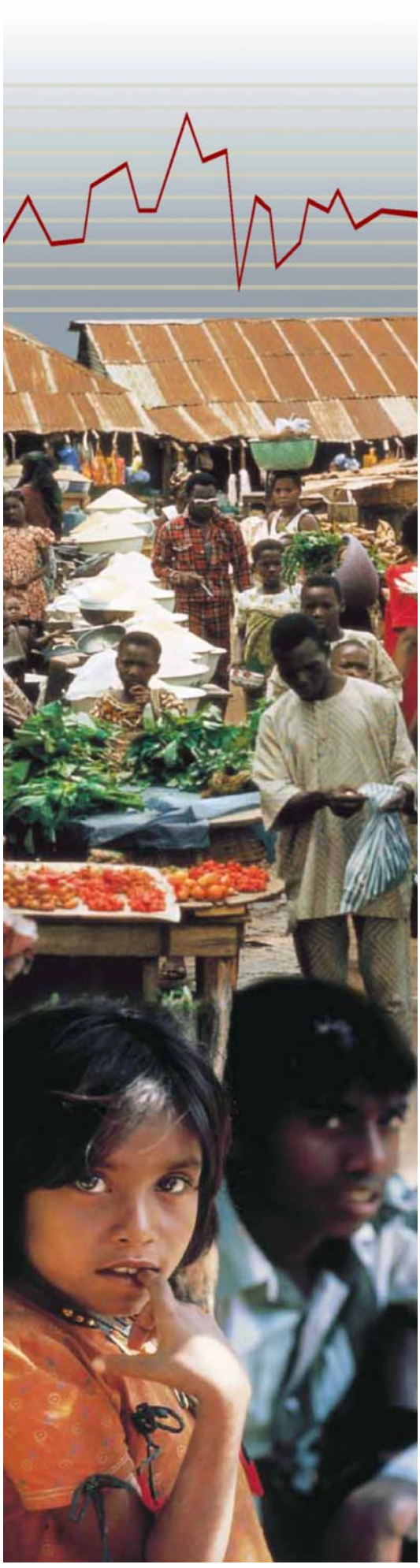

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The Effects of Increasing Openness and Integration to the MERCOSUR on the Uruguayan Labour Market: A CGE Modelling Analysis

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Abstract

Uruguay is a small economy. Its integration into MERCOSUR has increased its exposure to regional macroeconomic instability. The aim of this paper is to assess the impact of regional integration on the country's labour market and poverty. We estimated wage differentials between labour categories, finding a 60 percent wage gap between formal and informal workers. A CGE model with an efficiency wage specification for unskilled labour was built, with results showing that regional shocks deeply affect the Uruguayan economy. The consideration of an efficiency wage model is particularly important when shocks lead to a reallocation of resources towards sectors intensive in unskilled labour. A subsidy on formal, unskilled labour could contribute to decrease informality and therefore increase GDP, but this type of policy needs to be carefully implemented because it may have negative effects on investment. Finally, the effects on poverty and income distribution obtained through microsimulations are consistent with the results of the CGE experiments.

Keywords: Uruguay, labour market, general equilibrium model, regional integration, efficiency wage, microsimulation, poverty

JEL Classification: D58, I32, F15, F16, J41

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Introduction

In the nineties, with the signing of the MERCOSUR agreement, Uruguay deepened its economic integration within the region and hastened the country's trade liberalization process. As a result, trade within MERCOSUR increased significantly but also increased with the rest of the world. Trade openness led to resource reallocation from the manufacturing sector towards services, profoundly affecting labour market structure. The regional economic crisis that started with the Brazilian currency devaluation in 1999 led to a four-year economic recession, worsening labour market and poverty indicators.

The purpose of this study is to find out how the labour market is affected by external shocks, particularly those associated with the integration process or by changes in trade policies of the bloc. It intends to estimate the effects on specialization, trade, employment and wages stemming from those shocks or from changes in trade policies, taking into account the imperfections and specific features of the labour market in different sectors of the Uruguayan economy. It also identifies the impacts of these policy changes on poverty and income distribution. Finally, the study evaluates policy options to lower the costs associated with this process, directed to improve employment.

The study began with a review of the main characteristics of the Uruguayan labour market and an estimation of wage differentials between sectors and labour categories in order to obtain the stylised facts to be considered in the model. A CGE model was then built with the purpose of running different scenarios of regional shocks, and trade and labour market policies. Finally, microsimulations were run in order to evaluate the impact of these shocks on poverty and income distribution.

In Section 2 a brief overview of the Uruguayan economy is presented and the main features of the labour market are analysed, indicating the existence of imperfections that should be taken into account for the specification of the CGE model used in the analysis.

Section 3 describes the main characteristics of the CGE model, the calibration and the design of simulations carried out. It also presents the main aspects of the microsimulations methodology that was adopted to analyse the impact on poverty and income distribution.

Section 4 presents the results obtained and, finally, Section 5 the main conclusions.

Economic overview

Recent economic performance

During the last 25 years Uruguay gradually adopted several reforms focused on the liberalization and opening of real and financial flows in order to increase Uruguay's ties with the world economy, achieve macroeconomic stability and set the market as the main mechanism for resource allocation. The process started in the mid-seventies, with great transformations in the financial sector but only minor progress in terms of openness to trade. By the end of the 70s, financial flows were completely liberalized, while trade reforms were carried out more gradually. Starting from a maximum of 150 percent in 1980, by January 1993 the highest tariff was set at 20 percent.

The 1990s were dominated by the creation of the MERCOSUR, an imperfect customs union among Argentina, Brazil, Paraguay and Uruguay. The creation of the MERCOSUR implied the existence of free trade within the bloc and the adoption of a common external tariff (CET), which was agreed in 1994 and enforced in 1995. The adopted CET varied from 0 to 20 percent, with an average tariff of 11 percent. However, many exceptions to its application were accepted, and presently the four countries still apply different external tariffs to some goods, mainly capital goods and computing and telecommunication goods. The full enforcement of the CET by 2010 will mean that Argentina, Paraguay and Uruguay would have to increase their tariffs on these goods, an unwelcome development since these countries believe that such will hinder competitiveness in most sectors.

Since the creation of the MERCOSUR Uruguayan exports improved their access to a very large market (the sum of Argentina and Brazil). Trade within MERCOSUR increased significantly, and by 1998, 55 percent of Uruguay's goods were destined for the bloc. This was, in part, because of MERCOSUR, but this was also due to the loss of competitiveness of Uruguayan exports to third countries. The latter was a result of an overvalued local currency, the consequence of a policy of price stabilization based on the exchange rate. Since similar stabilization policies were adopted in Brazil and Argentina, exports to those countries remained competitive.

The situation changed dramatically when the Brazilian currency started to float in January 1999, affecting Uruguayan exports directly and indirectly (through the Brazilian impact on

Argentina). The share of Uruguayan goods exported to Brazil declined from more than a third in 1998 to a little more than 20 percent in 2001. In 2002, the financial crisis in Argentina also affected the Uruguayan economy. The reduction of Argentine income levels, the restrictions on credit access, and the change in relative prices in that country had a negative impact on Uruguay's trade outflows. The total service exports (tourism basically) fell more than 35 percent in the first quarter of 2002 compared to the same period in 2001 (that year, 80 percent of the tourists were Argentines). Exports of goods to Argentina dropped about 70 percent in the first semester of 2002 relative to the first semester of the previous year.

The Argentine crisis had relevant effects on financial activity as well. By 2001, the share of deposit stock of non-residents from Argentina was high, but in February 2002 Uruguay experienced an important capital flight due to the withdrawal of non-resident deposits. The critical situation worsened by fraud in three of the main private Uruguayan banks. By August, the deposit stock in the Uruguayan banking system had been reduced by 50 percent relative to the beginning of the year, which forced the abandonment of the exchange rate system in June 2002. A floating exchange rate was adopted, leading to a significant depreciation of the local currency. The exchange rate accumulated a total 106 percent increase from December 2001 to December 2002.

Towards the end of July 2002, given the international reserves loss due to capital flight, the Uruguayan government decided to call a "banking holiday" in order to make significant changes in the banking system. The restructuring entailed the compulsory reprogramming of term deposits in state-owned banks and the closure of four insolvent private banks (with a very large market-share). After the restructuring, the branches of international banks increased their importance in the banking system. This new financial situation implied severe restrictions on bank credit access, which did not affect uniformly across sectors.

