Poverty and Income Distribution Under Different Factor Market Assumptions: A Macro-Micro Model

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Abstract

The effect of trade liberalization on poverty and income distribution has long been a hotly debated topic. The approaches to analyze this important issue include a variety of methodologies, from general equilibrium modeling, to econometrics, to case analysis. Due to the central importance of the labor market for poverty results in developing countries, this paper tries to better represent the labor market both through household-level modeling and also through better factor market assumptions at the macro level. This paper combines a Computable General Equilibrium (CGE) macro model of Argentina with an econometric microsimulation model of household income generation. It examines the effects of a generalized trade liberalization scenario on poverty and income distribution under six different labor and capital market assumptions. The movement of individual workers across economic sectors and their wages are determined by personal characteristics in a sectoral choice and a wage regression model, respectively. The results show that the factor market assumptions do have an effect on the simulated poverty results. Assumptions of full employment, as most commonly used in many CGE analyses, result in negative poverty effects for the poorest. A growing economic sector can only increase its number of workers by pulling them from other productive sectors leading to smaller allocative improvements relative to a potentially negative terms-of-trade effect. More realistic scenarios that allow unemployment of labor, on the other hand, and simulate the effects of fixed nominal versus real wages, show that trade liberalization can lead to positive results for poverty, extreme poverty, and household income distribution. Although wage inequality increases some in this case, the overall results point to the benefits to the Argentine economy of domestic and worldwide trade liberalization.

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1 Introduction

The effect of trade liberalization on poverty and income distribution has long been a hotly debated topic. The approaches to analyze this important issue include a variety of methodologies, from general equilibrium modeling, to econometrics, to the analysis of cases. Due to the central importance of the labor market for poverty results in developing countries, this paper tries to better represent the labor market both through household-level modeling and also through better factor market assumptions at the macro level. This paper combines a Computable General Equilibrium (CGE) macro model of Argentina with an econometric microsimulation model of household income generation. It examines the effects of a generalized trade liberalization scenario on poverty and income distribution under six different labor and capital market assumptions.

In recent years, a number of papers have began to use household income generation models and microsimulation methods to assess the impacts of different demographic characteristics, labor market changes, or policy shocks on poverty and income distribution. Estimation of poverty and inequality is nothing new; comparisons of both welfare indices across countries and over time have been abundant. However, the increasing amount of household survey data and the increasing power of computers to process these larger datasets have greatly enhanced micro work at the household level and allowed the use of microsimulation techniques to describe behavioral changes and measure changes in these welfare indicators.

The methods and models used to measure poverty and inequality have varied over time and have built on each other. In the early 1970s, studies on, for example, inequality by Oaxaca (1973) and Blinder (1973) focused on wage differentials and wage distributions. To decompose the distribution and see the effects of particular components, the authors combined regression estimates of parameters from one period's wage distribution with the individual characteristics from another period to simulate a counterfactual distribution. Using this methodology, Almeida dos Reis and Paes de Barros (1991), Juhn, Murphy, and Pierce (1993), and Blau and Khan (1996) provide examples of different extensions and applications of this earlier work on wage inequality. Likewise, the decomposition of Generalized Entropy inequality measures (or Theil decompositions) became another way to measure the components causing income distributions to differ across countries (see Bourguignon, 1979, Cowell, 1980, Shorrocks, 1980, or Theil, 1967).

The next stage of research has focused on generalizing the methodology beyond just wage distributions. Bourguignon, Ferreira, and Lustig (1998)[1], for example, present a

[1] This research proposal builds on the work of Almeida dos Reis and Paes de Barros (1991) and Juhn, Murphy, and Pierce (1993).

decomposition of distributional changes based on the distribution of household per capita income and analyze its dynamics. In addition, rather than focusing on one (scalar) summary statistic, they study the effects of changes on the entire distribution. Their microsimulation methodology specifies a household income generation model through which a system of equations calculates price, income, demographic, and labor effects on household income and for which the labor market outcomes are based on estimated labor supply and earnings functions.

In a second paper, the authors again use a sequence of "intermediate" counterfactual distributions to compare two income distributions, but the methodology is now extended to a cross-country framework (Bourguignon, Ferreira, Lustig, 2002). The true conditional distributions are approximated using a parametric model as in Almeida dos Reis and Paes de Barros (1991).[2]

The most recent stage of research has combined household data with data at the sector, market, or economy-wide level. The latter three can incorporate the overall effects of different simulations on several key aggregate variables such as factor supplies and relative prices. However, unlike most economy-wide models, sector- or market-specific models, such as Taylor and Adelman's (1996) village model or Heckman's (2001) general equilibrium model for the labor market, respectively, usually include all observations from the corresponding household surveys (see Bourguignon, Robilliard, and Robinson, 2002). Economy-wide models, on the other hand, are multi-sectoral and describe the full economy (not just one market), yet usually employ representative household groups rather than all observations in the framework. Therefore, given a specification for the within-group distribution, simulation results from these models may miss the within-group component of inequality. However, using household surveys in a microsimulation econometric model that is integrated with an economy-wide model, as done in this paper, incorporates household heterogeneity and allows a better analysis of issues of income distribution and poverty.

Two types of economy-wide models that combine with data at the household level are macroeconometric models (as in Ferreira and da Silva for Brazil [2004]) and Computable General Equilibrium (CGE) models. Due to the difficulty in estimating macroeconometric models given poor data or short time-periods, the CGE model is a popular framework among many researchers. Robilliard, Bourguignon, and Robinson (2001) estimate a household income generation microsimulation model that is joined to a macro CGE component to create a "top-down" model that takes into account the heterogeneity of households in

[2] The true distribution could also be approximated non-parametrically as in DiNardo, Fortin, and Lemieux (1996).

calculating poverty and inequality. In this way, they join the micro-econometric household model with results from policy simulations at the macro level. It is called "top-down" because the CGE model communicates with the microsimulation model through a vector of prices, wages, and employment levels, which is passed from the macro to the micro level without a feedback effect.

Ganuza, Morley, Robinson, and Vos, eds. (2003), contains examples of another macro-micro methodology that uses a CGE framework. The micro component of the model, however, uses a random selection procedure to analyze changes in household income distribution and poverty for each simulation.[3] Given the counterfactual provided by the CGE model, the micro model selects at random (with multiple repetitions) from the corresponding labor groups the individuals who will change sectors, and then calculates the change in the poverty rate or income inequality for that given scenario.

