outlook, 1990.
(2) OECD (1987), National Policies and Agricultural Trade. (3) Consultation with officials at USDA, ERS.

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