EFFECTS OF THE COMPLETION OF MERCOSUR ON THE URUGUAYAN LABOR MARKET

A simulation exercise using a CGE model

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ABSTRACT

The Mercosur was born as an imperfect Customs Union. During the transition phase to a complete Customs Union -starting in 1995-, each country established some exceptions to trade liberalization within the region and to the external common tariff. This paper deals with the possible effects on the Uruguayan labor market of the elimination of those exceptions. With that purpose, the changes in tariffs during the transition are simulated with a Computable General Equilibrium model.

The model is specified for the Uruguayan economy but three other regions are considered: Argentina, Brazil and the rest of the world. There are nine sectors in the model, six of which are assumed to work under imperfect competition while the rest are perfectly competitive. In the sectors with imperfect competition a Bertrand type behavior is assumed. The labor market is segmented in skilled and unskilled labor and wages are flexible.

The results show that the overall effects on the main variables and on the labor market are not important. The most significant changes are found in trade flows. However, at the sectoral level relevant changes are found in consumption, output, trade and factor allocation in those sectors that are most affected by the intra-zone liberalization or by the complete enforcement of the Common External Tariff.

RESUMEN

El Mercosur se establece como una unión aduanera imperfecta. En 1995 comenzó un período de transición en que se mantienen excepciones al libre comercio intrazona y al arancel externo común. El documento discute los posibles efectos sobre el mercado de trabajo de Uruguay de la eliminación de dichas excepciones. Con ese fin se especifica un modelo de equilibrio general computable y se simulan las variaciones de los aranceles que habrán de tener lugar en el período.

El modelo se especifica para Uruguay pero se consideran otras dos regiones: el Mercosur y el resto del mundo. Es un modelo multisectorial con sectores en competencia perfecta y en competencia imperfecta. Se consideran bienes diferenciados usando una especificación de tipo Armington. En los sectores en competencia imperfecta se supone formación de precios de tipo Bertrand.

Se distingue entre mano de obra calificada y no calificada y se hacen simulaciones bajo distintas hipótesis respecto al funcionamiento del mercado de trabajo.

Los resultados que los efectos globales sobre las principales variables y sobre el mercado de trabajo no son relevantes. Sin embargo, a nivel sectorial se detectan importantes cambios en la producción, el comercio y el mercado de factores.

TABLE OF CONTENTS

1. INTRODUCTION

Mercosur started in 1991 when the Asunción Treaty was signed between Argentina, Brazil, Paraguay and Uruguay with the purpose of building a common market. During the first years, progress was made towards total liberalization of intra-zone trade. In 1995 a Common External Tariff (CET) was enforced, leading to the existence of an "imperfect" customs union among the four countries. The imperfections are due to the existence of exceptions to free trade inside the zone and also to the complete enforcement of the CET.

This first stage of Mercosur caused a significant adjustment in the Uruguayan economy. The share of manufacturing industry in total GDP and in total employment went down while important changes occurred in the composition of production and employment within the manufacturing sector.

Starting in 1995 further progress was made in the gradual elimination of both types of exceptions through the establishment of several special regimes. The goods affected by these special regimes belonged to the most sensitive sectors in each country, whose adjustment to the Mercosur rules presented the greatest difficulties. In those cases, the solution was to establish longer schedules for the achievement of total intra-zone liberalization and for the convergence to the CET.

Two aspects raise the greatest concern for the future of the Uruguayan economy. On the one hand, the tariff reduction for the most sensitive goods may have an important effect on domestic production. On the other hand, the rise in external tariffs (applicable to third countries) of capital goods, telecommunications and computer-related goods (which had very low tariffs in Uruguay) may endanger the technological updating of all activities in the country.

According to theory, the welfare effect of a discriminatory elimination of tariff barriers is ambiguous, depending on the prevailing market structures. In perfect competition, the net welfare effect depends on the extent of trade creation or trade diversion generated by the discriminatory policies. Under imperfect competition, other factors are added: economies of scale, degree of competition and consumption variety.

Computable General Equilibrium (CGE) models have been widely used to study the effects of either unilateral or negotiated trade policies. Particularly, they have been used to study different aspects concerning the European Union[1] and, more recently, the creation of the NAFTA.[2] The Mercosur also gave origin to several studies with multicountry models,

[1] Among other, see Spencer (1986), Smith and Venables (1988), Mercenier (1992), etc.

[2] Among others, see Hinojosa-Ojeda and Robinson (1991), Brown et al. (1992) and all the studies in Francois and Shiells (1994).

which in general included only the big countries (Argentina and Brazil).[3]

In this paper we analyze the impact on the Uruguayan labor market of the elimination of the special regimes in Mercosur, using a CGE model. Therefore, the model presented here is a different contribution to the analysis of Mercosur, as long as it poses the viewpoint of one of the smaller members of the agreement.

The model conceives the Uruguayan economy as a small economy with trade relations with three other countries or regions (Argentina, Brazil and the rest of the world) which are considered exogenous. Another particular feature of this model is the existence of non-competitive market structures in some sectors and the presence of scale economies.

These structural features are crucial for the realism of the model. In the Uruguayan case the size of the domestic market and the long tradition of high protection on domestic production led to a significant concentration of production and to the existence of non-competitive markets, particularly in the manufacturing sector. In order to compare the effects under different assumptions regarding market structure, two versions of the model were specified: perfect competition and Bertrand competition. This comparison facilitates the understanding of how the results may change if markets are more or less competitive.

The model is static so only the effects on resource allocation and on income distribution can be analyzed. On the contrary, it does not enable the study of the dynamic effects generated by the completion of the customs union.

It should be noticed that the tariffs that were used in the simulations were a simple average of those applicable to all items in the Harmonized System belonging to each sector. However, the Uruguayan production might be biased towards goods with the highest tariffs and, therefore, the actual tariff variations might be larger than those simulated in this paper. Therefore, the impact of the completion of the customs union might be underestimated, but *a priori* the sign of the effects should be those found in the simulation exercises.

In the next section of this paper there is a brief description of the convergence schedules of Mercosur to the Customs Union and the identification of the most affected sectors. In section 3, the main features of the model are described. Section 4 explains how the model was calibrated from the available data and the simulations carried out. Finally, the results and conclusions of the analysis are presented.

[3] Hinojosa-Ojeda et al (1997) use this methodology to analyze the relations between Mercosur and Nafta, taking into account only the two largest countries. The same criterion is adopted by Diao and Somwaru (1996) who analyze the relations between Mercosur and the United States and also by Behar (1991). Nin and Terra (1998) analyze the alternative of integration or unilateral opening. Mercenier and Cavalcante (1997) and Flores (1997) are exceptions, as their Mercosur models also include Uruguay.

2. THE COMPLETION OF MERCOSUR AND THE MAIN SECTORS AFFECTED[4]

As it was said before, Mercosur started in 1991 with the purpose of creating a common market among the four member countries. From 1991 to 1994 reciprocal trade was liberalized to a great extent as intra-zone tariffs were lowered to zero for a high percentage of the items in the Harmonized System. However, the four countries kept some goods away from that liberalization process, reducing tariffs more slowly or even leaving some of them unchanged in a number of cases. In December 1994, in Ouro Preto the institutional structure of Mercosur was finally defined and a whole set of rules was approved leading to the effective enforcement of a customs union (CU) with exceptions by January 1st, 1995.