Although in the long run the Uruguayan economy shows a poor performance, e.g. the average increase of GDP was 1.9 percent between 1970 and 1990, the 1990s were a period of economic growth. Between 1990 and 1998 GDP increased by an annual rate higher than 4 percent (see Table 1). However, by the end of 1998 this process began to reverse itself and after the Brazilian currency devaluation of January 1999 the country was in complete recession. In 2003 economic recovery started in Uruguay, mainly driven by exports, which grew 18 percent. Uruguayan exports had an 80 percent competitiveness gain in relation to

Brazil and other trade partners as a result of the depreciation of the Uruguayan currency. Total GDP increased 2,2% in 2003 and 12,3% in 2004

Table 1
Main indicators

Year	GDP a/	Annual inflation a/	Fiscal balance b/	Current account balance b/	Imp. goods & serv. b/	Exp. goods & serv. b/	Gross capital formation b/	Unempl. rate c/
1990	0,3	112,5	-3,0	2,0	18,10	23,53	12,20	8,5
1991	3,5	102,0	-1,8	0,7	17,86	20,69	15,13	8,9
1992	7,9	68,5	0,3	-0,8	19,63	20,45	15,38	9,0
1993	2,7	54,1	-1,7	-1,8	19,56	19,13	15,64	8,3
1994	7,3	44,7	-2,8	-2,3	20,38	19,77	15,87	9,2
1995	-1,4	42,2	-1,5	-1,3	19,10	19,00	15,41	10,3
1996	5,6	28,3	-1,4	-1,2	19,86	19,67	15,24	11,9
1997	5,0	19,8	-1,4	-1,1	20,54	20,55	15,22	11,4
1998	4,5	10,8	-0,9	-1,8	20,58	19,85	15,87	10,1
1999	-2,8	5,7	-4,0	-2,3	19,30	18,03	15,14	11,3
2000	-1,4	4,8	-4,0	-2,8	20,98	19,30	13,96	13,6
2001	-3,4	3,6	-4,3	-2,6	20,04	18,35	13,77	15,3
2002	-11,0	25,9	-4,2	3,1	20,01	21,97	11,52	16,9
2003	2,2	10,2	-3,2	-0,5	24,56	26,07	12,59	16,9
2004	12,3	7,6	-1,8	-0,8	27,94	29,65	13,29	13,1

Source: Elaborated with data from BCU and INE.

a/ Annual cumulative variation; b/ Percentage of GDP (current prices); c/ Urban areas

Recent trends in the Uruguayan labour market

In the nineties, the economic reforms carried out in Uruguay, along with increased trade openness and the creation of the MERCOSUR led to a restructuring process that determined changes in the composition of GDP as well as in the use of technology (Cassoni and Fachola, 1997; Croce, Macedo and Triunfo, 2000; Tansini and Triunfo, 1998a; 1998b). Between 1991 and 2002, the share of manufacturing employment was gradually reduced, from 21 percent to 13 percent of total urban employment[1]. On the other hand, the share of services, especially in retail, restaurants, hotels and financial services, increased: these sectors, together with the construction sector, rose from 27.5 percent of total employment in 1986 to 39 percent in 2002. This, in turn, drastically affected the Uruguayan labor market, displacing workers from some economic activities and changing the requirements of the work force.

[1] In 2001 the share of manufacturing employment was 17%. Between 2001 and 2002 methodology to measure industry product was modified by the INE, so the fall in 2002 might be overvalued.

The following facts thus characterized the evolution of the Uruguayan labor market in the nineties: a) a generalized increase in labor productivity (output per worker); b) an increase in the unemployment rate associated with the destruction of unskilled jobs; c) an increase in wage dispersion, with a relative improvement of skilled wages; and d) an increase in informality. These trends have deepened in the current decade.

Regarding the skill level of workers[2], data analysis shows that the unemployment rate is considerably lower for skilled workers, whereas unskilled workers show the highest unemployment rates. The unemployment rate in Uruguay climbed from 8.8 percent in 1991 to 16.9 percent in 2002. Even prior to the severe economic crisis that affected Uruguay between 1998 and 2002, the unemployment rate showed an increasing trend in a context of economic growth. This evolution differed clearly according to the education level of the labour force.

Another relevant change that occurred during the nineties was the reduction in public employment as a result of the ongoing state reform process. Public employment share in total employment fell from 24 percent in 1986 to 18 percent in 2002. However, public employment for skilled workers rose slightly during the same period. As a consequence, this structural change reinforced the effects of the changes observed in tradable sectors: greater destruction of unskilled jobs (UNDP, 2001) [3].

It should be noted that the changes in productive structure affected not only the quantity but also the quality of employment. Several studies suggest that precarious jobs, informality and underemployment increased throughout the decade, especially for workers with low education levels.[4] The destruction of low skilled jobs that took place both in the public sector and in the tradable sector drove unskilled workers towards employment in small productive units or self – employment, thus leading to an increase in precariousness and informality (UNDP, 2001; Bucheli, 2005). In this context, informality became one of the most important imperfections in the Uruguayan labour market, affecting more than one third of employed workers during this period.

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[2] This study considers that a worker is skilled if he has at least 12 years of formal education.
[3] In 1997-99, 22,400 unskilled and 5,600 skilled public jobs were destroyed. During the same period 3,600 new skilled jobs were created. The outcome was the destruction of 24,400 public jobs.
[4] Precarious workers are those private dependent workers who are not covered by social security, have an unstable job, or receive no remuneration for their work. Informal workers are those not covered by social security. Underemployment comprises workers who work less than 40 hours a week but would be willing to work additional hours.

Methodology

Labour market specification

As cited in the previous section, the Uruguayan labour market presents serious problems of unemployment and informality. Therefore, we considered that these imperfections had to be captured in the model. However, we needed to focus on one type of imperfection. Since one of the distinguishing features of the Uruguayan labour market is the existence of a persistent wage differential between formal and informal jobs, a dual market labour approach was adopted for the study.

The theory of dual labour markets is based on a two-tier regime where a primary and a secondary sector coexist with unemployment. Workers in the upper tier (primary sector) enjoy higher wages and fringe benefits; also, stability, union protection and labour regulation enforcement are more likely in this sector. Meanwhile, in the low wage (secondary) sector, the labour market clears and workers in this sector are not able to underbid those in the primary sector. A rationing of jobs in the primary sector explains the existence of queues and the persistence of unemployment. On the other hand, the secondary sector provides flexibility to the economy, adjusting its size to fluctuations in the business cycle.

The efficiency wage model provides a microeconomic foundation for these features. Different versions propose a persistent wage gap and a negative relationship between the rate of unemployment and the upper tier wage (Saint Paul, 1996). In the Shapiro-Stiglitz version firms are interested in paying wages above the expected rates because of cost monitoring reasons (Shapiro and Stiglitz, 1984). The model assumes some inability of employers to observe workers effort. This allows the worker to choose how much effort he wants to make but if he shirks, he faces the probability of being fired. There is a critical wage above which the worker will not shirk. As far as firms are concerned, they compete by offering wage packages that take into account the minimum wage required to induce workers' effort.

In equilibrium, if wages are very high, workers will value their jobs not only by the high wage itself but also by the low level of employment (due to low labour demand at high wages). Among others reasons, the critical wage for non shirking will be greater; i) the lower the probability of being caught shirking; ii) the higher the expected utility of being unemployed

(e.g. the most generous the unemployment subsidy program) and iii) the higher the flows out of unemployment.

The same results arise in versions based on "recruit, retain and motivate" reasons. On one hand, a high wage eases vacancies filling, reduces the quit rate and motivates effort. On the other hand, high unemployment affects the likelihood of finding a new job if dismissed (thus affecting effort) and the ease of voluntary turnover (quit).

In the CGE model we assumed that an efficiency wage model might explain the wage gap between formal and informal workers. In order to estimate the wage gap, the study used the Continuous Household Survey (*CHS*) collected by the National Statistics Institute (*INE*) in 2003. We restricted the sample to wage earners and self-employed workers between 18 and 59 years of age. Informal workers are defined in this paper as those who do not contribute to the social security system.

Different estimations of the wage gap were used in the simulation. First, we used a very simple econometric model: we regressed by ordinary least squares (OLQ) the log hourly wage on individual and labour characteristics, including a dummy variable that identified if the worker was formally employed.[5] The estimated dummy' parameter (*G1*) is a measure of the wage gap. Then we used the usual way of decomposing wage differences, proposed by Oaxaca (1973) and Blinder (1973). The study estimated an earning equation for the formal workers and another one for informal workers. The difference of the characteristic's rewards --weighted by the mean of the formal workers -- is interpreted as the mean wage gap (*G2*). Analogously, the study estimated the difference between coefficients but weighted by the average characteristics of informal workers (*G3*)

This estimation ignores the endogeneity of the selection decision being formal or informal. We expect unobservable, individual characteristics to be correlated with being formal or informal (i.e. people with easy access to informal networks or to informal benefits could have more potential gains than being informal). To deal with this problem we estimated a switching regression model and used it to calculate the gap between the predicted wage of an average informal worker and the wage he would have had in the formal sector (*G4*).

[5] We controlled personal characteristics (age, education, gender, marital status, geographical region), the type of occupation (public servants, size of the establishment of the private wage earners, self-

The results of the estimations are shown in Appendix 1. We report the different estimations of the wage gap in Table 1. The four alternative estimations suggest that formal workers are highly remunerated.

Table 2
Estimated mean difference in earnings between formal and informal workers (log Wf-log Wi)

Raw gap	0,85
Estimated gap	
G1	0,59
G2	0,65
G3	0,60
G4	0,52

A CGE model that captures these conclusions is presented in the next section.

The CGE model

A Computable General Equilibrium (CGE) model was used to analyse the effects of several external shocks and some specific policies on the Uruguayan labour market,. It is based on the model by Laens and Terra (2000), with several changes regarding labour market behaviour, export demand and institutional design.

The structure of the core CGE model is quite conventional in terms of the analysis of trade-related issues, but an alternative specification is made regarding the labour market. We used two different versions of the model for the simulations: an efficiency wage[6] model and a competitive labour market model.

The main features of this model are as follows:

- It is a multi-sector model with 23 sectors, including two special sectors. One of the two special sectors gathers all the activities (mainly, public services and the financial sector) where employment and wages are fixed, because institutional arrangements and/or trade unions are a deterrent to workers' dismissal or to wage reductions. By law, public employment is fixed: no new public employers are hired, and the existing

employed who own some property and self-employed who do not) and other labour characteristics (part-time and industry).

[6] Following Thierfelder, K.E., C.R. Shiells (1997) and Annabi, N. (2003)

ones cannot be fired. Although trade unions could have been introduced in the model, our intention was to focus on labour market duality between formal and informal workers. Trade union modelling might be included in a future specification of the model.

- The other special sector is an informal sector that produces one type of good destined to domestic final consumption.

- We assume that Uruguay has 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.

- Perfect competition is assumed in all sectors. However, goods are not homogenous, as they are differentiated by geographic origin.

- We assume that there are ten representative households which represent different income levels (by deciles of the income distribution).