In the present paper, as mentioned earlier, the methodology combines a similar "top-down" approach to join a CGE macro model to an econometric microsimulation model. The macro-level results for a given policy change will determine new levels of employment in each economic sector and new wages and relative prices. When transferred to the household model, the latter will result in new individual wages and employment as well as a new distribution of household per capita income and a new poverty rate. The methodological issue, as for the papers mentioned above, is how to select those individuals who will change sectors when there is a change in labor demand and what new level of income to assign them. For the micro component, rather than randomly selecting the individuals in the simulations as done in Ganuza et al. (2003), the paper will use econometric analysis to determine who moves and their new income levels. Also, rather than focus on an occupational choice model as done by Robilliard et al. (2001), this paper estimates a multinomial logit model for the sector of work and uses the full set of estimated coefficients in the prediction of probabilities. Therefore, this approach determines the probability of movement of each individual to the different production sectors based on personal characteristics, and estimates the potential wages of non-workers who enter the labor force.

In addition, this paper will focus one level up from the econometric household model on the labor market linkages in the macro model. The approach will be to analyze the results in the context of a macro shock to an economy-wide general equilibrium model for Argentina in 1993 to catch the interactions within the labor market that are not captured at the household level. The underlying assumptions concerning the adjustments of different factors and wages

[3] This model is again an extension of the earnings inequality methodology developed by Almeida dos Reis and Paes de Barros (1991).

across labor markets (called "factor market closures" in some general equilibrium models) should affect the final welfare results. Therefore, this paper will compare the different results obtained under a variety of labor market assumptions.

As an example and to make the model interesting from a policy perspective, the paper will look at the effects on poverty and income distribution from assuming full trade liberalization under a comprehensive WTO agreement. Trade liberalization can help promote economic development and poverty alleviation (WTO, 2001), therefore a simulation of a future multilateral trade scenario would show what benefits Argentina could potentially receive from a less protectionist domestic and world environment. The results will in large part also depend on the factor market closures that are assumed to represent the economy. By imposing a macro shock (in this case in the form of the WTO scenario), the paper can thus also focus on studying the effects of different labor and capital market closures. This is relevant for the simulations of different scenarios for trade negotiations. In general, most of the models used for these simulations utilize full employment closures, while others have explored alternative closures (Diao, E. Diaz-Bonilla, and Robinson, 2003), but there have not been comparisons of results under these different closure rules. This paper fills that gap.

The next section will present the econometric microsimulation model, beginning with an explanation of the household data and then an explanation of the sectoral choice model, the estimation of wages, and the household income generation model along with the poverty lines. Section 3 will present the results for the econometric models. Section 4 will then give a quick overview of the CGE model. Section 5 presents the policy simulations and market closures, while section 6 contains the results for poverty and income distribution. Section 7 concludes.

2 Econometric Microsimulation Model

To study the impact on poverty and income distribution from a shock to the economy or a policy change, in this case the implementation of full trade liberalization under a WTO agreement, a microeconomic model needs to account for movements in workers and changes in wages and other price levels. A household member's employment status, his sector of work, and the given wage rate all affect total household income and its distribution across the full sample of households. In turn, these variables, along with price levels that affect the poverty line, will also affect poverty rates.

It is not a simple task to decide how to model the movements in the labor market at the individual and household level (which would correspond to new poverty rates and income distributions). Several microsimulation methodologies have been proposed for this in the literature, as explained in section 1. Under a different econometric framework, the microsimulation approach used here allows one to go from labor market outcomes to the household distribution using information from household surveys.[4]

Employment levels in the economy adjust to shocks or policy changes both in terms of the total amount of labor utilized and their division among the sectors of production. Depending on the factor market closure assumed in the macro model (as will be explained in section 5.2), average nominal or real wages and sector specific nominal or real wages for each labor type also adjust. The labor force is broadly divided into unskilled, semi-skilled, and skilled men and the same for women (for a total of 6 categories). Therefore, for each simulation the CGE model calculates the change in the total number of workers by skill level and gender in each sector. The microsimulation model receives these totals from the macro model and uses econometrically estimated functions, rather than random drawings, to determine which specific people move to different employment categories and sectors.

The microsimulation model has three main components: a sectoral choice model, a model of wage earnings, and a summation of the new wage and employment results for each household, from which follow the new poverty and income distribution results. Before turning to an explanation of each of these components, the next subsection presents the micro level data.

2.1 Data

The data for the microeconometric model consists of cross-sections of urban households from Argentina's Permanent Household Survey (Encuesta Permanente de Hogares – EPH) in October 1993. Since the EPH does not include rural areas, the analysis in this paper will apply only to the urban sector, which includes about 88% of the total population. The cross-sections consist of demographic and income information for each member of each sampled household. The questionnaire has 3 levels of detail, which vary by urban center. The most detailed level (which includes a better disaggregation of sectors and sources of incomes) covers 18 urban agglomerates, which account for some 18.1 million people, about 62% of the urban population, or 54% of the total population. This is the sub-sample used for the microeconometrics. The full sample (that includes the surveys with less detailed

[4] Some early examples of simulation work, although not for household models such as these, include Orcutt (1960) and Bergmann (1973 and 1990). Bergmann points out that there are situations in which simulation aids theoretical models in terms of the analysis and in actually reaching results. However, she also explains how simulation work is best when aided by econometrically estimated parameters where possible (1990).

questionnaires) is only used to disaggregate the labor force in the macro CGE model.

The total labor force is disaggregated into 6 urban labor categories for use in the CGE model. These exhaustively include urban unskilled, urban semi-skilled, and urban skilled men and women. The unskilled are individuals with a primary school education or less (UUSKL), the semi-skilled have completed high school (USSKL), and the skilled have more than a high school education (USKL). The CGE also includes 2 rural labor categories for men and women (RURM and RURF, respectively), but due to a lack of information for rural households in the EPH, this group is omitted from the microsimulations and the welfare measures.

For the microeconometric model, the agglomerates in the sub-sample are divided into 5 main regions: Gran Buenos Aires (GBA), which is the capital plus the surrounding metropolitan area of Argentina; the Northwest (NW), which includes Gran Catamarca, S.M. de Tucuman y Tafí Viejo, La Rioja, Salta, S.S. de Jujuy y Palpalá, and Santiago del Estero y La Banda; Cuyo (CU), which includes Gran Mendoza, Gran San Juan, and San Luis y El Chorrillo; the Pampas region (PP), which includes Bahía Blanca, Concordia, Gran Córdoba, Gran La Plata, Gran Rosario, Mar del Plata y Batán, Paraná, Río Cuarto, Santa Fé y Santo Tomé, and Santa Rosa y Toay; and Patagonia (PT), which includes Comodoro Rivadavia, Neuquén y Plottier, Río Gallegos, and Tierra del Fuego. All 5 variables for the regions are 1/0 indicator functions. Because of a lack of data in 1993, a sixth region (the Northeast) is omitted from the analysis at the micro level.