In this second phase of Mercosur, the intra-zone tariff reductions carried out until that moment were consolidated and time schedules were established for the complete liberalization of those goods still protected by tariffs. At the same time the Common External Tariff (CET) was approved for trade with third countries and was enforced from January 1995, but maintaining special treatments for several categories of goods excepted from the immediate enforcement of the CET. Therefore, an "imperfect" CU was created, as many goods were excepted from the general principle of free reciprocal trade and from the CET.

In the case of intra-zone trade, each country made a list of the "sensitive" products which had not been liberalized as yet. Those four lists (one for each country) would follow a liberalization schedule laid down in the Adapting Regime to Mercosur ("Régimen de Adecuación al Mercosur"). This regime provided an additional time limit for the complete liberalization of intra-zone trade. This time horizon was scheduled to end by January 1999 in the case of Argentina and Brazil while the lists set up by Uruguay and Paraguay would complete the tariff reduction by January 2000. All goods in these lists would be subject to a linear and automatic tariff reduction starting from the prevailing tariffs by August 1994 minus an initial preference. The Uruguayan list contained 952 items of the "Nomenclatura Común del Mercosur" (NCM), compatible with the Harmonized System. The average tariff for all those items by August 1994 was 19,1%. The initial preference reduced that average to 17,9% in 1996 and then from January 1997 the tariffs were reduced by 25% each year until January 2000 when they would be completely eliminated. Besides, 356 of those items were simultaneously excepted from the CET, because otherwise the intra-zone tariff would be higher than the external tariff. In this case, a descending schedule was set up to reduce the average tariff for third countries from 23,7% to 14,8% by January 2000. By that time, the convergence to the CU for this set of products would be completed (see Table 1).

[4] This section is based on Laens and Terra (1998).

There are two types of *exceptions to the CET* of Mercosur: the properly called exceptions and the trade preferences established in bilateral trade agreements with other countries in the context of ALADI. The latter are renegotiated case by case and are not considered in this paper. The properly called exceptions (a total of 1910 items of the NCM in the Uruguayan case) are included in several lists that follow different schedules (see Table 1).

Table 1
Adapting Regime and exceptions to the CET (URUGUAY)
Tariff convergence schedules

	Adapting regime	Exceptions to the CET				
		Uruguayan list	Exceptions due to adapt. regime	Capital goods	Telecommuni-cations and computer goods	Total
Conver-gence date	1/1/2000	1/1/2001	1/1/2000	1/1/2006	1/1/2006	1/1/2006
Nº of items	952	304	356	905	345	1910
			Intra-zone tariff (*)			
1995	19,1					
1999	4,9					
CET	15,9	12,9	14,8	11,2	8,2	11,4
CET 1998-2000		16,0	17,8	11,2	8,2	12,3
			External tariff (*)			
1995		5,9	23,7	0,2	0,0	4,7
2000		10,6	17,8	4,9	4,5	7,5
2001		12,9	14,8	6,5	5,7	8,3
2006		12,9	14,8	11,0	10,1	11,3

Source: Based on data from MEF.
(*) Simple average

Apart from the case of the exceptions originated in the Adapting Regime, in all the other convergence schedules the tariffs move upwards (see Table 1). Therefore, for the whole set of exceptions the average tariff increases from 4.7% to 11.4%.

Finally, in addition to the special regimes already described there are two more groups of goods that do not receive the same treatment in all the Mercosur countries. These are 76 items belonging to the automotive sector and 4 items from the sugar sector. In these cases, there has been no agreement concerning a liberalization schedule for intra-zone trade neither the CET for trade with third countries has been set.

In order to classify the activity sectors according to the extent of their affectation by the special regimes described, every item in each list was assigned to the activity sector where they belong (four digits of the ISIC rev. 2). Most of the manufacturing sectors had one or more products affected by some of the special regimes, as it is shown in Table 2.

Table 2
Special regimes of Mercosur
Goods and sectors affected in Uruguay

Regime	No. of items	No. of sectors
Adapting Regime	952	60
Exceptions due to adapt. regime	358	37
Uruguayan exceptions list	304	33
Capital goods	905	19
Computer and telecommunications goods	346	8
Automotive and sugar sectors	80	3

Source: Based on data from the MEF

The sectors with the largest number of "sensitive" products are the chemical industries (ISIC 35), and the textiles, clothing and leather industries (ISIC 32), where the items in the Adapting Regime represented 25% of the total. The metallic products, machinery and equipment industries (ISIC 38) followed with 16% of the items and the food, beverages and tobacco industries (ISIC 31) accumulated another 9% of total items. In the case of the exceptions to the CET, the most affected sectors are those manufacturing chemicals, iron and steel, capital goods and computer and telecommunications - related goods.

The sectors defined at the four-digit level of the ISIC were grouped according to the degree of affectation by the special regimes, using two indicators. The first one is the average intra-zone tariff (IZT) in 1995, which measures the average protection each sector received before the Adapting Regime schedule started. The second one is the difference between the external or extra-zone tariff (EZT) and the CET in 1995, which indicates the degree of affectation each sector will have from the exceptions convergence schedules. The groups obtained are shown in Table 3 with the average intra-zone and extra-zone tariffs by the time each of the special regimes come to an end.

The first group (PRIM) produces agricultural and mining products without further elaboration. It is hardly affected by the Adapting Regime and by exceptions to the CET. In 1995 the intra-zone tariff was very close to zero and the extra-zone tariff was almost equal to the CET. The second group (EXPRO) is composed by several sectors that will very likely

be affected by the elimination of the Adapting Regime and the exceptions to the CET. They are relatively protected sectors whose extra-zone tariff in 1995 was higher than the CET. Several sectors oriented to the Mercosur countries (the dairy industry, the fabrication of tires and the textile industry) belong to this group.

The third and fourth groups are sectors affected by the Adapting Regime but not by the exceptions. Most food, beverages and tobacco industries belong to the third group while the fourth one is composed of paper products, rubber products, plastics and ceramics. The fifth group (BSK) gathers all sectors basically affected by the elimination of exceptions, particularly capital goods and computer and telecommunications - related goods. These goods have ascending convergence schedules to the CET. Uruguay does not have a significant production of these goods. The sixth group (EXP), should not be affected by any of the special regimes because it is composed by sectors with comparative advantages which sell most of their production to third countries (rice mills, beef and hides). The seventh group (INQUIM) contains sectors affected by exceptions with ascending convergence schedules, particularly the basic chemical products and fertilizers. Finally, the eighth group (EXCL) gathers three protected sectors: the automotive industry and the sugar industry (whose treatment has not been agreed in Mercosur) and the oil refining industry, a highly regulated sector whose performance will depend on the competition policy finally adopted.

A ninth sector was considered in the model (SERV) including all services and non-manufacturing industries, which are basically non-tradables, not affected by commercial policies. Table 4 shows several indicators of production and trade for each group.