- Government collects tariffs and taxes. Government revenue is used to buy goods and services and to make transfers to households. We assume that government has fixed consumption of goods and services (in physical units) and the transfers to households are updated by the change in the average wage[7]. Government savings is obtained as a residual.

- On the production side, the study uses a nested production function. At the top level, firms combine intermediate inputs with value added following a Cobb-Douglas function. Value added is obtained with a constant elasticity of substitution (CES) function that combines capital and composite labour. Then, composite labour is obtained by combining skilled and unskilled labour with a CES. In the informal sector, value added is only composed by unskilled labour.

[7] In 2001 social security transfers represented nearly 83 percent of total government transfers to households. In 1989 a constitutional reform measure established that social security benefits are adjusted to the evolution of Average Wage Index.

- Goods are 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. However, it is assumed that the country faces a downward sloping demand curve for exports (quasi small open economy)[8]. Export demand is a function of relative prices and real income in the trade partners, which are considered exogenous.

- Total demand for each sector is composed by domestic demand (intermediate and final) plus exports to each of the trading partners.

- Trade balance is fixed, 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 and factor markets and in the external sector.

- There are three factors of production: capital, skilled, and unskilled labour (the labour market is segmented by qualifications). The supply of each factor is fixed and there is no international mobility. Skilled labour can only be employed in the formal sectors, while unskilled labour can also be employed in the informal sector.

- In the model with efficiency wages, this behaviour is applied to all formal activities, except for those in the fixed employment sector, which we named APUBLIC, because it is mainly composed of public activities. Unemployment is fixed, so when unskilled workers are fired from the efficiency wage sectors, they go to the informal sector where they receive a lower wage. The specification of efficiency wage behaviour follows Thierfelder and Shiells (1997).

The model was run using GAMS (General Algebraic Modeling System).

Calibration of the CGE model

The model was calibrated using a Social Accounting Matrix (SAM) with data for the year 2000. It was taken from Barrenechea, Katz and Pastori (2004). Originally, the SAM included

[8] Following Cox's specification (1994).

30 different activities and 36 different commodities. Even though this disaggregation was quite appropriate for this study, some adjustments had to be made.

Specifically, it was necessary to show the differences in labour, according to the qualification of workers and their status of formality or informality. Therefore, labour was separated into skilled and unskilled labor. Among skilled workers, informality is not easily available, so it was assumed that skilled labour is always formal. Information about qualifications and formality of workers was taken from the 2003 Continuous Household Survey (CHS) collected by the National Statistics Institute (INE). Workers with twelve or more years of formal education were considered skilled workers.

In order to study the labour market, it was also necessary to distinguish between private and public activities, because there are rigidities concerning both wages and employment in the public sector. Some activities, which are carried out by public and private agents (for example, education or electricity supply), needed to be decomposed. Therefore, a new activity was created that included all activities carried out by the public sector[9]. This sector combines skilled and unskilled labour, such as those found in the private sector, but public employment is considered fixed. To separate public from private activities, information was also taken from the 2003 CHS.

In addition, government final consumption was disaggregated in the new matrix. In the original SAM, government final consumption expenditure was included in a miscellaneous sector called “other services”. Final consumption expenditure of government was estimated from National Accounts. Then, final consumption expenditure was disaggregated according to the information provided by the 1995 SAM (Lorenzo, Osimani and Caputti, 1999; Laens and Terra, 2000).

The rest of the world needed to be disaggregated as well. Argentina and Brazil were separated from the rest of the world, creating three foreign agents. In this case, data was taken from National Accounts and trade statistics from the Central Bank (BCU).

Finally, an informal sector was created besides those originally considered in the SAM. It was assumed that the informal sector produces a composite good of all the activities in

[9] That is: Electricity and Water Supply, Petroleum Refinery, Communications, Postal Service, Financial Services and Educational Services.

which informal labour was identified. This “informal good” is produced entirely for final consumption of households. It was assumed that value added of the informal sector includes only wages. The total amount of informal sector wages was estimated with data from the CHS. As a result, the informal sector includes activities such as agriculture and other primary activities, construction, retail, and textiles and clothing, which have an important component of informality.

The microsimulations methodology

The CGE model provides some insights about the poverty effects of the shocks and policies that were simulated. However, the combination of these results with a microsimulation methodology provides more precise information about poverty and income distribution by tracking the economy-wide changes at the household level. Several approaches have been developed with this purpose, as shown by Bourguignon, Pereira de Silva and Stern (2002).

The microsimulations are based on household data but there is no need to reconcile this data with the SAM because the procedure only needs information about changes in wages, employment and unemployment. The method assumes that changes in the labour market can be replicated by a random selection procedure, which imposes counterfactual changes in labour market parameters calculated for the benchmark year. This approach follows Paes de Barros and Leite (1998), Paes de Barros (1999), Frenkel and González (2000), Ganuza et al (2002) and Ganuza et al (2004). It was applied for the case of Uruguay by Bucheli et al (2002) and by Laens and Perera (2004). The SPSS program used in this paper is the same one used in the latter work.

The rationale for using microsimulations is that a CGE model captures only partial distribution of income between families, therefore making it difficult to see the real impact of shocks or public policies on income distribution and poverty. A crucial assumption adopted in this methodology is that a person’s position in the labour market is the main determinant of his income and poverty status.

The procedure takes CGE results as inputs. Labour market structure is considered as a function of six parameters: participation rate, unemployment rate, wage structure, overall average wage, worker’s education level and structure of employment (sector of activity and occupation category). In this study, the participation rate is fixed, so it is not considered for

the microsimulations. In turn, sector of activity is defined in terms of formal or informal activity.

Once the changes in the labour market parameters are obtained from the CGE results, the microsimulation methodology is applied. The procedure uses random numbers to simulate the changes in the labour market structure that are consistent with the parameters introduced. On average, the effect of the random changes will reflect the impact of the new (simulated) parameters in the labour market. The microsimulations are repeated a large number of times using Monte Carlo numbers to allow for the determination of confidence intervals for the poverty and income distribution indicators. In each simulation, changes in poverty and income distribution are measured through the percentage of population under the poverty line, the poverty gap, the Gini coefficient and the Theil coefficient. Data from CHS for the year 2000 was used.

For each scenario, several changes in labour market structure were simulated, first separately, then sequentially. The idea behind establishing a sequence is that changes in labour parameters follow some order, which is not neutral. The commonly accepted sequence is the following: first the person decides whether to participate or not in the labour force; then the market decides whether he or she will be employed or not; then the person decides whether to work in the formal or formal sector and this determines a certain wage level and, in the aggregate, the average wage. Finally, labour market structure by education level is defined. This sequence was applied in the three models considered. As unemployment is fixed in the model, the corresponding rate remains unchanged. The analysis was made taking the whole sequence into account.

Simulation design and results

Simulation design

In Section 2 we pointed out that increasing trade openness and the integration of the Uruguayan economy to the MERCOSUR augmented the country's vulnerability to external shocks, particularly those originating in Argentina or Brazil. With that idea in mind, the study carried out some simulations in order to show how and why some of the forces at work during the 2002 crisis affected the Uruguayan labour market.

Again as explained in Section 2 the crisis had many components: recession in Argentina and Brazil, changes in relative prices that affected Uruguayan exports to those countries, credit constraints, financial turmoil, external debt growth, capital flight, etc. Unfortunately, it is impossible to evaluate with our CGE the specific weight of each of these factors in the genesis and the deepening of the crisis, particularly because it had a very significant financial component, which cannot be tracked by this model.

Nevertheless, we chose to simulate two relevant components of the 2002 crisis: the change in relative prices vis-à-vis the main trade partners (due to devaluations in those countries) and the foreign savings constraint. In order to assess the effects of the change in relative prices that occurred when Argentina abandoned the currency board regime, we simulated a 40 percent decline in domestic prices nominated in dollars in Argentina and a 7 percent decrease in the price of imports from that origin (ARGRP scenario), which was what really happened in Argentina between 2000 and 2002[10]. In order to compare the effects of the shocks originating in one or the other MERCOSUR partner, we simulated an identical change in prices in Brazil (BRARP).

The third simulation was a restriction in foreign savings. In 2000 the Uruguayan current account was running a deficit, which was financed by capital inflow from the rest of the world. In 2002 the situation was reversed and no capital inflow was available, so a severe adjustment was needed to obtain a current account surplus. Therefore, in this simulation we fixed the current account balance (EXTSAV) at zero.

As cited in Section 2, the MERCOSUR is an imperfect customs union because the common external tariff has not been fully enforced across the four countries. Its full enforcement was simulated in order to assess the effects that it might have on the Uruguayan labour market, especially because the rise in capital goods tariffs might have a negative effect due to a competitiveness loss (CET).

Finally, we simulated a specific labour market policy. Assuming that a reduction in the relative cost of labour might improve employment, the study simulated a 10 percent direct subsidy on formal employment of unskilled labour (DIRTAX).

Table 3 summarizes the five experiments and shows how variables or exogenous parameters are affected. The complete model equations are presented in Appendix 2.

Table 3

Simulation scenarios

Simulation scenario	Variable or exogenous parameters	Variation (%)	
ARGRP	Domestic price index ($DP_{ARG\ i}$)	-40%	
	Exports price from Argentina ($PW_{ARG\ i}$)	-7%	
BRARP	Domestic price index ($DP_{BR\ i}$)	-40%	
	Exports price from Brazil ($DP_{BR\ i}$)	-7%	
EXTSAV	Current account balance (B)	-100%	*
CET	Common external tariff (t)		
DIRTAX	Labour taxes (trab)	-10%	

* In benchmark the current account balance was 4% of GDP

The results of these five simulations with the CGE model are presented in Tables 4 (Variation of main macroeconomic variables) and 5 (Effect on labour market variables).

Simulations of regional shocks and results

These experiments show the vulnerability of the Uruguayan economy to regional shocks, which have increased due to geography and the deepening of the integration process with the MERCOSUR countries.