The productive sectors within the EPH sub-sample are also aggregated into 5 main categories for urban workers: 1) "Primary Activities" (agriculture and mining) or "Food Processing"; 2) Manufacturing, which includes "Textile", "Chemical", and "Metal Production and Equipment"; 3) "Electricity, Gas, and Water"; 4) "Construction" and "Other Manufacture"; and 5) Services, which includes "Wholesale", "Retail", "Restaurants and Hotels," "Transportation," "Communications and Telephone," "Financial Services," "Services to Firms," "Public Administration and Defense," "Public Education," "Medical Services," "Other Social Services," "Repair Services," "Domestic Services," and "Other Services." The variable for industry of work, IND, in the multinomial logit model is aggregated up to these 5 industry codes to maintain comparability across the cross-section survey samples.

The education variables are 1/0 indicator functions that equal 1 for the corresponding educational level and zero otherwise: no education or incomplete primary (eduPn), complete primary (eduP), incomplete secondary (eduSn), complete secondary (eduS), incomplete vocational (eduVn), complete vocational (eduV), incomplete university (eduUn), and complete university (eduU). In the case of the MNL, vocational and university levels are put together into one variable so that edUn is incomplete vocational or university education and edU is complete vocational or university education.

The remaining relevant variables include: MALE, a 1/0 indicator function which equals 1 if the individual is male and 0 otherwise; AGE and AGE2, a variable for the individual's age and its corresponding squared term; y, the log of labor income; y0, all sources of non-labor income, and dum92, dum93, and dum94, which are 1/0 indicator functions for the corresponding years 1992, 1993, and 1994.

Table 1 shows the variable definitions as well as the mean and standard deviation of each. The observations' weights are used to calculate the statistics and represent the population of the 18 urban centers.

2.2 Sectoral Choice Model

The first two components of the microsimulation model are estimated econometrically, starting with the sectoral choice model in this subsection.[5] For a specific policy simulation in the macro model, if a sector gains workers, the micro model requires a way to choose who will be the added workers. A multinomial logit (MNL) model determines a person's probability, given certain characteristics, of working in each of the 5 productive sectors. This provides a way of sorting people from those with the highest to the lowest probability of working in a particular sector. Therefore, when a sector gains workers, the new workers are chosen from the unemployed pool for that specific sector by their probability of working there. If all the unemployed (according to the household surveys) within a sector find a job, then the remaining demand would be met by any unemployed workers in the remaining sectors, and lastly, if the demand is still not met, by choosing from available inactive working-age men and women (also according to the household surveys). For example, a shock to the economy that causes an increase in the demand for unskilled male workers in manufacturing will pull these workers from the pool of unemployed unskilled male manufacturing workers first. If this pool is depleted, then the remaining new workers are chosen from the remaining unemployed unskilled male workers, and lastly if needed from inactive unskilled working-age men.

The likelihood of working in a particular sector is modeled as a discrete choice problem because the five possible sectors of work form a finite set of choices for each individual. Individual choice is treated as deterministic, using the economic and econometric approach developed by McFadden (1973). In addition, the model is based on the multinomial logit

[5] Refer to C. Díaz-Bonilla, 2004, for a more detailed description of the multinomial logit model for the sectoral choice econometrics.

functional form because of its computational simplicity. However, since this functional form assumes that the independence of irrelevant alternatives (IIA) holds, the validity of this assumption is tested following Hausman (1978).

Discrete choice models build upon random utility models. In neoclassical economic theory, assigning utility to an alternative in a set of choices and choosing the alternative with the highest utility is equivalent to using a preference operator to make a choice. The random component is due to unobservables for the attributes of alternatives or of individuals, measurement errors, and/or proxies (Manski, 1997).

For the ith individual faced with J choices,

$$U_{ij} = \boldsymbol{\beta}_j' \mathbf{z}_i + \varepsilon_{ij} \tag{1}$$

where U_{ij} represents the utility for individual i associated with sector j, the vector $\mathbf{z}$ includes demographic characteristics, $\boldsymbol{\beta}$ is the vector of coefficients to be estimated, and ε_{ij} is the stochastic part of the utility function that accounts for the uncertainty.

The alternative that has the highest utility is assumed to have been chosen, so that if the individual has chosen j in particular this implies that

$$\Pr(U_{ij} > U_{ik}) \tag{2}$$

for all other $k \neq j$.

The Logistic Probability Unit, or logit model, which is the most widely used in practical applications, assumes that the disturbances are independent and identically distributed with Weibull distribution

$$F(\varepsilon_{ij}) = \exp(e^{-\varepsilon_{ij}}). \tag{3}$$

The distribution is an approximation of the Normal distribution, but is “fatter” in the tails. It implies that the probability of choice j is:

$$\Pr(Y_i = j) = \frac{e^{\boldsymbol{\beta}_j' \mathbf{z}_i}}{\sum_k e^{\boldsymbol{\beta}_k' \mathbf{z}_i}}, \tag{4}$$

where Y_i is a random variable that indicates the choice made, the vector $\mathbf{z}_i$ again includes the characteristics of individual i, and $\boldsymbol{\beta}$ the corresponding parameters to be estimated. The regressors include data on sex, age, age-squared, relation in the household (head, spouse, child), and indicator functions for the education level and for the region where the individual lives. The error terms in the random utility model represent the effect of the unobserved variables such as unobserved tastes or ability. The assumption is that the workers choose the sector in which to work that has the greatest value. Since the error terms are unobserved, the model can only describe the probabilities of choosing each occupation.

The model contains an indeterminacy because there is more than one solution to the βs that leads to the same probabilities for the different outcomes. To identify the model, one of the βs must be arbitrarily set to 0, which implies that the other coefficients estimated in the model will now be measured relative to this base group. Although the coefficients will vary depending on which outcome is normalized as the base, the predicted probabilities estimated from these coefficients will be the same. In the model, the Services sector is arbitrarily set as the base.

The probabilities for the MNL model for sector of work are thus modeled as

$$\Pr(S_i = j|X) = \frac{e^{\boldsymbol{\beta}'_j \mathbf{x}_i}}{1 + \sum_{k=1}^{4} e^{\boldsymbol{\beta}'_k \mathbf{x}_i}} \qquad \text{for } j = 1, ..., 4, \tag{5}$$

$$\Pr(S_i = 0|X) = \frac{1}{1 + \sum_{k=1}^{4} e^{\boldsymbol{\beta}'_k \mathbf{x}_i}} \tag{6}$$

The maximum likelihood estimator maximizes the product of these probabilities of the chosen outcomes. The log-likelihood becomes

$$\ln L = \sum_{i=1}^{n} \sum_{j=0}^{J} d_{ij} \ln \Pr(S_i = j), \tag{7}$$

where $d_{ij} = 1$ if alternative j is chosen by individual i, and 0 if not, for the 5 possible outcomes. Then, for each i, one and only one of the d_{ij}'s is 1.