Table 3
Simple average tariffs by groups (sectors)

	Nº of items	In force by: 1/1/1995 IZT	In force by: 1/1/1995 EZT	Foreseen by: 1/1/2000 IZT	Foreseen by: 1/1/2000 EZT	Foreseen by: 1/1/2001 EZT	Foreseen by: 1/1/2006 CET	Difference CET - EZT 1995	Tariff preference given to Mercosur partners 1995	Tariff preference given to Mercosur partners 2006	Tariff preference given to Mercosur partners Difference
PRIM	568	0.4	5.8	0.0	5.6	5.7	5.7	-0.1	5.4	5.7	0.3
EXPRO	1227	5.9	17.4	0.0	15.7	15.8	15.8	1.6	11.5	15.8	4.2
ALIREG	278	4.7	13.4	0.0	12.8	12.9	12.9	0.6	8.7	12.9	4.2
OREG	290	6.8	15.6	0.0	15.1	15.2	15.4	0.2	8.8	15.4	6.6
BSK	2298	1.3	7.0	0.0	7.0	7.0	13.6	-6.6	5.7	13.6	7.9
EXP	398	0.7	9.9	0.0	9.7	9.7	9.8	0.1	9.2	9.8	0.6
INQUIM	2898	1.4	8.3	0.0	8.1	8.7	8.7	-0.5	6.9	8.7	1.9
EXCL	244	1.3	9.9	1.3	9.9	9.9	13.5	-3.6	8.7	12.2	3.6
Total	7633	2.4	10.0	0.0	9.6	9.8	11.9	-2.0	7.6	11.9	4.4

Source: Elaborated from MEF data.

Table 4
Economic indicators by group (sector)

	Gross output (%)	Exports (%)	Imports (%)	Exports/ output (%)	Imports / Dom. demand (%)	Relative factor intensities (*)		
						Skilled labor	Unskilled labor	Capital
PRIM	7.3	7.1	11.2	10.7	19.9	0.5	0.6	1.2
EXPRO	8.1	17.3	7.7	23.5	14.3	1.5	1.5	0.8
ALIREG	7.2	2.8	4.4	4.3	7.3	1.1	1.3	0.9
OREG	2.8	2.7	5.6	10.5	25.7	2.2	2.2	0.5
BSK	3.9	1.4	24.6	4.0	76.1	2.2	2.0	0.5
EXP	6.5	23.1	2.7	39.2	7.9	1.2	1.4	0.9
INQUIM	4.1	2.1	17.7	5.8	53.5	1.5	0.9	0.9
EXCL	4.0	3.5	15.7	9.7	50.3	1.1	0.9	1.0
SERV	56.2	40.1	10.3	7.9	2.3	0.9	0.9	1.0
	100.0	100.0	100.0			1.0	1.0	1.0

Source: Based on data from BCU and INE.
(*) Ratio between factor intensity in each sector and total factor intensity.

3. THE MODEL

The structure of the CGE model is quite conventional in terms of the analysis of trade-related issues but alternative assumptions are made regarding market structures: perfect or imperfect competition. It is a multi-sector model with nine sectors defined by the groups obtained in the previous section. It is assumed that Uruguay is a small economy with three trading partners (Argentina, Brazil and the rest of the world). The Uruguayan economy is explicitly modeled while in the case of the other trading partners only the supply of imports and the demand for exports are endogenous.

Uruguay has been a protected economy where oligopolistic markets have developed and where the existence of regulations, trade unions and entrepreneurial associations impose certain rigidities in factor markets. For this reason, the model includes those market imperfections by means of modeling two different competitive behaviors in the manufacturing sectors: i) perfect competition and ii) Bertrand-type competition with scale economies and product differentiation. The model was run under the assumption of flexible wages.

There are three factors of production: capital, skilled and unskilled labor (the labor market is segmented by qualifications). The supply of each factor is fixed and there is no international mobility. Two alternative assumptions were made regarding factor mobility: i) all factors are perfectly mobile across sectors and ii) capital and skilled labor are sector-

specific factors, while unskilled labor is perfectly mobile across sectors.

It is assumed that there is only one representative consumer. Government only collects tariffs and makes transfers to consumers as a lump-sum.

The perfectly competitive sectors operate with constant returns to scale and the price of the produced good is equal to the variable unit cost. In the imperfect competition sectors it is assumed that firms have monopoly power associated to their capacity to differentiate their products. This monopoly power enables them to determine their prices both in the domestic and the external markets. In these sectors, firms operate with decreasing average costs and they apply a mark-up on variable unit costs. Prices are determined *à la Bertrand*, assuming competitors do not react to the firm's decisions. There is free entry, so the number of firms is endogenous. There are no benefits in the long run.

On the production side, firms combine intermediate inputs with capital, skilled and unskilled labor. In the competitive sectors the production functions are neoclassical with constant returns to scale. In the noncompetitive sectors, there are increasing returns to scale because there are fixed costs, not depending on the quantity produced.

In the perfectly competitive sectors, goods differ by geographic origin, being imperfect substitutes in consumption (*Armington*). The small country assumption is made for imports, so the country faces a perfectly elastic supply curve in the external markets. It is also assumed that the country faces a downward sloping demand curve for exports.

In the imperfect competition sectors there is product differentiation at the firm level and each firm faces negatively sloped demand curves in all three external markets. The price in each market is determined as a function of the variable unit cost, the elasticity of demand and the share of the firm in each market.

The representative consumer maximizes a utility function subject to his budget constrain (total national income). The utility function is separable and follows a Dixit and Stiglitz (1977) specification. In turn, each of the trading partners has a single representative consumer who maximizes a similar utility function but in these cases their total income and their domestic prices are exogenous. Total demand for each sector is composed by domestic demand (intermediate and final) plus exports to each of the trading partners.

The model closure adopted was a fixed trade balance, so that imports and exports of goods and services maintain the difference existing in the benchmark data. The equilibrium in the model is defined by the simultaneous equilibrium in goods markets, in factor markets and in the external sector. The equations of the model are presented in the Appendix.

4. CALIBRATION AND SIMULATIONS

This section describes the methodology for the simulations. First of all, the construction of the SAM and the calibration of the model are reported. Then, the experiments are described.

4.1 Parameter calibration

The "benchmark" data for calibrating the model was taken from Lorenzo et al (1999) who built a Social Accounting Matrix for the year 1995, just when the special regimes of Mercosur started. This SAM gathered data from different sources and made it compatible, having the National Accounting System as a framework. The task implied the updating of the existing input-output matrix (for the year 1983) and its combination with trade data and others. The aggregation level of this SAM was not exactly coincident with what was needed to calibrate the model so some further work was done to adapt it to this purpose.

In order to calibrate the model it was necessary to introduce extraneous values for the elasticity of substitution between factors of production and between domestic and imported goods.

As the model only considers three factors of production, it was assumed that all the rest of value added (once labor payments and indirect taxes are deducted) is the payment to capital. Therefore, land is considered as capital and its rent is included as a return to capital. Labor was classified as "skilled" or "unskilled" following the same criterion adopted by Cassoni and Labadie (1999), that is, the unskilled are the blue collar workers. All the rest are considered "skilled".