A change of relative prices in any of the MERCOSUR partners generates a GDP decline in Uruguay, a reduction of exports and imports, and a decrease in investment. The reduction of both exports and imports is due to our choice of model closure, which fixes current account balance. When export demand falls as a consequence of the relative price change with the trading partner, imports fall as well, and adjustment is done through the exchange rate, with a devaluation of local currency.

[10] Data was taken from Indec- National Institute of Statistics and Censuses of Argentina.

Table 4

Macroeconomic variables for each simulation
Percent Variation

	Relative prices change with Argentina	Relative prices change with Brazil	External Savings Restriction	Common External Tariff	Subsidy to Unskilled labour
			Perfect competition model		
Absortion*	-0,38	-0,24	-4,42	-0,23	-0,03
Household Consumption*	-0,14	-0,12	-0,66	-0,18	1,65
Investment*	-2,24	-1,19	-31,32	-0,77	-10,00
Exports*	-7,26	-2,79	9,97	-3,18	-0,44
Imports*	-5,95	-2,04	-11,82	-2,54	-0,36
Real GDP	-0,48	-0,33	-0,54	-0,29	-0,03
Real Exchange Rate	4,19	2,15	1,45	-0,36	-0,81
Export Price	-0,12	-0,09	0,00	0,00	0,00
Import Price	-2,96	-2,44	0,00	0,00	0,00
Consumer Price	0,05	0,00	-0,25	0,09	-0,21
			Efficiency wage model		
Absortion*	-1,13	-0,30	-4,59	-0,22	0,20
Household Consumption*	-0,28	-0,23	-0,58	-0,17	1,85
Investment*	-7,38	-1,03	-33,13	-0,75	-9,39
Exports*	-8,99	-4,62	10,25	-2,78	-0,34
Imports*	-8,22	-4,27	-11,91	-2,14	-0,26
Real GDP	-1,11	-0,27	-0,64	-0,29	0,19
Real Exchange Rate	4,37	2,57	1,57	-0,45	-0,60
Export Price	-0,40	-0,29	0,00	0,00	0,00
Import Price	-2,67	-2,16	0,00	0,00	0,00
Consumer Price	0,04	0,03	-0,14	0,09	-0,17

The macroeconomic impact of the same change in relative prices is more pronounced when it happens in Argentina than when it happens in Brazil. This could be explained by the relative importance of exports to each country in the benchmark: 24 percent of total exports were destined for Argentina, 17 percent for Brazil and 59 percent for the rest of the world. In turn, the share of imports from those origins was 26 percent, 18 percent and 56 percent, respectively.

This result should be taken with caution because it is not necessarily true that a shock coming from Brazil will always have lower effects on the Uruguayan economy than a shock from Argentina. This result is highly dependent on the prevailing macroeconomic conditions, as the region has been affected by severe instabilities that have significantly changed the trade composition by origin or destination. As long as Brazil increases its relative importance as trade partner for Uruguay, the impact of a relative price change in that country could increase substantially.

The impact of a relative price change in Argentina is higher when efficiency wages and the existence of an informal sector are assumed. In this case, real GDP falls by 1.1 percent, while it decreases 0.38 percent when the neoclassical assumptions are adopted. The variation of Argentine relative prices generates a very significant reduction of investment in Uruguay, which would reach 7.4 percent in the efficiency wage model and 2.2 percent in the perfect competition model. Investment declines because government savings decline (as government revenue is lower) along with household savings.

Table 5

Labour Market Variables for each simulation
Percent Variation

	Relative prices change with Argentina	Relative prices change with Brazil	External Savings Restriction	Common External Tariff	Subsidy to Unskilled labour
			Perfect competition model		
Informal Emp	-0,48	0,21	0,48	-0,01	-4,97
Unskilled Emp	0,10	-0,04	-0,10	0,00	1,02
Unskilled Wage	0,34	-0,33	-1,14	-0,17	6,98
Skilled Wage	-0,95	0,20	-0,33	-0,23	0,07
			Efficiency wage model		
Informal Emp	-0,28	0,19	0,37	0,02	-4,36
Unskilled Emp	0,12	-0,08	-0,16	-0,01	1,86
Wage Differential	0,16	-0,11	-0,21	-0,01	2,75
Unskilled Wage	0,00	-0,42	-0,94	-0,19	6,50
Skilled Wage	-1,00	0,09	-0,23	-0,23	-2,76

On the other hand, a change of relative prices in Brazil has greater impact on the Uruguayan GDP when the perfect competition model is used. This could be explained by the factor intensity of goods traded, which is quite different from one country to the other. Trade flows with Argentina are more intensive in skilled labour than trade flows with Brazil (see tables 6 and 7). Therefore, a competitiveness loss with Argentina generates a reallocation of resources towards industries that make intensive use of unskilled labour and capital (see table 8).

Table 6

Factor Intensity of export by destination

	Argentina	Brazil	Rest of the world
Skilled labour / Unskilled labour	0.68	0.30	0.37
Capital / Unskilled labour	0.94	1.47	1.82

Table 7

Specialization and Factor Intensity by sector

	Skill Labour/ Non Skill Labour	Capital/ Non Skill Labour	Trade Balance (millions of U$S)			% of Exports			% of Imports		
			ARG	BRA	RM	ARG	BRA	RM	ARG	BRA	RM
Agriculture & agroindustries	0.08	0.67	1	338	964	11.9	55.9	66.1	12.1	14.7	9.4
Other manuf. goods	0.37	1.33	-411	-330	-1289	25.8	34.7	17.6	63.7	73.1	70.6
Services	1.33	1.06	434	-24	-162	62.3	9.4	16.4	24.2	12.1	20.0
Total	1.00	1.00	23	-16	-487	100	100	100	100	100	100

The study assumes that the skilled labour market is perfectly competitive while the unskilled labour segment is subject to efficiency wages, so that an increase in demand for unskilled labour and a reallocation of resources to those sectors make the results differ more than in the case when the reallocation of resources operates in the opposite direction.

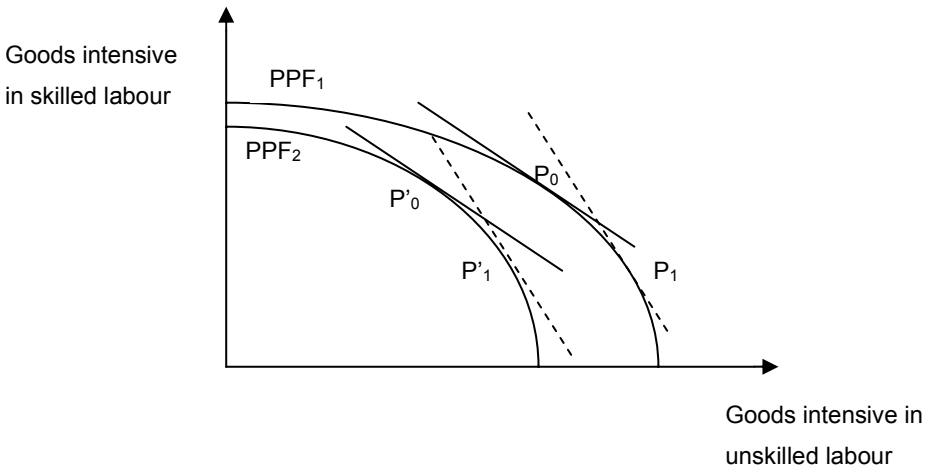
In fact, when there are reasons for paying an efficiency wage, an inefficient resource allocation takes place. The production possibilities frontier shifts to the left when specialization becomes biased towards the production of goods intensive in unskilled labour. Therefore, the larger the specialization in goods intensive in unskilled labour, the greater the inefficiency generated by the existence of efficiency wages and the greater the difference in GDP in relation to an economy where the labour market is perfectly competitive.

Table 8

Output shares and variation by sector
Percentages

	AGRI	MANUF	SERV	INFORMAL
Share of sector in total output	15,4	16,4	63,8	4,4
		Argentina RP		
Perfect Comp	5,1	2,4	-0,8	-0,3
Efficiency Wage	6,1	1,5	-1,9	-0,2
		Brazil RP		
Perfect Comp	-2,9	-1,6	0,2	0,1
Efficiency Wage	-3,6	-1,4	0,3	0
		External Savings Restriction		
Perfect Comp	2,1	0,8	-1,5	0,5
Efficiency Wage	2,8	0,9	-1,8	0,3
		CET		
Perfect Comp	-0,6	1,2	-0,1	-0,1
Efficiency Wage	-0,8	1	-0,2	0
		Subsidy to Unskilled labour		
Perfect Comp	2	0,3	-0,4	-2,3
Efficiency Wage	1,1	0,2	0	-1,9

In order to simplify the problem, we can gather production in two big sectors according to their intensity in skilled or unskilled labour. The following graph illustrates the argument:



The curve PPF_1 is the production possibilities frontier when the labour market is perfectly competitive, while PPF_2 shows the production possibilities frontier when there are efficiency wages in the unskilled labour market segment. Production possibilities are reduced more as production gets more specialized in goods that intensively make use of unskilled labour. P_0

and P'_0 show the best production combinations under perfect competition and under efficiency wages for the initial relative prices. The graph shows that as relative prices change, favoring an increase in the production of goods intensive in unskilled labour, the production combinations shift to P_1 and P'_1, respectively. It can be observed that P_1' is more distant from P_1 than P_0' is from P_0, due to the bias in the production possibilities frontier. This is because when employment increases in the efficiency wages sector, there is an efficiency loss due to an increase in the wage differential.

Table 4 shows that the Argentine change in relative prices generates a very significant reduction in Uruguayan exports, which brings about an increase in specialization in goods intensive in unskilled labour (see table 7). In 2000, 62 percent of total exports to Argentina were services (tourism, financial services, transportation, etc.), many of them intensive in the use of skilled labour (especially, financial services).