The derivative of the log-likelihood function with respect to the vector of parameters $\boldsymbol{\beta}_j$ is

$$\frac{d \ln L}{d\boldsymbol{\beta}_j} = \sum_i [d_{ij} - P_{ij}]\mathbf{x}_i \qquad \text{for } j = 1, ..., J. \tag{8}$$

The multinomial logit is computationally easy to solve because the second derivative Hessian matrix from this log-likelihood is everywhere negative definite, and therefore there is a global maximum.

The individual observations of potential workers in the household survey are now ranked in two steps. The first step considers employment status, sorting the individuals so that those at the top are the unemployed in the sector of interest, followed by unemployed individuals from other sectors, and at the bottom the inactive population of working age.[6] The second step ranks the individuals within these groups in order of their probability of moving as calculated using the MNL. If the CGE model determines that the number of employed workers in a given sector increases after a specified shock to the economy, the ranking of individuals helps determine which of the potential workers will become new workers. The unemployed workers with the highest estimated probabilities within the sector of interest move first until total demand for workers is satisfied. If the demand in a specific sector is larger than the supply of unemployed workers, the model selects from the remaining unemployed workers. These individuals are also ranked in order of their probability of moving into the sector and the remaining demand for workers is filled from this group. If it turns out that the supply still does not meet the demand, then the workers are chosen from among the eligible inactive population, also ranked by the estimated probability, given their personal characteristics. In the case of the particular policy change simulated in this model, the number of total unemployed workers was more than enough to fulfill the new demand so that the inactive population was not changed in any of the simulations.

2.3 Wage Regressions

The second component of the econometric microsimulation model estimates a wage regression model. Once a person moves into a sector of production, which is determined both by an increase in employment coming from the macro model and the probability of working in each sector as determined by the MNL, the worker receives a wage that corresponds to the change. If the macro model determines that employment should decrease in a given sector, then those with the lowest probability of working in that sector exit first and the new unemployed lose the wages they had.

Therefore, this section of the microsimulation model determines the labor income received by a new worker. Since the data do not record market wages for an individual who is not working, Mincer's human capital theory (1962) leads to estimates of wages as a function of human capital variables (such as experience and education). A series of wage regressions (for the five sectors and both sexes) estimates the sector-specific potential wage of each sector for each person according to his or her personal characteristics.

Letting y represent the log of labor income in 1993 levels:

$$y_i = \alpha + \boldsymbol{\gamma}_i \mathbf{x}_i + \varepsilon_{yi} \tag{9}$$

[6] Those who are employed are not considered in this ranking because they already have work and are thus not potential new workers.

where $\mathbf{x}$ is a vector that includes age, age squared, and education, region, and year dummies, the vector $\boldsymbol{\gamma}$ contains the corresponding parameters to be estimated, α is a constant, and ε_{yi} is assumed to be normally distributed with mean 0 and standard deviation σ. The variables age and age squared are proxies for experience (which cannot be proxied as in standard Mincer equations because the data does not include a continuous schooling variable). The squared term captures the concavity of the age-earnings profile. The education dummies include complete and incomplete primary, secondary, and university education. The dummies for region of residence include Gran Buenos Aires (GBA), the Northwest (NW), Cuyo (CU), the Pampas (PP), and Patagonia (PT). Individuals under age 15 are not included in the regression.

In order to have enough observations within each of the 10 wage regressions, the data for wage earners between 1992 and 1994 is pooled. Therefore, a dummy variable for each year is included in the regressions to account for any year effects caused by including three years of wage data. In addition, for comparability, the data is transformed into pesos from base year 1993.

A potential self-selection bias arises in the wage regressions for women if the decision to participate in the labor force is not random given the observable data. Unobservable characteristics may affect both the participation decision and the potential wage, therefore the possibility of selection bias into the labor force is addressed following Heckman (1976). Since marital status and number of children in the household should affect the participation decision and not the wage, these variables are used to estimate the selection equation and, through Heckman's lambda, the set of unbiased wage coefficients.

Once the model estimates the returns to personal characteristics and thus the potential wage of each person, all observations that are not in the 1993 household survey are dropped. Therefore, each person of working age in 1993 will have five potential wages, which correspond to each of the five sectors.

On joining the workforce, the potential wage for the chosen sector becomes the new worker's actual average wage. However, this implies that all workers with the same known characteristics will receive the same mean wage. To include variation (inequality), one has to focus on the error terms. Therefore, each person outside the labor market who is chosen to move into the labor market must also have an error term attached to him or her. The available error terms from which to choose are those calculated from each sector's income regression of its workers. No assumption is made about the distribution of the pool of error terms, but rather the simulation program draws randomly from this pool (by sector) and attaches the error term to the new worker.

Once all new workers receive their corrected income, the change in the nominal average wage per sector (as calculated from the CGE simulations for each urban labor type) is utilized to adjust the income of all workers (whether they moved or not). This results in the final version of wage income per worker for a given simulation. Summing up all income sources for all workers in a household, and dividing by the adult equivalent number of members, results in the new household per adult equivalent income.

The model does not adjust the amount of capital owned or the return to that capital for each of the households under each simulation. Although the macro model shows the effects of the different macro simulations on overall capital returns, the household survey data underreports the amount of profit and rent income received. Thus, it is difficult to adjust this source of income without potentially creating a larger bias in the results than by simply calculating the effects on poverty and inequality under the assumption that capital remains at its initial level.

2.4 Poverty and Indigence Lines

The last component of the microsimulation model combines the different income sources from each household member, i, to calculate new levels of household per capita income ($HPCI$) for each household, h:

$$HPCI_h = \frac{1}{m_h}\left[\left(\sum_i w_i L_i\right) + y_{0h}\right]. \tag{10}$$

L_i equals 1 for member i if that member is working in one of the economy's 5 productive sectors[7], w_i is the labor income received by member i in the previous month, m_h is the number of members in household h, and y_{0h} is total non-labor income for household h in the previous month. Summing up every member's earnings plus non-labor income and then dividing by the total number of household members results in total household per capita income for household h.

To calculate the changes in poverty and indigence (extreme poverty) under each labor market scenario in the WTO simulation it is necessary to not only account for changes in household income, but also for changes to the poverty and indigence line. The National Institute of Statistics and Census (INDEC) creates a basic food basket to calculate the indigence line taking into account the basic caloric and protein requirements needed for an adult male of moderate activity between 30 and 59 years of age. The food types and

[7] The sectors are: 1) Primary Activities, Mining, and Food Processing; 2) Manufacturing; 3) Other Manufacturing and Construction; 4) Electricity, Gas, and Water; and 5) Services. The sectors are limited to these aggregate groups because of the need to combine the macro data with the household data.

quantities for the basket are then chosen according to information from the Household Income and Expenditure Surveys.