The elasticities of substitution between capital and labor and between skilled and unskilled labor were taken from the econometric estimates presented in Cassoni and Labadie (1999), based on the microdata from the Industrial Survey carried out from 1987 to 1995. The values for the elasticities of substitution between goods from different geographic origin were taken from the literature.

Finally, there was no recent data available in relation to market structures. Therefore, the key parameters were calibrated directly, assuming zero profits. It is assumed that the imperfect competition sectors are ALIREG, BSK, EXCL, EXPRO, INQUIM and OREG. In turn, the sectors EXP, PRIM and SERV are perfectly competitive. Each of these sectors produces a single good. The number of firms in each sector was obtained from the Herfindhal index calculated using data from 1988 Economic Census.

4.2 Simulations

The experiments were designed to analyze the impact of trade policy changes in Uruguay, due to the elimination of the special regimes of Mercosur and its consolidation as a perfect CU. The following experiments were carried out:

a) Elimination of the Adapting Regime.

This experiment simulates the impact of the elimination of all the exceptions to free trade inside the zone and to the CET for the items included in the Adapting Regime. It simulates the change in tariffs occurred from January 1995 to January 2000. To calibrate the initial equilibrium the average tariffs in force in 1995 were considered, both for intra-zone trade and for trade with third countries (see Table 3). The intra-zone tariff was lowered to zero and the extra-zone tariff was set at the approved CET level. Two sectors remained unchanged: EXCL and SERV. As it was said before, the first one includes sectors whose treatment has not been agreed yet (automotive, sugar and oil refining). The second one includes all activities whose trade is not affected by tariffs.

b) Elimination of all the special regimes.

Taking the results of the first experiment as the starting point, the second experiment simulates the elimination of all the exceptions to the CET (including those of the Uruguayan list that will be completely eliminated by the year 2001).[5] The convergence schedules were presented in Table 3.

Both experiments imply a discriminatory reduction of tariffs applied to goods originated in the Mercosur. The difference between them is the change in the external tariffs applicable to goods originated outside the Mercosur. In the first experiment, the latter have a moderate *decrease*, while in the second one they *increase* moderately. In either case the preference received by goods originated in the Mercosur countries increases, thus deepening the discriminatory character of trade policy.

The policy changes simulated also discriminate by sectors. The first experiment mainly affects protection from intra-zone imports for three sectors: the protected exporting sectors (EXPRO), the food industries with intense intra-zone trade (ALIREG) and other intra-zone exporting sectors (OREG). The second experiment adds an increase in protection from imports originated in third countries mainly for two sectors: BSK (capital goods, computer and telecommunications goods) and INQUIM (intermediate chemicals).

[5] The elimination of the Uruguayan list of exceptions by the year 2001 introduce relatively minor changes in average tariffs, so it was not justified to carry out a specific simulation for that case.

The model and the experiments were run in GAMS.

5. RESULTS

The first important finding from the simulations is that the overall effects of both experiments are rather low. Real income does not change by more than 1% in any of the simulations carried out. The most significant changes are observed in the trade flows. However, there are some relevant changes in terms of factor allocation, and factor demand by sector.

This exercise confirms in a moderate way the findings of other studies carried out with CGEs: the effect of trade policy changes are higher when market imperfections are considered. The overall changes on trade, relative prices and production by sector are higher in the simulations with imperfect competition than in those with perfect competition.

5.1 First experiment: Elimination of the Adapting Regime

In this section the results obtained from the simulation of the elimination of the Adapting Regime are presented.

- *Global effects*

Table 5 shows the overall results, which are quite similar under different assumptions concerning market structure and factor mobility. Real GDP and real income fall –0,1%, the terms of trade decrease 0,6 or 0,7% and the exchange rate increases between 0,6 to 0,8%.

Under perfect competition, tariff reduction lowers the domestic price of foreign goods. Real imports increase by 0,5% as a result. Simultaneously, the fall in import prices (through its effect on intermediates) translates into lower prices for domestic goods. Therefore, domestic output becomes more competitive in foreign markets and real exports increase by 1,1%. There is a slight change in the real returns on capital and labor while labor productivity remains constant.

Table 5
Experiment 1: Global effects with flexible wages
Percentage variations

	With perfect factor mobility		With specific factors	
	Perfect compet.	Bertrand compet.	Perfect compet.	Bertrand compet.
Real income	-0.1	-0.1	-0.1	-0.1
Real exports	1.1	2.4	1.1	2.4
Real imports	0.5	1.7	0.5	1.7
Terms of trade	-0.6	-0.7	-0.6	-0.7
Exchange rate	0.6	0.7	0.6	0.8
Real return to capital	0.1	0.1	0.1	0.1
Real wage	0.0	-0.1	0.1	0.0
Real skilled wage	0.0	-0.1	0.1	0.0
Real unskilled wage	0.0	-0.1	0.1	0.0
Labor productivity	0.0	0.1	0.0	0.0

When imperfect competition is assumed,[6] the results are not too different. Real exports increase 2,4% while real imports show a 1,7% increase. The trade response is larger in the Bertrand model because product differentiation at the firm level implies higher elasticities of substitution.

These general findings do not change significantly when it is assumed that capital and skilled labor are specific factors with no mobility across sectors. The overall effects remain low.

The global effects on the labor market are a weighted average of the changes occurred in each sector. As a consequence, the results can be ambiguous and should be complemented with the sectoral analysis below.

The overall results on the labor market are very low. The intra-zone liberalization causes a slight fall in both real wages of skilled and unskilled labor. In the model with specific factors the results are very similar.

- *Effects by sector*

In order to simplify the comments, only the results for the imperfect competition model are presented. This option is justified given the characteristics of the Uruguayan economy and the slight differences in the results. Table 6 shows the changes in output,

[6] It should be remembered that in all the versions of the model it was assumed that the typically exporting sector (EXP), the primary sector (PRIM) and the service sector (SERV), were perfectly competitive and price-takers in foreign trade.

consumption, trade, markups, number of firms and output per firm by sector.

In the simulations with perfect factor mobility, the results by sector are consistent with neoclassical theory. The fall in protection causes a reduction in domestic prices for all goods, especially those that are more exposed to competition from intra-zone imports. Thus, three effects are found: i) there is a reallocation of consumption towards those goods whose tariffs suffered the largest reduction (EXPRO and OREG), ii) output falls in two of the most affected sectors (ALIREG and OREG) while it increases in the other sectors (including the EXPRO sector) , iii) competitiveness in foreign markets improve due to the fall in prices of intermediate imports.