Table 5 shows the corresponding effects of these shocks on the labour market. In perfect competition, a change in relative prices with Argentina generates the opposite effect than the same change in Brazil: labour demand increases and so does the wage of unskilled labour, relative to skilled labour wage. A similar occurrence can be found in the version of the model with efficiency wages.

The experiment that assumes an external savings restriction, due to the uncertainty prevailing in the region, generates a very significant decline in imports and investment, while there is an increase in exports. The effects on informal employment and wages are similar to those obtained in the case of a Brazilian change in relative prices, but their size is bigger. In this case, there is also a reallocation of resources towards the traditional exporting sectors, which are intensive in unskilled labour. Sectors like meat packing, dairy products, rice and other typical exporters, increase their unskilled labour demand by more than five percentage points. However, the reduction of investment brings about a 25 percent decrease in unskilled labour demand in construction as 75 percent of this sector's output is destined for investment. This leads to a reduction in the service sector, but this reduction is concentrated to service sector activities that are intensive in unskilled labour. Therefore, unskilled labour demand falls, increasing informality. In addition, the external savings decline generates a fall in payments to all factors (see table 5).

Simulation of MERCOSUR deepening and results

Simulating the full enforcement of the MERCOSUR CET implies an increase in protection in the Uruguayan domestic market, but its global impact is scarce (minimal?) (see table 4). Absorption, household consumption, trade and GDP fall, and this happens in the two versions of the model. There is a reallocation of resources towards the manufacturing sector (chemicals and other import substituting industries), leading to a more intensive use of capital. Anyway, the change in the production structure is slight. (see table 8). The increase in protection brings about an anti-export bias, so agriculture falls. Within services, the sectors that grow are commerce and transportation, but health services, hotels and gas distribution fall and so does other services.

In the labour market a wage decrease is observed, mainly for skilled workers. In the efficiency wage model, there is an increase in informal employment (see table 5). Therefore, the CET approved by the MERCOSUR would not have a positive effect on employment in Uruguay: it would protect workers in the manufacturing sector (where employment increases) but would harm global employment.

Impact of employment policies

We tried to analyse the impact of some policies that could compensate for the negative effects on unskilled labour wages and informal workers, which were found in the previous simulations. To these ends, a 10 percent subsidy was simulated in the case of formal employment of unskilled workers (DIRTAX). The rationale for this type of policy stems from the existence of efficiency wages, which lead to lower employment of unskilled workers.

This policy would have a low impact on absorption and trade, and would increase household consumption, but investment would fall (see table 4). Even though global income increases, savings do not increase in the same proportion because this policy favors lower income households: their income increases exponentially, but these households have lower propensity to save. On the other hand, the policy has a strong fiscal impact, as government expenditure and deficit increase. This explains the investment decline. Table 9 shows the evolution of income for every agent. In the poorest households income increases by 3

percent, while in the richest households, it only increases 0.5 percent. In turn, net government income (revenue minus the subsidy cost) falls by almost 6 percent.

Table 9

Income variation as a result of subsidy on unskilled labour
Percentages

	Perfect Competition	Efficiency Wage
Household average	1,5	1,7
First decile	2,4	3
Second decile	2,6	3,1
Third decile	3,2	3,6
Fourth decile	2,6	2,9
Fifth decile	2,3	2,6
Sixth decile	2,3	2,6
Seventh decile	2,4	2,6
Eight decile	2,1	2,3
Nineth decile	1,2	1,3
Tenth decile	0,4	0,5
Government	-5,9	-5,7

In the perfect competition model, this policy has a negative effect on GDP due to its negative effects on efficiency and resource allocation, but it has a positive effect on GDP in the model with efficiency wages, because this policy tackles the core of the market imperfection: the demand for unskilled workers is below the optimum because there is a cost associated to monitoring, hiring and training such workers.

In the labour market, a very significant increase in unskilled labour demand is observed, which is translated into higher employment of unskilled workers in the formal sector and a rise in their wage (see table 5). In perfect competition, the wage of unskilled workers rises by 7 percent, while this rise is at 9.4 percent in the efficiency wage model. This is consistent with the informality decline of -2 percent in the efficiency wage case. In addition, these changes increase the relative wage of unskilled workers.

Consequently, even though this type of policy seems appropriate in increasing efficiency and improving income distribution, when the efficiency wage hypothesis is valid, it may have perverse long run effects. This is so because investment falls, and there is also a disincentive to human capital accumulation. Both aspects might hinder economic growth in the long run.

Impact on income distribution and poverty

In order to analyse the impact on poverty and income distribution of the shocks simulated with the CGE, we ran microsimulations for two cases: the external savings restriction (EXTSAV) and the subsidy to formal employment of unskilled labour (DIRTAX). In both cases the microsimulations were run based on the CGE results obtained from the two different versions of the model. We chose these two cases because these had the greatest impact on employment, informality and wages.

For each microsimulation, changes in poverty are measured by two indicators: 1) the percentage of people under the poverty line; and 2) the poverty gap that shows the average distance between their income and the poverty line. Income distribution is measured with two well-known indicators: the Gini coefficient and the Theil coefficient. Table 10 shows the results obtained from these microsimulations. As can be observed, all the results are significant with a 95 percent confidence interval.

Table 10

Microsimulation results*
Percentage variations

		Perfect competition model		Efficiency wage model	
	Base year values (%)	External savings restriction	Subsidy on unskilled employment	External savings restriction	Subsidy on unskilled employment
Population below poverty line (P0)	17,8	1,9	-8,3	1,1	-7,7
Poverty gap (P1)	5,6	1	-9,5	1,3	-7,7
Gini coefficient	44,2	0,1	-1,4	0,2	-1,9
Theil coefficient	35,5	0,3	-2,8	0,7	-3,9

*All results are significant with a 95% confidence interval

The restriction on external savings increases the share of the population below the poverty line and the inequality in income distribution, whereas a subsidy on unskilled labour employment in the formal sector has the opposite result. This is consistent with the changes in relative wages between skilled and unskilled labour found in the CGE results.

In the efficiency wage model, a reduction in external savings leads to an increase in poverty: the population below the poverty line increases by 1.1 percent. In addition, income distribution deteriorates, as the Gini coefficient increases by 0.2 percent and the Theil

coefficient by 0.7 percent. The results obtained with the perfect competition model are very similar.

The microsimulations based on the CGE results for the subsidy on formal employment of unskilled labour show a positive impact on poverty and income distribution. The population below the poverty line declines - 8.3 percent in the perfect competition model and - 7.7 percent in the case of the efficiency wage model. Income distribution also improves, as the Gini coefficient is reduced by -1.4 and -1.9 percent, respectively. This might be explained by the significant rise of unskilled wage when this type of policy is implemented: in the efficiency wage model, unskilled wage rises 6.50 percent while the wage differential between formal and informal unskilled workers rises 2.75 percent.

Conclusions

The analysis of the Uruguayan labour market clearly shows the existence of wage differentials between sectors and labour categories. These differentials are wider between workers employed in the formal and in the informal sector, and between skilled and unskilled labour. These characteristics of the Uruguayan labour market indicate the need to incorporate labour market imperfections in the analysis of external shocks and trade policies using a CGE model.

Minimum wage is not effective in Uruguay and labour unions are not strong enough to explain those differentials, except in a few activities, and mainly covering the public sector. Therefore, based on this evidence, the study assumed the existence of efficiency wage behaviour in the private formal sector.

In this context, we constructed a CGE model in which we distinguished for kinds of workers. First, we made a distinction between skilled and unskilled workers. Second, we noted that there is a group of workers in a fixed employment sector, mainly the public sector. Then, as informality is not important for skilled workers, we considered that duality only affects unskilled workers. When unskilled workers are fired from the efficiency wage sectors, they go to the informal sector where they receive a lower wage.

Different simulations were carried out with two versions of the CGE model: perfect competition and efficiency wage. In the second model it was assumed that the labour market

segment for skilled labour operates without distortions, while unskilled labour behaves in an efficiency wage mode. This assumption is reasonable, as both unemployment and informality are low for skilled labour. The perfect competition model was run as a reference.

In the efficiency wage model, an extreme assumption was adopted concerning the displacement of unskilled workers. It was assumed that all displaced unskilled workers went to the informal sector. In fact, some of them remain unemployed.

One clear conclusion from the simulations carried out in this study is that the MERCOSUR economies deeply affect the Uruguayan economy through changes in relative prices. The study shows that the same shocks on relative prices are more important for Uruguay when they originate in Argentina than when they occur in Brazil. However, this result should be taken cautiously because it is highly dependent on the composition of trade with each of those partners. In the benchmark year trade of goods and services was more important with Argentina, which explains the greater impact of shocks from that origin.

Similarly, a restriction on external savings as a consequence of the instability in the region has significant effects on the Uruguayan labour market. On the contrary, the full enforcement of the common external tariff approved by the MERCOSUR does not have an impact of relevance.

The first four simulations show the impact that macroeconomic instability in the region can have on the Uruguayan economy. Both the effect of changes in relative prices with Argentina and Brazil and an external savings restriction are significantly larger than a tariff change. The implementation of policies that tend to reduce the region's share in total trade, such as the reduction of the CET, or free trade agreements with third markets (FTTA, EU-MERCOSUR agreement) is therefore important for Uruguay. At the same time, one main objective of Uruguayan macroeconomic policy should be to avoid significant changes in relative prices with its main trading partners.

The consideration of labour market imperfections is particularly important in cases where the simulations lead to a reallocation of resources towards sectors that use unskilled labour intensively. In this case, the increase in the wage premium implies an efficiency loss, which is larger in areas where the economy is more specialized, such as sectors intensive in unskilled labour.