The poverty line, which is higher than the indigence (extreme poverty) line, is similarly calculated using a basket of goods. In this case, in addition to food, INDEC also takes into account non-food goods and services (such as clothing, transport, education, and health). This total basic basket determines the poverty line in each region.

Each simulation using the CGE model results in a new level of economy-wide prices. The price changes for the different productive sectors lead to a change in the cost of the basic food basket and the total basic basket. Therefore, the percentage changes in the prices of the relevant goods and services that result from the simulations are utilized to adjust the poverty lines accordingly under each scenario.

3 Microsimulation Results

The econometric results from the microsimulation model serve as building blocks in the full model, converting movements at the macro level into movements at the individual level. Before turning to the macro model, this section presents the results for the microeconometric models. The results of the multinomial logit sectoral choice model are shown in Tables 2 and 3, while the corresponding results for the Hausman (1978) test of the Independence of Irrelevant Alternatives (IIA) are shown in Table 4. The male and female wage regression results are shown in Table 5. The welfare results depend on the scenario chosen and are therefore left for section 6.2.

3.1 Results for the Multinomial Logit Model

Table 2 presents the multinomial logit model results for the probability of working in the 5 sectors. The Services sector was the base for the estimations and therefore does not appear explicitly in the table results. The majority of the estimated coefficients are statistically significant. Since the effect of a marginal change in the regressors on the probability of a specific choice depends on the probability itself, the estimated corresponding parameters, and the weighted average of all the estimated parameters, the results are easier to interpret as Relative Risk Ratios (RRR). Therefore, Table 3 presents the transformation of the coefficients from the MNL table into RRR.

The RRR measures the likelihood of working in one industry versus the base Services industry. However, this is an arbitrary choice and any other sector could be set as the base. In addition, for indicator functions the calculations are also with respect to the base value of these functions. The chosen base values for the indicator functions are: female, incomplete primary school, and the Gran Buenos Aires region (GBA).

The results show that being male increases the likelihood that the individual works in Primary Activities, Manufacturing, Electricity, or Construction rather than the Services sector. In particular, the relative risk ratios are almost 30 times higher in favor of Construction than Services if the individual is a male, whereas only 2.7 times higher if the worker is in Manufacturing. Age, on the other hand, does not seem to have a strong effect in either direction.

A higher education favors the Service sector over the others except Electricity, Gas, and Water. For example, a university graduate as compared to an individual who never completed primary school is 65% less likely to work in Primary Activities and Food Processing than in the Services sector. The education result favoring Services is mainly due to a few specific service sectors, such as Finance and Real Estate, and Public Administration and Defense (see C. Díaz-Bonilla, 2004, which has a more disaggregated and detailed analysis of the service sectors).

In terms of region of residence, the likelihood that an individual between 15 and 70 will work in Primary Activities rather than in Services is 14 times higher if the person lives in Patagonia rather than Gran Buenos Aires. If the person lives in the Northwest, Cuyo, or the Pampas, the relative risk ratios drop to 2 to 4 times higher. Similarly for Electricity, Gas, and Water, and for Construction, although the results are not as high. On the other hand, the likelihood of working in Manufacturing rather than in Services is higher if the individual lives in Gran Buenos Aires rather than in any of the interior regions.

All the MNL results hinge on whether the IIA assumption holds, which is a requirement of multinomial logit models. The exclusion or inclusion of one of the outcome categories from the model (in this case any of the 5 sectors of work) should not systematically change any of the estimated coefficients, and thus should not affect the relative risks among the options. Table 4 shows the results for the Hausman (1978) specification test. To compute Hausman's chi-squared statistic, one re-estimates the parameters of the model while excluding one of the sectors of work and then compares the resulting coefficients to the full model. None of the results show evidence of a violation of the IIA assumption.

The final step in this section is to use the estimated coefficients from the MNL to form each person's predicted probability of working in each of the five sectors. Consider a simulation in which the number of unskilled male workers in Manufacturing has increased. Therefore, at the micro level, using the MNL results, the unemployed unskilled male workers with the highest probability of working in Manufacturing are the first to move into this sector. As explained earlier, the first step is to choose among the unemployed unskilled men who in the survey data consider themselves in Manufacturing. Only if this pool of workers is depleted does the remaining demand for workers come from the unemployed unskilled men from other sectors. In both cases, it is the probability of working in a specific sector as estimated from the MNL that determines who moves first.[8] Likewise, if the simulation requires a decrease in the number of workers, those with the lowest probability of working in that specific sector lose their job first.

3.2 Results for the Wage Regression Model

Table 5 presents the wage regression results for men and women in each of the 5 sectors for a total of 10 combinations. A worker who enters into a specific sector, and has no observable wage, is given a new wage according to his characteristics and to the estimated coefficients from these wage regressions. However, since this would determine a wage on average, and would therefore potentially bias the estimation of income distribution, an "error term" is added to the new worker's wage. This error term can be positive or negative and is randomly picked from the pool of error terms determined in the wage regressions.

In terms of selection bias, Heckman's lambda is necessary when estimating the wages that an inactive person would receive should she enter the labor force. However, the simulation results never require an inactive individual to join the labor force but rather that some of the unemployed become newly employed. Since this implies that the newly employed are women who were already in the labor force (albeit unemployed), the selection bias correction does not have any effect. Therefore, the wage regression results do not require estimation that accounts for selection bias.

A common approach to estimating wage regressions is to transform the wage variables into logs because it makes the estimation easier. However, in order to return to currency levels, one cannot simply reverse the transformation as this would cause what is called in health economics a "retransformation bias" (Manning, 1998). Duan (1983) uses a "smearing" estimator to perform an appropriate retransformation and shows that this estimator is the mean of the anti-log of the residuals. A number of alternatives (ordinary least squares on the natural log of the dependent variable, variations of generalized linear models [GLM], and hazard models) are also described in Manning and Mullahy (2001), but no single model is considered best under all circumstances.[9]

[8] These predicted probabilities are also estimated for inactive potential workers not already in a sector. However, the simulations never required that inactive individuals enter into the labor force as there were enough unemployed workers to fulfill the demand for labor.

[9] In STATA one can use the command "predlog" to estimate Duan's smearing retransformation (1983).

The results in Table 5 show that age tends to increase wages for both men and women and in all sectors, but the effects are relatively small. The effects of the education variables are also positive, but stronger than for the age variable. A higher education implies higher average wages across the board, with few exceptions to the increasing trend. A university education, complete (eduU) or incomplete (eduUn), has a higher return (as compared to incomplete primary, eduPn) than any other education level. Vocational training (eduV and eduVn) and secondary education (eduS or eduSn) also show higher returns than primary schooling, but the increasing trend varies by sector and by gender.