Table 6
Experiment 1: Effects on consumption, output and trade by sector
Bertrand competition, flexible wage
Percentage variations

	Total cons.	Domestic goods cons.	Real exports	Real imports	Output	Mark-up	Number of firms	Output / firm
Perfect factor mobility								
Perfectly competitive sectors								
EXP	-0,2	-0.2	1.3	-0.1	0.4	nc	nc	nc
PRIM	-0,2	-0.1	1.3	0.1	0,2	nc	nc	nc
SERV	-0,2	-0.2	1,3	-1.3	0,0	nc	nc	nc
Bertrand competition sectors								
ALIREG	-0,1	-0.5	4.8	12.0	-0,4	0,0	-0,6	0,1
BSK	-0,1	0.9	4.5	-1.1	0,9	0,0	0,9	0,0
EXCL	-0,3	1.2	3.2	-2.6	1.1	-0,2	1.0	0,2
EXPRO	0,2	-1.2	5.2	14.6	0,1	-0,2	-0,4	0,5
INQUIM	-0,1	-0.1	4.5	0.3	0,3	0,0	0,1	0,1
OREG	0,7	-4.8	5.9	16.1	-2,0	0,0	-2,4	0,3

The effect of the elimination of the Adapting Regime on real imports from sectors EXPRO, ALIREG and OREG is quite noticeable (they grow from 12% to 16%). On the other hand, sectors differ by their exporting behavior, which in turn, affects output behavior. In most sectors, the increase in exports compensates the contraction of domestic demand and enables a rise in output. However, in the case of ALIREG and OREG, the export increase is not enough to compensate the fall in domestic demand and there is a contraction in output.

All sectors increase their exports, but this effect is larger for non competitive sectors, particularly those most affected by the tariff reduction. In the sectors under imperfect competition, domestic firms determine their selling price in the domestic market and abroad using the monopoly power derived from product differentiation. In those sectors

the increase in exports is due to the price reduction of domestic goods, which improves their competitiveness abroad. In turn, this price reduction can be explained by the fall in the price of intermediate imports, and their feedback effect on the domestic goods' prices.

In the EXPRO sector, which had a high export share in output in the benchmark, the significant export increase (5,2%) fully compensates the fall in domestic demand and output increases. In contrast, the sectors ALIREG and OREG, severely affected by the elimination of the Adapting Regime -but whose share of exports in total output was much lower-, show an export expansion that is not enough to compensate the fall in domestic demand. As a result, the output of these sectors show a contraction (-0,4% y –2,0%, respectively).

There are no significant changes in mark-ups. In the new equilibrium, some firms disappear in the three most affected sectors while new firms arrive in the BSK and EXCL sectors. The combined effect of the changes in output and in the number of firms enables some sectors to take better advantage of scale economies, as the output per firm indicator shows. The largest effect of this kind is found in the EXPRO and OREG sectors.

The results under the specific factor assumption were quite similar, so they are not presented in the table. When specific factors are assumed, in the most affected sectors by the elimination of the Adapting Regime, markups fall as a result of the change in competition, even in the case of the EXPRO sector whose output increases. On the contrary, in BSK and EXCL markups rise.

The sectoral variations analyzed above affect factor markets. Table 7 shows the changes in factor allocation by sector. These effects are the expected but not relevant. There is a reallocation from the most affected sectors (labor intensive) towards all the rest, particularly to the less affected non competitive sectors (BSK and EXCL). As the relative return to capital is higher (see Table 5) all sectors change their technology towards a more intense use of labor.

However there is no direct relation between the tariff reduction in each sector and its factor intensity. This explains why the discriminatory opening policy causes a reallocation of factors without significant changes in their relative demand. The contracting sectors are labor intensive (OREG and ALIREG), while the expanding ones are intensive in skilled labor (BSK, INQUIM), unskilled labor (EXP) or capital (PRIM). The contracting sectors weight relatively less in output and employment. The net effect is an increase in the relative return to capital. According to these results, the elimination of the Adapting Regime should not bring significant changes on the functional distribution of income.

Table 7
Experiment 1: Effects on factor allocation with perfect mobility
Bertrand competition, flexible wage
Percentage variations

	Capital	Skilled labor	Unskilled labor
ALIREG	-0.6	-0,5	-0,5
BSK	0.8	0.9	0.9
EXCL	1.1	1.2	1.2
EXP	0.4	0.6	0.6
EXPRO	-0.3	-0.2	-0.2
INQUIM	0,1	0,2	0,2
OREG	-2.4	-2.3	-2.3
PRIM	0,2	0,2	0,2
SERV	0,0	0,0	0,0

In the model with specific factors, the unskilled labor demand rises in BSK, EXCL and EXP sectors -where output grows- and fall in ALIREG and OREG sectors (see Table 8). Unskilled labor moves from the ALIREG and OREG sectors (-0.1% and -0.2% respectively) to the BSK, EXP and EXCL sectors (0.1% in each of them).

Skilled labor and capital are assumed as sector-specific, so there is no reallocation in their case. Theory suggests that the returns of specific factors of the sectors affected by a tariff reduction will go down while they will increase in the rest of the sectors. That is precisely what can be observed in Table 8 where the real wage for skilled labor and real capital return falls in ALIREG, OREG and EXPRO. Factor productivity decrease in ALIREG and OREG, but it goes up in EXPRO. This is not a typical result of a sector-specific model but it should be remembered that in our Bertrand model the non competitive sectors are working in the downward side of the cost curve. In the EXPRO sector the number of firms goes down but export growth generates an increase in the scale of production.

In sum, when perfect factor mobility is assumed, a reallocation of factors is observed from the sectors most affected by the elimination of the Adapting Regime to all other sectors. In turn, when specific factors are assumed, an increase in real wage for skilled labor is observed in those sectors whose output grows.

Table 8
Experiment 1: Effects on the labor market with specific factors
Bertrand competition, flexible wages
Percentage variations

	Unskilled Employment	Real skilled wage	Real capital return	Labor productivity		Capital productivity
				Unskilled	Skilled	
ALIREG	-0.1	-0.7	-0.5	-0.1	-0.2	-0.2
BSK	0.1	0.6	0.4	0.2	0.3	0.3
EXCL	0.1	0.7	0.5	0.0	0.0	0.0
EXP	0.1	0.6	0.5	0.1	0.2	0.2
EXPRO	0.0	-0.2	-0.1	0.2	0.2	0.2
INQUIM	0.0	0.1	0.1	0.1	0.1	0.1
OREG	-0.2	-2.1	-1.6	-0.5	-0.7	-0.7
PRIM	0.0	0.3	0.3	0.0	0.1	0.1
SERV	0.0	0.1	0.1	0.0	0.0	0.0

One final aspect that should be noticed is what refers to the effect of the elimination of the Adapting Regime on trade flows, particularly in terms of trade creation and trade diversion.

Table 9 shows a remarkable increase in imports from the sectors most affected by the tariff reduction. There are also significant changes in the share of imports from the Mercosur countries and from the rest of the world. The imports from the Mercosur countries increase while they decrease from the rest of the world, particularly in sectors where preferences get larger. The convergence to the CET of the items included in the Adapting Regime might generate some trade diversion costs. However, the increase in intra-zone imports may also give rise to trade creation since in several sectors imports increase substituting for domestic production.