The simulation of a subsidy on formal employment of unskilled workers shows that despite the increase in the wage premium, there is an increase in GDP due to the efficiency gain derived from the decline of informal employment or unemployment. The introduction of a subsidy stimulates demand for unskilled labour, thus compensating the demand reduction caused by the inefficiency derived from the wage premium. Even though this policy leads to an improvement in employment and income distribution, it generates a decline in investment and a disincentive to human capital accumulation, which could be harmful for growth in the long run.

However, this kind of policy could still be implemented but should be more focused on specific workers, and with a lower tax rate. This way, adverse macroeconomic effects in the long run could be avoided, and informal, low productivity employment could be reduced. With this in mind, a more disaggregated CGE model can contribute in evaluating the impact of more focused policies in the future.

Finally, the effects on poverty and income distribution obtained through microsimulations are consistent with the results of the CGE experiments, that a restriction in foreign savings has a negative effect on both. On the contrary, a policy that introduces a subsidy on formal employment of unskilled labour reduces the percentage of population under the poverty line and improves income distribution.

The study results show the importance of taking into account the existence of imperfections in the labour market. The effects of external shocks, as well as the impact of some policies are clearly different in the presence of these imperfections. This fact emphasizes the need to make an appropriate diagnosis of the labour market when modeling the economy of a particular country.

References

Annabi, N. (2003): “Modeling labor markets in CGE models. Endogenous labor supply, unions and efficiency wages”, Québec, Université Laval (PEP).

Barrenechea, P., G. Katz, H. Pastori (2004): “Construcción de una matriz de contabilidad social para Uruguay para el año 2000”, Working Paper 20/04, Department of Economics, School of Social Sciences, Universidad de la República, Uruguay.

Blinder, A. (1973), “Wage discrimination: reduced form and structural estimates”, Journal of Human Resources, 8(4).

Bourguignon, F., L. Pereira da Silva, N. Stern (2002): “Evaluating the poverty impact of economic policies: Some analytical challenges”, Washington D.C., The World Bank (Mimeo).

Bucheli, M. (2005): “Uruguay: La cobertura de la seguridad social en el empleo, 1991 – 2002”, in Bertranou, F. (ed.): *Protección Social y Mercado Laboral,* ILO, Santiago de Chile.

Bucheli, M., R. Diez de Medina, C. Mendive (2002): “Uruguay: Equidad y pobreza ante la apertura comercial de los noventa. Un enfoque a través de microsimulaciones.”, in R. Vos, L. Taylor and R. Paes de Barros (eds.) *Economic Liberalisation, Distribution and Poverty: Latin America in the 1990s*, Cheltenham (UK) and Northampton (US): Edward Elgar Publishers.

Cassoni, A. and M. Fachola (1997): “Non financial services sector: perspectives in view of the openness and integration process”, unpublished report for the Ministry of Labor, Uruguay.

Cox, David (1994): “Some Applied General Equilibrium Estimates of the Impact of a North American Free Trade Agreement on Canada”, in Francois, J. and C. Shiells: Modeling *Trade Policy. Applied General Equilibrium Assessments of North American Free Trade*, Cambridge University Press.

Croce, H., L. Macedo, and P. Triunfo (2000): “Cost function: an analysis of Uruguayan commercial banks”, Working Paper 1/00, Department of Economics, School of Social Sciences, Universidad de la República, Uruguay.

Frenkel, Roberto, and Martín González Rozada (2000): “Liberalización del balance de pagos. Efectos sobre el crecimiento, el empleo y los ingresos en Argentina – Segunda parte”. Buenos Aires, CEDES (mimeo).

Ganuza, E., R. Paes de Barros, R. Vos (2002): “Labour Market Adjustment, Poverty and Inequality during Liberalisation”, in: R. Vos, L. Taylor and R. Paes de Barros (eds.) *Economic Liberalisation, Distribution and Poverty: Latin America in the 1990s*, Cheltenham (UK) and Northampton (US): Edward Elgar Publishers.

Ganuza, E., S. Morley, S. Robinson, and R. Vos (2004): *¿Quién se beneficia del libre comercio? Promoción de exportaciones y pobreza en América Latina y el Caribe en los 90.* New York, UNDP-Alfaomega Colombiana S.A.

Laens, Silvia and Inés Terra (2000): “Efectos del perfeccionamiento del MERCOSUR sobre el mercado de trabajo de Uruguay: un ejercicio de simulación usando un modelo

CGE", Revista de Economía, Banco Central del Uruguay, 7 (2), segunda época, November.

Laens, S., M. Perera (2004). "Uruguay: crecimiento de las exportaciones, pobreza y distribución del ingreso", in: E. Ganuza, S. Morley, S. Robinson, R. Vos (eds). *¿Quién se beneficia del libre comercio? Promoción de exportaciones y pobreza en América Latina y el Caribe en los 90.* New York, UNDP-Alfaomega Colombiana S.A.

Lorenzo F, R. Osimani, P. Caputti (1999): "Matriz de Insumo Producto y Contablidad Social para la economía uruguaya. Año 1995", *Impacto de la apertura comercial del MERCOSUR sobre el mercado laboral uruguayo*, Documento 3. Montevideo, Programa para el fortalecimiento del Área Social (FAS), Oficina de Planeamiento y Presupuesto (Inédito).

Oaxaca, R. (1973): "Male-Female Wage Differentials in Urban Labor Markets", International Economic Review, 14.

Paes de Barros, R. (1999): "Evaluando el impacto de cambios en la estructura salarial y del empleo sobre la distribución de renta", IPEA, Rio de Janeiro (Mimeo).

Paes de Barros, R. and P. Leite (1998): "O Impacto da Liberalizaçao sobre Distribuiçao de Renda no Brasil", IPEA, Rio de Janeiro (Mimeo).

Saint Paul, Gilles (1996): *Dual labor markets*. The MIT Press.

Shapiro, C. and Stiglitz, J. (1984): "Equilibrium unemployment as a worker discipline device", American Economic Review, Volume 74, N° 3.

Tansini, R. and Triunfo, P. (1998a): "Technical efficiency and trade openness in the Uruguayan manufacture sector", Working Paper 4/98, Department of Economics, School of Social Sciences, Universidad de la República, Uruguay.

Tansini, R. and P. Triunfo (1998b): "Technical change and productivity in Uruguayan industrial firms", Working Paper 12/98, Department of Economics, School of Social Sciences, Universidad de la República, Uruguay.

Thierfelder, K.E., C.R. Shiells (1997): "Trade and labor market behavior", in J.F. Francois and K. A. Reinert (eds), Applied methods for trade policy analysis. A handbook. Cambridge, Cambridge University Press.

United Nations Development Program (2001): "Human Development in Uruguay Report".

Appendix 1
Wage gap between formal and informal workers

Even if there is no widely accepted and accurate definition of informality, the term is often used to refer to economic activities that are not illegal but avoid government regulations. From the labour perspective, workers are considered to be informal when they are not covered -- in practice -- by labour regulations. These regulations include the different aspects of labour legislation, taxation and the entitlement to certain benefits such as the paid sick leave or the retirement pension.

Because of the broad set of aspects covered by labour regulations, it is necessary to choose an operational definition. For our purpose, workers are considered informal when they have a job but do not contribute to the social security system. This contribution is the only regulation that is mandatory to the whole labour force regardless of one's occupation. In turn, the contribution entitles workers to receive a pension during retirement. Besides, the system provides other benefits -- less important in coverage and spending -- to some contributors during their working life e.g. health benefits, family allowances, pensions for the widow and children in case of death, among others.

The data

To estimate the wage gap between formal and informal workers, we used the Continuous Household Survey (*CHS*) collected by the National Statistics Institute (*INE*) in 2003. The *CHS* is a survey carried out in urban areas that inquires about personal and labour characteristics (age, sex, marital status, schooling, hours of work, occupation, industry, etc.) and income received the preceding month classified by sources (wages, pensions, interest payments, etc).

We restricted the sample to the wage earners and self-employed. This means that we excluded the following: people who work in a family enterprise without receiving pay, owners of firms (regardless of size), and members of cooperative units. These groups represent around 5 percent of the active population.

We also limited the sample to workers of 18 to 59 years old, who represent 10 percent of the labour force. The bottom border was chosen because there are specific regulations for

workers younger than 18 years old (the minimum legal work age is 14). Regarding the top border, 60 years old is the minimum required retirement age.

In order to classify a worker as formal or informal we used his status of contributor to the security system for reported information on his main occupation. Accordingly, we worked with data on the earnings and characteristics of the main job.

The earnings were calculated as the sum of in-cash and in-kind monthly regular labour income divided by 4.2 (number of weeks in a month), and multiplied by the hours worked in the preceding week. The monthly regular labour income included: i) the regular earnings reported in the CHS; ii) the monthly in-the-job health benefits estimated by INE and cited in the CHS; iii) an estimation of the so-called thirteenth month wage; and iv) an estimation of a pecuniary benefit received during holidays.

The thirteenth month wage is the right of private and public wage earners to receive an extra monthly wage equivalent during a year. The CHS reports the receipt of this benefit in the worker's main job. Where a positive answer was given, we added an amount equivalent to 1/12 of the reported monthly in-cash regular wage.

Specifically for private sector wage earners, the law establishes a pecuniary benefit to be received during holidays. However, the CHS does not collect information about this benefit. To approximate this benefit, we added an amount equivalent to 1/18 of the reported monthly in-cash regular wage when the worker was a private wage earner and reported to receive a thirteenth month wage.

We made different estimations of the wage gap between formal and informal workers.

First, we used a very simple econometric model: we regressed by OLS the log hourly wage on individual and labour characteristics, including a dummy variable that identified if the worker was formally employed. Let *W* be the wage of a worker, *X* its observable characteristics and *F* a variable that has value1 when the worker is formal (contributes to the social security system):

$$(1) \qquad \ln W = \beta X + G1F + \varepsilon$$

The estimated 'dummy' parameter *G1* reflects the wage gap between formal and informal workers.