The negative estimated coefficients for women in the Electricity, Gas, and Water sector result from a change in the education level used as the base for comparison. Due to small sample size (and no women in the sample with incomplete primary education for this sector), the base is instead completed university education. Therefore, a negative value implies that a higher education is still associated with higher average wages. In any case, the new wage estimations required from this model do not depend on which category is used as a base in the regressions.

The wage results show a slight variation by region and by sector. In Gran Buenos Aires (GBA), Argentina's capital and the surrounding metropolitan area, where the majority of the population lives and works, wages tend to be relatively higher. The regression results imply that, even after holding all else constant, wages are on average higher for a worker in GBA than in three of the other four regions. However, wages in the Patagonia (PT) region tend to be the highest among all the regions. Due to the region's colder and more remote location (the data shows that Patagonia's population is less than 5% that of GBA), workers must be paid more in order to be willing to move south. The Construction sector is the only exception, for both men and women, but even in this sector workers in Patagonia are paid more on average than in Cuyo, the North West, or the Pampas. Living in the North West implies the lowest average wages, holding all else constant, which corresponds to its lowest income level among the regions. Overall, the results show that region of residence does have an impact on the potential wages of workers.

The final variables included in a few wage regressions are dummy variables for the years 1992, 1993, and 1994. As explained earlier, the estimation of coefficients in small samples required the pooling of data across more years. Therefore, the dummy variables are included to account for any year effects in the results. In addition, some other variables were also statistically insignificant in a first specification of the regressions, in particular for the regressions for women (again a problem of sample size). Therefore, a Wald test was run on the coefficients and those that were not statistically different from each other were grouped into one variable. The final regressions show that all coefficients are statistically significant at least at a 10% confidence level.

4 Economy-wide Modeling Framework

After a shock to the economy, the estimated parameters from the MNL and wage regressions in section 3 are used to allocate people to different income levels and productive sectors (or unemployment), from which new poverty and income distribution levels are calculated. However, it is through a particular macro model that the economy-wide price, wage, and employment levels (by sector, skill, and gender) are first modified. Therefore, for the macro component, this paper estimates the impact of a shock or policy decision in Argentina by adapting the "standard" CGE model (see Lofgren et al., 2001) to the specifications of the Argentine economy.[10]

A CGE model allows one to separate out the effects of one particular scenario at a time, which is impossible to do with a given cross-section of data or even with econometrics on time-series data. Since data incorporates the effects of different events that occur together, it is hard to know the direct effect of a particular reform rather than another when both are implemented at the same time. Therefore, the CGE model works as a tool for counterfactual analysis and, of interest in this paper, links a trade liberalization scenario directly to changes in prices, wages, and employment levels.

The standard economy-wide CGE model incorporates the relevant behavioral relationships for producers, households, exporters, importers, investors, and the government within a country. Domestic prices are determined endogenously and equilibrate the domestic markets for goods and services, as well as factor markets. World prices are exogenous and interact with domestic production and consumption prices through the exchange rate and export taxes and subsidies. Goods and services are produced in sectors ("Activities") and then sold domestically or exported. Producers decide the allocation of total supply between exports and the domestic market through a CET transformation function as they maximize sales revenue. As "Commodities," goods and services are consumed, invested, added to inventories, or used as intermediate inputs along with labor, capital, and land. Commodities are aggregates of imports and domestically produced items, which are assumed to be imperfect substitutes in the cost minimization that derives final demand.

The institutions in the CGE model include households, enterprises, government, rest of

[10] For more detail on the Argentine CGE model see E. Diaz-Bonilla, C. Diaz-Bonilla, Piñeiro, and Robinson (2003).

the world, and a savings-investment account. Households own enterprises and work in them. Households receive wages, profits, and transfers (which may be negative) from the government and other institutions, save a proportion of disposable income, and buy consumption goods. The Argentine CGE model has a single private household, but its disaggregation in the CGE model is not necessary since factor levels and prices are passed down to the micro component of the model, which incorporates the country's urban households as disaggregated through the national surveys. Enterprises produce goods and services in each activity by buying intermediate goods and hiring factors of production, after taking into account output prices, wage rates, intermediate input prices, and the stock of capital. Producers thus maximize profits subject to a production function, and use factors of production up to the point where the marginal revenue product of each factor is equal to its wage. The government receives tax revenue and spends it on consumption or transfers; a surplus or deficit adds to or subtracts from the economy's savings-investment account. The rest of the world buys exports, sells imports, and adds to or subtracts from the savings-investment account through foreign savings. The savings-investment account, therefore, receives savings from all other institutions and buys investment goods.

The model also includes a set of macroeconomic balance equations and four closure conditions. The alternative closures cover the equilibrium in the factor market, the current account balance, the government balance, and the savings-investment balance (see Lofgren et al., 2001, for details). The equilibrium conditions for the latter three will remain the same under all the simulations (see below). This paper will focus on the effects of using different factor market closure assumptions, which are explained in section 5.2.

A Social Accounting Matrix (SAM) contains the model's underlying data, which comes from national accounts, trade, and household survey data. The SAM for Argentina is based in 1993 and includes 44 sectors ("activities") and commodities, 9 factors of production, and the standard accounts for households, firms, the government, the rest of the world, and savings-investment. The activities and commodities are disaggregated into 11 primary agricultural products, 4 non-agricultural primary sectors, 11 food manufacturing sectors, 14 non-food manufacturing sectors, 3 service sectors, and the government. The nine factors of production are rural male and female labor, urban unskilled, urban semi-skilled, and urban skilled male and female labor, and capital. Unskilled labor is defined as those with at most completed primary schooling; semi-skilled labor have no more than high school or vocational training; and skilled labor have a university education or more.

The Argentine model modifies the standard CGE framework in two ways (see E. Díaz-Bonilla et al., 2003, for all the details). First, it includes a cash-in-advance technology that combines constraints for both consumption sales and production, equally weighted, which is used to anchor the nominal variables and can allow money supply or demand to have real effects (Walsh, 1998). Second, the modified model includes real wage variables for the whole economy and also by sector, which are deflated by the CPI and thus define consumption wages. These allow separate sectors to have different degrees of real wage rigidity.

In terms of the closures rules, in all simulations the model will maintain a fixed investment rate and government spending. Therefore, government savings are left endogenous to clear the government account and the savings rates of domestic institutions are scaled to generate enough savings to finance the exogenous investment quantities. That is, total savings adjust via tax receipts and household savings to equilibrate the different accounts.

In terms of the Current Account balance, the model is run with a fixed nominal exchange rate, although the real exchange rate is endogenously determined (see Devarajan, Lewis, and Robinson, 1993; Robinson, 1991). Capital flows are also exogenous and kept at the level of the base year for the simulations. The assumption concerning the fixed exchange rate is appropriate for this 1993 model because Argentina was maintaining the Currency Board that had pegged the Argentine peso to the U.S. dollar 1-to-1 in 1991. Lastly, as mentioned above, the factor market closures will be explained in section 5.2 as these will play a crucial role in the simulations for this paper.