Table 9
Experiment 1: Effects on sectoral imports with perfect factor mobility
Bertrand competition, flexible wages
Percentage variations

	IMPORTS			
	Argentina	Brazil	Rest of the world	Total
ALIREG	17.8	20.0	-4.0	12.0
BSK	3,0	2.9	-2.6	-1.1
EXCL	-2.8	-2.7	-2.5	-2.6
EXP	0.2	0.2	-0.7	-0.1
EXPRO	27.2	26.2	0.6	14.6
INQUIM	3.0	3.0	-2.4	0.3
OREG	31.6	31.3	-4.8	16.1
PRIM	0.3	0.3	-0.1	0.1
SERV	-1.3	-1.3	-1.3	-1.3

5.2 Second experiment: Elimination of all exceptions to the CET

This experiment simulates the effect of the elimination of all the to the CET (except the automotive and sugar sectors). The experiment signifies an increase in the average protection with third countries received by all sectors (see Table 3). This increase is significant in three sectors: BSK (6.6%), EXCL (3.6%) and INQUIM (0.4%), which represent 58% of total imports in 1998. Therefore, this experiment simulates a reversion of trade opening with the rest of the world. As it was said before, this experiment simulates the situation that will take place by January 2006.

Basically, the elimination of the exceptions to the CET moves in the opposite direction to the elimination of the Adapting Regime, since it increases protection in most sectors. However, it should be noticed that in both cases there is a deepening of intra-zone preferences.

As it was said before, the results presented in this section show the changes simulated starting from the results of the previous experiment.

- *Global effects*

When perfect factor mobility is assumed, the overall results are very similar under all the assumptions adopted (see Table 10). Real income and real GDP increase less than 0.2%. Trade flows decrease -particularly real exports-, and the results are larger under the assumption of imperfect competition. The terms of trade improve while the exchange rate falls by a similar percentage. There is a slight variation in factor returns (less than 1%). The

real return on capital decrease relative to the average wage.

Table 10
Experiment 2: Global effects with flexible wages
Percentage variations

	With perfect factor mobility		With specific factors	
	Perfect compet.	Bertrand compet.	Perfect compet.	Bertrand compet.
Real income	0,1	0,2	0.1	0.1
Real exports	-1.4	-2.2	-1.3	-1.7
Real imports	-0,7	-1.2	-0.6	-0.9
Terms of trade	0,7	1.2	0,7	0,9
Exchange rate	-0.9	-0.8	-0.9	-0.8
Real return on capital	-0,2	-0,3	-0.2	-0.1
Real wage	0,0	0,6	-0,1	0,0
Real skilled wage	0,0	0.7	-0,1	0,0
Real unskilled wage	-0.1	0.4	-0,1	0,0
Labor productivity	0,0	0,1	0,0	0,0

As it was said in the case of the first experiment, the overall effects on the labor market are the result of very different situations by sectors. Therefore, they should be considered together with the results presented below for each sector.

- *Sectoral effects*

As it was mentioned before, the elimination of all the exceptions and the completion of the CU of Mercosur lead to a rise in protection in some sectors (BSK and INQUIM) and the maintenance of existing tariffs in the sector EXCL. The expected effects should be a reduction in their demand (due to higher prices) and a rise in output.

The sectoral results show an important increase in the consumption of domestic goods from the BSK and EXCL sectors (8,2% and 2,3% respectively). Therefore, domestic output substitutes for imports in those sectors due to the increase in tariffs. Consequently, exports also fall.

In the model with perfect factor mobility, the sector BSK is the one where the largest changes in output are observed. Its output grows 6,1% and the number of firms 5,8%, but no significant change is observed in markups or in the scale of production. This means that the completion of the CU would not bring substantial advantages in terms of

economies of scale or in terms of greater competition in the domestic market. On the contrary, it might bring important costs in terms of trade diversion in a sector with great impact on the rest of the economy. Output also rises in EXCL where the number of firms increases. In all other sectors output and the number of firms fall.

Table 11
Experiment 2: Sectoral effects on output, consumption and trade
Bertrand competition, flexible wage
Percentage variations

	Total cons.	Domestic goods cons.	Real exports	Real imports	Output	Mark-up	Number of firms	Output / firm
With perfect factor mobility								
ALIREG	0.3	0.2	-4.0	3.1	-0.1	0,0	-0.2	0.1
BSK	-0.2	8.2	-4.8	-9.6	6.1	-0,1	5.8	0,3
EXCL	0.2	2.3	-3.7	-2.7	1.0	-0.1	1.0	0.0
EXP	0.4	0.3	-1.3	1.0	-0.5	nc	nc	nc
EXPRO	0.0	-0.2	-4.2	3.9	-1.6	0.2	-1.5	-0.1
INQUIM	0.3	0.2	-3.9	2.2	-0.2	0,0	-0.3	0.2
OREG	0.3	-1.1	-4.3	4.0	-1,0	0,1	-1.2	0.2
PRIM	0,4	0.4	-1.2	1.2	-0.4	nc	nc	nc
SERV	0.3	0.2	-1.5	1.6	0,0	nc	nc	nc

As for the effects on factor reallocation when perfect mobility is assumed, the results are shown in Table 12. It can be observed that factor demand increases approximately 6% in the sector whose tariffs rise the most (BSK) and approximately 1% in the sector not included in the Mercosur agreements (EXCL). In all other sectors factor demand decreases. Therefore, factor reallocation takes place from the sectors most affected by the elimination of exceptions towards the rest.

Table 12
Experiment 2: Effects on factor allocation with perfect mobility
Bertrand competition, flexible wage
Percentage variations

	Capital	Skilled labor	Unskilled labor
ALIREG	-0.1	-0.5	-0.5
BSK	6.1	5.6	5.7
EXCL	1.0	0.7	0.8
EXP	-0.4	-1.1	-1.1
EXPRO	-1.4	-1.9	-1.8
INQUIM	-0.3	-0.5	-0.5
OREG	-1.1	-1.4	-1.3
PRIM	-0.4	-0.7	-0.7
SERV	0.1	0.0	0.0

In the model with specific factors, the reallocation of the only mobile factor (unskilled labor) is rather small (see table 13). Instead, the returns on the specific factors (skilled labor and capital) of the most affected sector (BSK) is quite noticeable (4,2% and 3%). In all other sectors the returns on specific factor fall. Factor productivity increases only in the BSK sector which takes advantage of scale economies.

Table 13
Experiment 2: Effects on factor markets with specific factors.
Percentage variations

	Unskilled employment	Real skilled wage	Real capital return	Labor productivity		Capital productivity
				Unskilled	Skilled	
ALIREG	0.0	-0.3	-0.2	0.0	0.0	0.0
BSK	0.5	4.2	3.0	1.5	2.0	2.0
EXCL	0.1	0.5	0.4	0.0	0.1	0.1
EXP	-0.1	-0.7	-0.5	-0.1	-0.2	-0.2
EXPRO	-0.1	-1.2	-0.8	-0.4	-0.5	-0.5
INQUIM	0.0	-0.3	-0.3	0.0	0.0	0.0
OREG	-0.1	-0.8	-0.6	-0.2	-0.3	-0.3
PRIM	-0.1	-0.6	-0.5	-0.1	-0.2	-0.2
SERV	0.0	-0.1	0.1	0.0	0.0	0.0

One final aspect to consider is the impact of the elimination of the exceptions on imports. In the model with perfect factor mobility, there are relevant effects of opposite signs (see Table 14). In the BSK and EXCL sectors there is a substantial fall in total imports together with a large increase in imports from the Mercosur countries. This result signals the possible existence of a strong trade diversion effect which is particularly serious,

given the large share of total imports that belong to these sectors. In those most affected by the intra-zone liberalization, imports show an increase, mainly from the Mercosur countries. This result suggests there is a trade creation effect in ALIREG, OREG and INDQUIM.