Next, we used the usual way of decomposing wage differences proposed by Oaxaca (1973) and Blinder (1973). We divided the sample into two sub-samples, one of formal workers and another of informal workers, and an earning equation was estimated for each one. Let *W* be the wage of a worker, *X* its observable characteristics and *f,i* two sub-indices that denote formality and informality respectively:

$$(2) \qquad \ln W_f = \beta_f X_f + \varepsilon_f$$

$$(3) \qquad \ln W_i = \beta_i X_i + \varepsilon_i$$

We assume that ε_j *(j=i, f)* is an error term with a normal distribution with zero-mean and we estimate both equations by OLS. Denoting the mean of the variables with a bar and making some calculations, we can decompose the raw gap between sectors as:

$$(4) \qquad \left(\ln \overline{W}_f - \ln \overline{W}_i\right) = \left(\overline{X}_f - \overline{X}_i\right)' \hat{\beta}_f + \overline{X}_i ' \left(\hat{\beta}_f - \hat{\beta}_i\right) = \left(\overline{X}_f - \overline{X}_i\right)' \hat{\beta}_i + \overline{X}_f ' \left(\hat{\beta}_f - \hat{\beta}_i\right)$$

The last of the components reflects the wage difference that is not explained by independent variables but by the coefficients of the earnings equations. This may be interpreted as the wage gap valuated in the mean of the formal worker's characteristics. An analogous decomposition allows estimating the wage gap as the difference between coefficients but weighted by the average characteristics of informal workers thus:

$$G2 = \overline{X}_i ' \left(\hat{\beta}_f - \hat{\beta}_i\right)$$

$$G3 = \overline{X}_f ' \left(\hat{\beta}_f - \hat{\beta}_i\right)$$

This estimation ignores the endogeneity of the selection decision of being formal or informal. We expect unobservable individual characteristics to be correlated with being either formal or informal (i.e. people with easy access to informal networks or to informal benefits could have more potential gains in being informal). One strategy to deal with this kind of a problem consists of estimating a switching regression model.

A latent variable F* defines a variable F that takes value 1 when the worker is formal and 0 when he is informal. The variable *F** depends on two different types of characteristics: those that affect the level of earnings and hence the choice of being formal or informal (*X*) and

those that have a direct effect on this choice (*Z*). The model is completed with two wage equations:

$$(5) \qquad F^* = \mu X + \pi Z + \eta$$
$$F = 1 \quad if \quad F^* > 0 \; ; \; F = 0 \quad otherwise$$
$$(6) \qquad \ln W_i = \alpha_i X_i + \omega_i \quad if \quad F = 0$$
$$(7) \qquad \ln W_f = \alpha_f X_f + \omega_f \quad if \quad F = 1$$

The disturbances η are potentially correlated with ω_i and ω_f. We assume that they have a trivariate normal distribution and we do a joint estimation using the full-information maximum-likelihood method. The wage gap between formal and informal workers is estimated by calculating the predicted difference in earnings. Similar to the OLS estimations, we estimate the two gaps thus:

$$G4 = \overline{X}_i \,' \left(\hat{\alpha}_f - \hat{\alpha}_i \right)$$
$$G5 = \overline{X}_f \,' \left(\hat{\alpha}_f - \hat{\alpha}_i \right)$$

Results

The results of the earning equation proposed in equation (1) are reported in column (A) of Table 1. We controlled personal characteristics (age, education, gender, marital status, geographical region), the type of occupation (public servants, size of the establishment of the private wage earners, self-employed who own some property and self-employed who do not and other labour characteristics (part-time and industry). In columns (B) and (C) we report the results of the estimation of equations (2) and (3). Finally, the results of the switching regression model estimations appear in the last columns. The signs of the effect of the usual explanatory variables included in the earning equation are expected: labour income increases with education, rises with age at decreasing rates and is higher for married people and for men.

We report the predicted difference in earnings in Table 2. The five alternative estimations suggest that the formal workers are highly remunerated.

Table 1. Results of regression estimates

	OLS regression estimates			Switching regression estimates		
	Whole sample (A)	Formal workers (B)	Informal workers (C)	Sector allocation*** (D)	Formal workers (E)	Informal workers (F)
Formal	0,592 (41.63)**					
6 to 8 years of schooling	0,163 (6.49)**	0,07 (2.37)*	0,182 (5.12)**	0,263 (29.62)**	0,093 (19.76)**	0,162 (31.67)**
9 to 11 years of schooling	0,294 (11.07)**	0,212 (6.98)**	0,296 (7.39)**	0,563 (60.39)**	0,256 (52.92)**	0,247 (42.64)**
12 years of schooling	0,446 (16.47)**	0,379 (12.31)**	0,421 (9.84)**	0,811 (84.04)**	0,434 (88.70)**	0,343 (52.96)**
Tertiary level incomplete	0,662 (21.35)**	0,56 (16.51)**	0,788 (12.33)**	0,977 (78.10)**	0,626 (116.85)**	0,689 (75.02)**
Tertiary level complete	0,902 (30.54)**	0,805 (24.59)**	1,118 (13.28)**	1.601 (127.72)**	0,894 (170.94)**	0,925 (75.36)**
Age	0,051 (14.93)**	0,059 (16.46)**	0,048 (7.68)**	0,055 (39.09)**	0,063 (110.35)**	0,043 (46.43)**
Age squared (/100)	-0,05 (11.54)**	-0,057 (12.50)**	-0,053 (6.36)**	-0,044 (24.75)**	-0,061 (85.66)**	-0,048 (40.83)**
Civil status (Married=1)	0,119 (11.28)**	0,093 (8.33)**	0,149 (7.33)**	0,22 (38.10)**	0,108 (61.73)**	0,125 (39.91)**
Gender (Female=1)	-0,217 (20.14)**	-0,209 (19.06)**	-0,243 (9.94)**	0,038 (6.93)**	-0,209 (125.31)**	-0,247 (70.99)**
Agriculture	-0,06 (2.11)*	-0,127 (3.67)**	0,016 (-0,35	0,234 (23.80)**	-0,115 (23.99)**	-0,005 -0,68
Electricity, water & gas	0,352 (9.79)**	0,262 (7.35)**	-0,19 -0,42	0,542 (8.80)**	0,276 (41.80)**	-0,296 (3.17)**
Construction	0,128 (4.85)**	0,037 -1,36	0,194 (4.81)**	-0,312 (30.42)**	0,011 (2.16)*	0,206 (34.97)**
Commerce	-0,055 (3.32)**	-0,068 (3.96)**	-0,011 -0,35	0,254 (39.83)**	-0,05 (17.29)**	-0,034 (7.26)**
Transport	0,076 (3.38)**	0,055 (2.46)*	0,025 -0,44	0,395 (40.92)**	0,079 (22.12)**	-0,026 (3.23)**
Finance	0,241 (10.37)**	0,234 (9.27)**	0,163 (3.37)**	0,556 (62.69)**	0,273 (80.96)**	0,101 (14.17)**
Services	0,102 (6.08)**	0,007 -0,39	0,248 (7.53)**	0,084 (12.19)**	0,018 (6.27)**	0,24 (48.38)**
Part time (less than 30 hours=1)	0,416 (28.03)**	0,395 (20.86)**	0,427 (20.12)**	-0,863 (163.92)**	0,334 (120.11)**	0,504 (129.86)**
Region (Montevideo=1)	0,209 (21.09)**	0,169 (16.30)**	0,271 (13.83)**	0,196 (47.65)**	0,181 (111.85)**	0,251 (84.36)**
Public servant	0,231 (8.09)**	-0,007 -0,1	0,167 -1,49	3.382 (258.43)**	0,32 (33.93)**	-0,29 (13.65)**
Self-employed with property	0,137 (4.88)**	-0,08 -1,09	0,129 (3.92)**	0,7 (72.13)**	0,052 (6.40)**	0,094 (20.92)**
Private micro-enterprise (< 5)	0,117 (4.56)**	-0,21 (2.95)**	0,132 (4.46)**	1.352 (141.40)**	-0,034 (4.03)**	0,032 (5.95)**
Private little enterprise (5-9)	0,163 (5.76)**	-0,163 (2.29)*	0,25 (6.45)**	1.865 (178.31)**	0,084 (9.43)**	0,08 (9.74)**
Private other size (>9)	0,289 (10.73)**	0,027 -0,38	0,231 (5.84)**	2.619 (271.86)**	0,33 (36.27)**	-0,067 (6.01)**
Household head				0,022 (3.37)**		
Household head's spouse				0,031 (3.82)**		
School attendance (attendance=1)				0,058 (6.33)**		
Retirement pension (recipient =1)				-0,306 (31.14)**		
Household income (log)				-10^4 x 4.7 (-0.53)		
Constant	1,057 (15.24)**	1,87 (18.91)**	1,068 (9.09)**	-3,613 (123.27)**	1,362 (84.85)**	1,219 (67.54)**
Observations	17767	11450	6317			
R-squared	0,48	0,4	0,23			

* Denotes significance at 5%; ** denotes significance at 1%; *** Correlations: η and ωf = 0,41314*; η and ω_l = -0,30800*

Table 2. Estimated mean difference in earnings between formal and informal workers (log Wf – log Wi)

Raw gap	0,85
Estimated gap	
G1	0,59
G2	0,65
G3	0,60
G4	0,52

Appendix 2: The CGE model

Equations

The equations of the CGE model are presented in this appendix. Three versions of the model were specified: perfect competition in the labour market, efficiency wages for non skilled workers, and the wage curve. Lower fonts indicate endogenous variables, capital fonts refer to exogenous variables, and Greek letters indicate parameters. The subscripts *i, j* refer to sectors, the subscripts *z, t* refer to geographic zones and the subscripts f refer to representative households grouped according to income levels as follows:

i, j = {1, 2, …, J}

z = Uruguay (u), Argentina (a), Brazil (b), rest of the world (r)

t = a, b, r

f=(f1,f2,f3,f4,f5,f6,f7,f8,f9,f10)

k=(f1,f2,f3,f4,f5,f6,f7,f8,f9,f10,g)

Demand Structure

Demand functions are derived from a Cobb Douglas utility function which is an increasing function of consumption of composite goods that combines different varieties of differentiated goods. In turn, the sub-utility functions follow an Armington specification (1969) in perfect competition sectors. In the perfectly competitive sectors, goods are differentiated by geographic origin.