5 Policy Simulations and Market Closures

5.1 Trade Liberalization Under a Generalized WTO Agreement

"International trade can play a major role in the promotion of economic development and the alleviation of poverty" (WTO Ministerial Declaration, 2001). Much has been written about the impact of multilateral trade liberalization, in particular as it concerns developing countries and the poor within these countries (Winters et al., 2004; Hoekman et al., 2001). This paper will apply the macro-micro model presented above to analyze the effects on poverty and income distribution in Argentina of trade liberalization under a generalized WTO agreement.

In these simulations, all import tariffs[11] in Argentina are set to zero to represent a liberalization across all sectors. The same generalized liberalization occurs in all countries, thus removing all distortions and in effect changing world prices for goods and services. These new exogenous world prices in dollar terms are taken from Diao, E. Díaz-Bonilla, and Robinson (2003). Diao et al. run a separate set of WTO simulations using a multi-region

[11] Quotas have been transformed into their tariff equivalents.

(i.e., multi-country or world) and multi-sector general equilibrium model from the Trade and Macroeconomics Division of the International Food Policy Research Institute.[12] Overall, the trade liberalization scenario considered in the present paper could show the benefit to Argentina of all countries (including Argentina and the industrialized world) reducing (or alternatively, the harm of countries maintaining) the current protectionist policies.

The results from the trade liberalization, in terms of aggregate employment levels, wages, and prices, are passed down to the econometrically estimated microsimulation model to calculate the new levels of poverty and income distribution. The macro results, however, also depend on the factor market linkages assumed for the economy. These interactions within the labor and capital market are not captured at the household level as they represent the overall functioning of these markets.

5.2 Factor Market Closures

The underlying assumptions concerning the adjustments of factors and wages across labor markets and the capital market (called "factor market closures" in some general equilibrium models) affect the final welfare results. Whether a model assumes unemployment exists, or wages are rigid, or capital is fixed, for example, will result in different values for employment, wages, and prices, and thus different poverty and inequality measures. Therefore, it is important to focus one level up from the econometric household model to compare the different results obtained under a variety of labor and capital market assumptions.

The trade liberalization scenario is run under six different factor market closures. In turn, these six simulations consist of two groups of three simulations. In the first group, capital is fully employed and mobile[13], that is, it can move among sectors depending on the equilibrium solution reached and none goes unused or underused. In the second group, capital is still fully employed, but now fixed by sector. Therefore, supply and demand cannot be equated by transferring more capital from sector A to sector B, but instead the rent on capital must adjust to bring equilibrium. Since capital cannot move, the second group can be considered a more short-run scenario.

For both closure assumptions for capital, the model makes three assumptions concerning labor mobility and wages, thus creating 6 different simulation scenarios. When capital is fully employed and mobile the three simulations are: WTO1 – labor is fully employed and mobile with wages adjusting to clear the market; WTO1-N – unemployment exists and

[12] Most of the data come from the database of the Global Trade Analysis Project (GTAP), version 5 (Hertel et al., 2000). There are 38 products and 29 countries and regions.

[13] Mobility is understood as a long-term adjustment process through which different investment rates across sectors reallocate the stocks of capital.

nominal wages are fixed so labor adjusts to clear the market; and WTO1-R – unemployment exists and consumption real wages (nominal wages deflated by the CPI) are fixed, so labor again adjusts to clear the market.

When capital is fully employed but fixed by sector, and the three labor market closures above are considered, the last three simulations are: WTO2-K, WTO2-NK, and WTO2-RK. The first is the case of fully employed and mobile labor with wages adjusting, the second is fixed nominal wages with unemployment, and the last is fixed real wages with unemployment, all modeled with fixed capital. These six closure conditions lead to different results both at the macro and micro level (see below).

6 Policy Results

6.1 CGE Results

Tables 6 and 7 present the results for the trade liberalization scenario (a generalized elimination of tariffs on all sectors and a change in the exogenous world prices for goods) under the six different labor market closures. The first set of results (WTO1, WTO1-N, and WTO1-R in columns 1-3) corresponds to a more medium-run scenario in which capital is free to move among the sectors in order to equilibrate supply and demand. The second set of results (WTO2-K, WTO2-NK, and WTO2-RK in columns 4-6) corresponds to a short-run scenario in which capital is fixed by sector. In columns 1 and 4 labor is fully employed and mobile among sectors. In columns 2 and 5 (N) nominal wages are fixed and labor is unemployed so that labor equilibrates supply and demand. In columns 3 and 6 (R) consumption real wages are instead fixed and labor is again unemployed and the equilibrating factor. All simulations are run under a fixed exchange rate, as was the situation in Argentina in 1993 after the Convertibility Plan of 1991, and a fixed foreign savings framework. The real exchange rate (RER), money supply in the economy (MONEY), and the consumer price index (CPI) are endogenous.

The increase in the world price of agricultural goods in the trade liberalization scenario benefits the Primary Activities and Food Processing sector, which for Argentina includes the more important export commodities. Exports increase strongly under all 6 scenarios, but more so in the "medium-run" when capital is mobile (between 8%-16.5% versus 4.3%-5.3% in the last three columns). The demand for factors of production, especially labor, in Primary Activities and Food Processing increases in all 6 simulations due to the need to increase production for exporting. The increased demand for labor in this sector is higher than for the other 4 sectors, with increases averaging 20% in the fixed-nominal-wages simulation (even across skill types and gender).

In general, the labor response in all 5 sectors to the trade liberalization shock is strongest when nominal wages are fixed, and even more so when capital is free to move. In that case, production can be increased at lower factor costs and higher efficiency. GDP experiences the highest increase (6.3%) under this simulation (WTO1-N), as do exports (16.5%), imports (18.8%), and the CPI (8%).

GDP shows the smallest increase under WTO1 (0.3%) and practically no effect under WTO2-K (-0.05%). In both these simulations, the labor market assumption is that labor is fully employed and mobile. This implies that the only way to increase the number of workers in the Primary Activities and Food Processing sector is by moving workers out of the other sectors. Total employment in Manufacturing, Electricity, Construction, and Services for all skill types and both genders (except for unskilled female labor in the last three sectors) decreases under WTO1. With a few exceptions, this also holds in the short-run scenario for which capital is fixed (WTO2-K).

In terms of wages, the results show a much smaller increase under the short-term scenario in which capital remains fixed by sector. In some cases, mainly in the Primary Activities and Food Processing sector, wages show a slight decrease, in particular for the less skilled. The CPI also shows smaller increases (between 0.1% and 0.4%) in the last three columns than in the medium-term scenario (between 6%-8% increases). The trade liberalization scenarios thus have an impact throughout the whole economy, but even more so in a timeframe where capital can adjust.