Table 14
Experiment 2: Effects on imports **w**ith perfect factor mobility
Bertrand competition, flexible wage
Percentage variations

Sector	IMPORTS			
	Argentina	Brazil	Rest of the world	Total
ALIREG	3.1	3.4	2.8	3.1
BSK	7.2	6.8	-15.9	-9.6
EXCL	4.8	4.4	-10.3	-2.7
EXP	1.0	1.0	0.8	1.0
EXPRO	4.2	4.0	3.5	3.9
INQUIM	3.5	3.5	0.8	2.2
OREG	4.5	4.4	3.0	4.0
PRIM	1.3	1.3	1.1	1.2
SERV	1.6	1.6	1.6	1.6

6. CONCLUSIONS

The results presented in this paper are caused by opposite forces. On the one hand, the intra-zone tariffs fall in a discriminatory way. On the other hand, tariffs with third countries fall moderately in the first experiment but rise moderately in the second. In either case, the preference received by imports from the Mercosur countries increase in all sectors, deepening the discriminatory character of trade policy.

The first important finding of this exercise is that the overall impact in both experiments is quite low. Real GDP and real income remain almost unchanged. The most significant changes are found in trade flows and in the relation between domestic and foreign prices.

The second finding to be emphasized is that none of the policy changes that were simulated has relevant effects on the aggregated labor market. However, this global result should be taken cautiously because at the sectoral level there are effects with opposite signs that compensate in the aggregate.

The welfare effect that can be found due to the existence of imperfect competition also seems quite modest. The procompetitive trade effect does not appear to be important, given the minor decrease in markups. The same thing can be said about the scale effect as

no significant increase in firms' size is found. Finally, the most important variation in welfare could originate in the variety effect due to the increase in imports.

As for trade flows, the growth in intra-zone imports is coupled with a decrease in imports from the rest of the world, particularly in those sectors where preferences deepen the most. This result might be interpreted as a signal of the existence of trade diversion costs in some sectors.

The effects are quite large in some sectors. On the one hand, in those most affected by the intra-zone liberalization, there is a significant increase in imports, mainly from the Mercosur countries (ALIREG and OREG). On the other hand, in the sector BSK, whose tariffs increase for third countries the elimination of all the exceptions in Mercosur cause a substantial fall in total imports while intra-zone imports increase. This result suggests that a serious trade diversion effect may occur in a sector that represents a large share of total Uruguayan imports and which plays a crucial role in the technological development of the country.

When perfect factor mobility is assumed the elimination of the Adapting Regime generates a reallocation of resources and changes in consumption. Factors of production move from the three sectors most affected by this experiment (labor intensive) to the other sectors. However, as the tariff reduction is not directly correlated with factor intensity in each sector, the discriminatory opening causes a reallocation of resources without significant changes in the relative factor demand. Therefore, the elimination of the Adapting Regime should not cause significant changes in income distribution.

As the sectors considered by the model are relatively aggregated, it is not easy to identify winners and losers based on theoretical grounds. Nevertheless, in the factor-specific model, it is clear that the specific factors (capital and skilled labor) of the sectors ALIREG, OREG and EXPRO are the most affected by the elimination of the Adapting Regime. Those sectors show a decline in unskilled labor use and a fall in the real wage of skilled workers and in capital return.

In the second experiment (the elimination of exceptions to the CET), the rise in protection leads to a demand decrease and an increase in output of the BSK sector, where the most relevant changes take place. No significant variations are found in markups or in firm size, so the procompetitive or scale effects on welfare are rather small. On the contrary, there are signals of possible trade diversion effects, mainly in the BSK sector.

This second experiment generates a reallocation of resources towards the sectors whose protection increases in relation to third countries. The reallocation is effective mainly through the entry or exit of firms in each sector and the changes in firms' size.

When specific factors are assumed in the second experiment the owners of capital and the skilled workers of the BSK and EXCL sectors improve their factor returns. This sector also benefits from a positive scale effect. On the other hand, it is in this sector where the greatest trade diversion effects might occur.

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APPENDIX

The equations of the CGE model are presented in this appendix. Capital fonts indicate variables (endogenous or exogenous), lower fonts and Greek fonts indicate parameters. The subscripts *i, j* refer to sectors and the subscripts *z, t* refer to geographic zones as follows:

i, j = PRIM, EXPRO, ALIREG, OREG, BSK, EXP, INQUIM, EXCL, SERV
z = Uruguay (U), Argentina (A), Brazil (B), rest of the world (r)
t = A, B, r

Each sector combines primary factors and intermediate inputs following a Cobb-Douglas production function, so the variable unit cost is:

$$VU_i = \frac{1}{\omega_i}\left(\frac{PN_i(1+tind_i)}{1-\sum_j \alpha_{ji}}\right)^{1-\sum_j \alpha_{ji}} \cdot \prod_j \left(\frac{PCI_{ji}}{\alpha_{ji}}\right)^{\alpha_{ji}}$$

where *VU* is variable unit cost, *PN* is value added price, *PCI* is the composite price of intermediate inputs and *tind* is the percentage of indirect taxes paid by the sector. α and ω are the distribution and scale parameters (respectively) of the production function.

In turn, value added is a combination of labor and capital especified as a CES. Thus, *PN* is:

$$PN_i = \left(\frac{1}{\beta_i}\right).\left[(1-\delta_i)^{\sigma_i}.R_i^{(1-\sigma_i)} + \delta^{\sigma_i}.W_I^{(1-\sigma_I)}\right]^{1/(1-\sigma_I)}$$

where *R* and *W,* are the rate of return to capital and the wage rate , respectively. δ y β are the distribution and scale parameters of the CES function for value added, while σ is the elasticity of substitution between capital and labor.

As the model considers that the labor market is segmented, the average wage is a combination of wages for both types of labor. It was assumed that skilled and unskilled labor are combined following a CES function, so the average wage is:

$$W_i = \frac{1}{\varphi_i}.\left[(1-\xi_i)^{\theta_i}.WNC^{1-\theta_i} + \xi_i^{\theta_i}.WC_i^{1-\theta_i}\right]^{1/(1-\theta_i)}$$

where *WNC* and *WC* are the wages for unskilled and skilled labor, ξ and φ are the distribution and scale parameters and θ is the elasticity of substitution between skilled and unskilled labor.

In the imperfect competition sectors, the intermediate inputs are differentiated at the firm level and are combined with an Armington formulation. It is assumed that all firms are the same sized for each sector in each zone, so the composite price of intermediates is:

$$PCI_{ji} = \left(\sum_{z} \gamma_{zji}^{\phi_j} NF_{zj} .. P_{zj}^{1-\phi_j} \right)^{1/(1-\phi_j)}$$

where *P* is the domestic price of goods from each zone, *NF* is the number of firms for each sector in each zone, γ is the CES distribution parameter and ϕ is the elasticity of substitution between goods from different origin. In the perfect competition sectors, *NF* is equal to one.