Consumers maximize a Cobb Douglas utility function subject to their budget constraint. As such, demand for each good is stated thus:

$$c_{if} = \mu_{if} . \frac{y_f (1 - td_f)(1 - msav_f)}{pf_i} \qquad (1)$$

where c_{if} is the demand for a composite final good *i* (differentiated by geographic origin), Y_f is total income of a representative household f in Uruguay, td_f is direct tax rate, $msav_f$ is marginal propensity to save, and pf_i is the composite price index. This index can be written as:

$$pf_i = \left(\sum_z \lambda_{zi}^{\phi_i} \left(p_{zi} \right)^{1-\phi_i} \right)^{1/(1-\phi_i)} , \qquad (2)$$

being λ_{zi} the share parameter in the Armington function, Φ_i the elasticity of substitution between goods from different origin, and p_{zi} the market price of good *i* from market *z.*

Investment demand of good i is a fixed share of total investment:

$$c_{iinv} = \mu_{iinv} \frac{I}{pf_i} \quad (3)$$

I being total investment.

Final demand of a differentiated good *i* produced in country *z* by a representative household f is:

$$d_{zik} = \lambda_{zi}^{\phi_i} . \left(\frac{p_{zi}}{pf_i} \right)^{-\phi_i} . c_{ik} \quad (4)$$

where d_{zih} is the final domestic demand of the ia<institution f.

The export demand for a representative domestic firm is a decreasing function of the export price:

$$e_{iz} = \frac{e_{0iz} . p_{iz}^{-\eta_i} . R_t}{ER . pd_{zi}^{-\eta_i}} \quad (5)$$

where e_{iz} is the demand for a variety of the differentiated good *i* in market *z*, p_{iz} is the export price from Uruguay, pd_{zi} is the domestic price index of good i in market z, R is the real income of the partner z, ER is the exchange rate, and e_{oiz} is a parameter.

Production

Each sector combines primary factors and intermediate inputs following a Cobb-Douglas production function. The value added is a nested CES production function combining skilled labour, unskilled labour, and capital.

Cost

Total variable cost is derived from a Cobb-Douglas constant returns to scale production function. The variable unit cost is:

$$v_i = \omega_i \left(vc_i \left(1 + tind_i \right) \right)^{1-\sum_j \alpha_{ji}} . \prod_j vi_{ji}^{\alpha_{ji}} \quad (6)$$

where v_i is the variable unit cost, vc_i is the value added cost and vi_{ij} is the composite price of intermediate inputs. α_{ij} is the distribution parameter of a Cobb-Douglas production function, and ϖ_i is a parameter.

Value added is a combination of labor and capital specified as a CES. Thus, vc_i is:

$$vc_i = \left[\left(1 - \delta_i \right)^{\sigma_i} . r_i^{(1-\sigma_i)} + \delta^{\sigma_i} . w_i^{(1-\sigma_i)} \right]^{1/(1-\sigma_i)} \quad (7)$$

where r_i y w_i,, are the rental rate of capital and the average wage. δ is distribution

parameters of the CES function for value added, while σ_i is the elasticity of substitution between capital and labour.

As the model considers two types of labour, the average wage is a combination of skilled and unskilled wage. It is assumed that skilled and unskilled labours are combined following a CES function, so the average wage is:

$$w_{li} = \frac{1}{\varphi_i} .\left[(1-\xi_i)^{\theta_i} .(wu.wd)^{1-\theta_i} + \xi_i^{\theta_i} .ws_i^{1-\theta_i}\right]^{1/(1-\theta_i)} \quad (8)$$

where w_{li} is the average wage, *wu* y ws_i are the unskilled and the skilled wage, respectively, ξ y φ are the distribution and scale parameters, and θ_i is the elasticity of substitution between skilled and unskilled labour.

The efficiency wage is endogenous. It is assumed that the workers caught from (What do you mean by this?) the efficiency wages sectors go to the informal sector, where the labour market is competitive and wage premiums are absent. To model the efficiency wage premium we follow Thierfelder and Shiells (1997):

$$\frac{wd_i - 1}{wd} = \frac{\kappa.rd}{((D2 - D1))} + \frac{\kappa(D1 + S)\overline{LU}}{((D2 - D1)\left(\overline{LU} - \sum_{i \mp \inf ormal} lu_i\right)} \quad (9)$$

where κ is the utility of shirking, rd is the discount rate, D! is the probability that no-shirking workers will be falsely accused and fired from the efficiency wage sector, D2 is the probability to be caught shirking and therefore fired, S is the rate of quitting the efficiency wage sector. Other specifications of the model do not consider situations when a worker is fired from the efficiency wage sector and remains unemployed. The estimation of the wage curve will be used to calibrate the parameters.

The intermediate inputs are differentiated by geographic origin with an Armington formulation. The composite price of intermediates is:

$$vi_{ji} = \left(\sum_z \gamma_{zji}^{\phi_j} .. \left(p_{zj}\right)^{1-\phi_j}\right)^{1/(1-\phi_j)} \quad (10)$$

where p_{zj} is the price in the local market of input j used in sector i from each zone, γ_{zji} is the CES distribution parameter, and ϕ_j is the elasticity of substitution between goods from different origins.

Input and factor demand by firm

Firms maximize their profits so demand for intermediate inputs and value added (labour and capital) in each sector is obtained from their maximization program:

$$x_{zji} = \frac{\alpha_{ji}.v_i\, q_i}{vi_{ji}} \left(\frac{p_{zj}}{\gamma_{zji}.vi_{ji}} \right)^{-\phi_j} \qquad (11)$$

where x_{zji} is the demand for input *j* coming from country *z* and used by sector *i* for each firm in sector *i*. It is a decreasing function of the input price.

Valued added demand is a decreasing function of the value added cost and increasing function of the unitary cost and output in each sector:

$$va_i = \alpha v_i q_i \frac{v_i}{vc_i(1+tind_i)} \qquad (12)$$

Factor demand is a decreasing function of their return rate and is an increasing function of value added and its price:

$$fd_i = \left(\frac{w_i}{\delta_{fi}.vc_i} \right)^{-\sigma_i} .va_i \qquad (13)$$

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

$$ls_i = . \left(\frac{ws_i(1+tfac_f}{\xi_i.w_i} \right)^{-\theta_i} . fd_{li} \qquad (14)$$

$$lu_i = \left(\frac{wu.wd_i(1+tfac_f)}{(1-\xi_i)w_i} \right)^{-\theta_i} . fd_{li} \qquad (15)$$

Domestic pricing

In the perfect competitive sectors, the equilibrium price of output is equal to its variable unit cost (v_i):

$$p_{ui} = v_i(1+tex_i) \qquad \text{when i= competitive sectors} \qquad (16)$$

where the lower case *"u"* refers to Uruguay. The firms charge the same price in domestic and foreign markets.

General Equilibrium

Public services fix prices, wages, and employment whereas production level and capital demand is endogenous.

Income of the households is endogenous and is the sum of the returns to factors of production and transfers from the government:

$$y_f = \sum_i (l_i.w_i + k_i.r_i + f_i). + tr_f + \overline{wg}\,\overline{\lg} \qquad (17)$$

Government income is the sum of the receipts of tariff collection, indirect taxes and profits from public firms:

$$y_g = \sum_i (l_i.w_i + k_i.r_i + f_i).tind_i + \sum_i (\pi_i). + \sum_i \left(\sum_z \tau_{zi} d_{zi} n_{zi} p_{zi}. + n_{ui} \sum_z \sum_j \tau_{zj} x_{zji}.n_{zj}.p_{zj} \right) \qquad (18)$$

Government expenditure is the sum of household transfers, public wages and government consumption:

$$GE = \sum_f \overline{tr}_f + \sum \overline{d}_{zig} p_{zi} + \overline{wg}\,\overline{\lg} \qquad (19)$$

where GE is the government expenditure, d is the government consumption of good I, which is a fixed coefficient, wg is the public wage and lg is public employment, both fixed.

Government savings is the difference between government income and expenditure:

$$SG = y_G - GE \qquad (20)$$

and assumed to be constant.

The equilibrium conditions in the labour market are:

$$LS_i = ls_i + fs_i.n_i \qquad (21)$$

where LS_i is the supply of skilled labour and

$$LU = \sum_i (lu_i + fu_i.n_i) \qquad (22)$$

where *LU* is the supply of unskilled labour. Both variables are exogenous.

The equilibrium equation for capital is:

$$K_i = k_i + fk_i.n_i \qquad (23)$$

where K_i is capital supply (exogenous).

When factors are assumed to be sector specific there is one equilibrium condition for each factor and sector, but when factors are assumed perfectly mobile there is only one equation for each factor.

The equilibrium conditions in the goods market require that supply equals demand in each sector:

$$q_i = d_{ui} + \sum_j x_{uij} + \sum_t e_{it} \qquad (24)$$

Finally, the external equilibrium is:

$$\sum_i \sum_t e_{it}.p_{ui} ER - \sum_i \sum_t d_{ti} p_{ZI} - \sum_i n_{ui} \sum_j \sum_t x_{tji}.p_{tj} = B \qquad (25)$$

In all the simulations B is fixed in terms of the numerary.