For the perfectly competitive sectors, the total cost for each firm includes the variable costs and the fixed cost, so that the average cost is decreasing:

$$CT_i = F_i + \frac{VU_i . Q_i}{NF_{Ui}}$$

where Q_i is output of sector *i*, NF_{Uj} is the number of firms of sector *i* in Uruguay and *F* the fixed costs. These are defines as:

$$F_i = \left(fc_i . WC_i + fnc_i . WNC + fk_i . R_i \right) \left(1 + tind_i \right)$$

where *fc* is the fixed amount of skilled labor used by sector *i*, *fnc* the fixed amount of unskilled labor and *fk* the fixed amount of capital.

The demand for intermediate inputs, labor and capital in each sector is obtained from the benefit maximization program of the firms:

$$X_{zji} = \frac{\alpha_{ji} . NF_{zj} VU_i}{PCI_{ji}} \left(\frac{P_{zj}}{\gamma_{zji} . PCI_{ji}} \right)^{-\phi_j}$$

where X_{zji} is the demand for the input *j* coming from country *z* and used by sector *i* for the production of one unit. It is a decreasing function of the input price.

Labor demand is a decreasing function of the wage rate and is an increasing function

of value added and its price:

$$L_i = \beta_i^{\sigma_i - 1} . \left(\frac{W_i}{\delta_i . PN_i} \right)^{-\sigma_i} . VA_i$$

Similarly, capital demand is a function of the rate of return to capital, value added and its price:

$$K_i = \beta_i^{\sigma_i - 1} . \left(\frac{R_i}{(1 - \delta_i) . PN_i} \right)^{-\sigma_i} . VA_i$$

Finally, the skilled and unskilled labor demand equations are the following:

$$LC_i = \varphi_i^{\theta_i - 1} . \left(\frac{WC_i}{\xi_i . W_i} \right)^{-\theta_i} . L_i$$

$$LNC_i = \varphi_i^{\theta_i - 1} . \left(\frac{WNC}{(1 - \xi_i) . W_i} \right)^{-\theta_i} . L_i$$

In the competitive sectors, the equilibrium price of output is equal to its variable unit cost *VU*:

$P_{ui} = VU_i$ when i= competitive sectors

where P_{ui} is the price of goods produced in Uruguay.

In the imperfect competition sectors goods are differentiated at the firm level. Firms determine their prices adding a markup on variable unit cost. It is assumed that firms have no profits and the markup just enables them to cover their fixed costs. Then the domestic and export prices will be:

$P_{ui} = VU_i . M_{Ui}$ when i= imperfect competition sectors

where *M* is the percentage markup on variable unit cost, which depends on the demand elasticity the firm faces:

$$M_{zi} = \frac{ELAS_{iz}}{ELAS_{iz} - 1}$$

where:

$$ELAS_{iz} = \phi_i - (\phi_i - 1).sh_{zi}$$

and sh_{zi} the share of each firm in each market.

In the imperfect competition sectors, foreign firms also apply a markup to determine their export price. So the import price for Uruguay is:

$$P_{ui} = PW_{bi}.M_{zi}\,ER.(1+\tau_{bi})$$

where PW is the international price, τ is the tariff and ER is the exchange rate. In the perfect competition sectors, M equals one.

The export price for perfect competitive sectors is:

$$PE_{iz} = \frac{P_{ui}}{ER}$$

Imperfect competition sectors differentiate their products at the firm level, their export price is:

$$PE_{iz} = \frac{VU_i}{ER}.\ \frac{ELASM_{iz}}{ELASM_{iz} - 1}$$

where

$$ELASM_{iz} = \eta_i - (\eta_i - 1).she_{iz}$$

and *she* is the share of each firm's exports in the destination market.

Total profits for each sector are defined as the difference between sales and output costs:

$$\pi_i = Q_i.PQ_i - CT_i.NF_i$$

Consumers maximize a Cobb Douglas utility function, subject to their budget constrain. Then, demand for each good is:

$$C_i = \mu_i . \frac{Y_u}{PF_i}$$

where *PF* is the price of final goods:

$$PF_i = \left(\sum_z \lambda_{zi}^{\phi_i} . NF_{zi} . P_{zi}^{1-\phi_i} \right)^{1/(1-\phi_i)}$$

and the composite price index:

$$IP = \mu_o \prod_i \left(\frac{PF_i}{\mu_i} \right)^{\mu_i}$$

C is the consumption of a composite of differentiated goods with an Armington formulation. The goods are differentiated by firms (in imperfect competition) or by geographic origin (in perfect competition). Therefore, final demand of a good *i* produced in z is:

$$D_{zi} = \lambda_{zi}^{\phi_i} . \left(\frac{P_{zi}}{PF_i} \right)^{-\phi_i} . C_i \, NF_{zi}$$

The export demand is a decreasing function of the export price:

$$E_{iz} = \varepsilon_{iz} . Y_z . PE_{iz}^{-\eta_i} . PM_{iz}^{1-\eta_i}$$

where *PM* is the average price index prevailing in the destination country and *Y* is that country's income (exogenous variable).

Income is endogenous and is the sum of the returns to factors of production, the receipts of tariff collection, profits and capital inflows from abroad:

$$Y = \sum_i (L_i.W_i + K_i.R_i + VA_i\ PN_i\ tind_i + NF_{Ui}.F_i + \pi_i) +$$

$$+ \sum_i \left(\sum_z \tau_{zi}.D_{zi}.PW_{zi}M_{zi}. + \sum_z \sum_j \tau_{zj} AZ_{zji}.Q_i.PW_{zj}M_{zi} - B.ER \right)$$

The equilibrium conditions in the labor market are:

$$LCS_i = LC_i + fc_i.NF_i + UC_i$$

$$LNCS = \sum_i (LNC_i + fnc_i.NF_i) + UNC$$

where *LCS* and *LNS* are the supply of skilled and unskilled labor, respectively. Both variables are exogenous. *UC* and *UNC* are unemployment of skilled and unskilled labor, respectively. In the versions of the model where it is assumed that real wage is fixed, *UC* and *UNC* are endogenous variables. On the contrary, if it is assumed that wages are flexible, *UC* and *UNC* remain constant.

The equilibrium equation for capital is:

$$KS_i = K_i + fk_i.NF_i$$

where *KS* is capital supply (exogenous).

It should be noticed that these equilibrium equations in factor markets assume that skilled labor and capital are specific factors, with no mobility accross sectors. In that case, supply and demand for those factors should be in equilibrium in each sector. On the contrary, in the simulations with perfect factor mobility, supply and demand for all factors should be in equilibrium in the aggregate.

The equilibrium conditions in the goods market require the equalization of supply and demand in each sector:

$$Q_i = D_{ui} + \sum_j X_{uij}.Q_j + \sum_t E_{it}$$

Finally, the external equilibrium is:

$$\sum_i \sum_t E_{it}.PE_{it} - \sum_i \sum_t D_{ti}.PW_{ti}M_{ti} - \sum_i \sum_j \sum_t X_{tji}.Q_i.PW_{tj}M_{ti} = B$$

In all the simulations B remain constant.