Overall, in terms of employment, the results suggest that trade liberalization tends to benefit the unskilled more than the skilled, and the primary activities and food processing urban sector more than the other 4 sectors. In terms of factor market closures, the underlying assumptions made about the linkages in labor and capital within the economy have strong effects on the final results. Assuming that labor is fully employed implies that a growing economic sector can only increase its number of workers by pulling them from other productive sectors, leading to smaller allocative improvements. Therefore, the possibly negative terms-of-trade effects may end up dominating the former allocative improvements. Lastly, maintaining capital fixed by sector as a short-run scenario shows the important tempering effects this has on all the results.

6.2 Impact on Poverty and Income Distribution

The macro model results thus show the changes in employment, wages, and prices from alternative labor and capital market closures under the umbrella of a trade liberalization scenario. The three parts of the microsimulation model convert these results at the macro level into movements at the individual level in order to calculate the effects on poverty and income distribution under each simulation. As explained earlier, the final step in the wage section (see section 4.2.3) is to adjust the income of all workers (whether they moved or not) by the new nominal average wage per sector and gender as calculated from the CGE simulations for each urban labor type. This results in the final version of wage income per worker for a given simulation. Therefore, total household income is the summation of wages (previous or newly received and adjusted for overall sector changes) for each household member doing market work plus total non-labor income from other sources. However, rather than calculating total household per capita income, the approach here is to use INDEC's adult equivalency scale to calculate total household per adult equivalent income. This is a better reflection of the scale effects, for example, that occur within households with more children. Dividing total household income simply by the total number of members in the household may not accurately reflect the household's income situation.

The new distribution of household per adult equivalent income and the new distribution of wages are now used to calculate the effects on poverty and inequality from the trade liberalization scenario under each of the six labor and capital market assumptions. The standard poverty indices include the headcount ratio (P0), the average normalized poverty gap (P1), and the average squared normalized poverty gap (P2) (see Foster, J., J. Greer, and E. Thorbecke, 1984). These estimates are calculated for both the poverty line and the extreme poverty line in Argentina (see Table 8).

For the second set of welfare results, the Gini coefficient and the Theil index are used to calculate earnings inequality for the workers as well as inequality of the distribution of household per adult equivalent income. Table 9 presents both measures for both distributions in base values and the changes to base values under the 6 simulations.

An important step in measuring poverty is to account for changes in the poverty and extreme poverty lines due to changes in the prices of the given baskets of goods that determine these lines. As mentioned earlier, a basic food basket is created by INDEC to calculate the extreme poverty line, then an adjustment for non-food goods and services determines the total basic basket with which to calculate the poverty line in each region. There are two ways that the poverty line is transformed in the results. The first and most straightforward is to simply adjust the poverty line by the change in the Consumer Price Index. These results are found in the bottom half of Table 8. However, the CPI takes into account a number of goods that do not reflect goods that are purchased by the poor. Therefore, the second method to adjust the poverty and extreme poverty line is to use percentage changes in prices for the different productive sectors from the CGE simulations that represent goods and services in the basket. This gives a much closer representation of what the true baskets would measure under these six scenarios. These results are presented in the upper half of Table 8.

The first result that stands out is the strong decrease in poverty under the WTO1-N simulation. When nominal wages are fixed and capital is mobile the CGE results showed a large increase in the employed workforce across all sectors, all skill levels, and both genders. Prices also increased, but the results show that although the poverty line is higher, the overall effect of more people working, and in particular in a more unskilled sector like Primary Activities, leads to an overall reduction in poverty levels. The 6.8% reduction in the poverty line's headcount index, however, seems small compared to the 35% reduction in extreme poverty's headcount index. In addition, the P2 result shows that the ones who most benefit from the implementation of the trade liberalization in this simulation are the poorest of the poor.

The headcount index (P0), which is just a straightforward count of the proportion of people who are below the poverty line, shows a decrease for the trade liberalization scenario under all 6 labor and capital market linkage possibilities. The welfare benefit, however, is generally less when one considers a short-run scenario in which capital cannot adjust to the new demands in the economy. In addition, this first cut at the poverty measure hides opposing effects at the level of the very poorest, in particular in the full employment simulations.

As mentioned earlier, when the labor market closure implies that the country is at full employment (WTO1 and WTO2-K), the only means of adding workers to a sector that is increasing is by taking workers away from other productive sectors. In this case, this implies that the Primary Activities and Food Processing sector increases the size of its labor force at the expense of Manufacturing, Services and the rest. Also, whether capital is fixed or not, it is skilled labor that shows the highest increase in the expanding sector. At the same time, wages for the highest skilled are increasing by more than for the semi-skilled and the unskilled. In addition, prices are going up, thus increasing the cost of the basic basket of commodities for the poverty and extreme poverty line.

Under the full employment scenarios, the purchasing power of the poorest takes a hit, without the help of increased employment. All of this results in an increase in extreme poverty of 5.3%, but even worse, the average normalized poverty gap and its square increase by 14% and 21%, respectively. The latter two indices try to capture more than just the number of poor, but the effects on those in the furthest left tails of the distribution. The poorest of the poor are the hardest hit under the WTO1 factor market assumption, but also when capital cannot move across sectors (WTO2-K).

The other labor and capital market closures show that the combined effects of employment, wages, and prices in a full trade liberalization scenario leaves the poor and the extreme poor better off overall. Allowing the more realistic assumption of unemployment, under the scenario of mobile capital and fixed real wages, the headcount index for the poor decreases by 1.4% and for the indigent (the extreme poor) by 10%. When capital is also fixed by sector, however, the poor and indigent still benefit, but by less (0.6% and 1%, respectively). For all four scenarios, their purchasing power ability increases even given the increased cost of the basic basket of commodities.

In terms of inequality, both the Gini and the Theil measures for the distribution of wages show an increase for all simulations. That is, wage inequality gets worse since wages for the higher skilled increase by more than those for the lower skilled. On the other hand, when taking into account total household income, the results are the opposite in most cases. When the model assumes unemployment exists in the economy and either nominal or real wages are fixed, both the Gini and the Theil measures of inequality show a decrease in the distribution of total per adult equivalent household income. This happens for both the short-run and medium-run version of capital mobility. Overall, the Gini decreases by 3.8% for the nominal wage simulation and by 1% for the real wage simulation with capital free to move. When capital is fixed, the changes are small, never going higher than 0.8%.

These results raise an interesting issue that goes to the center of another current debate on the trends in inequality. Galbraith (2002) claims that wage inequality is increasing while Dollar and Kray (2002), focusing on a more comprehensive measure of inequality than simply wage differences, claim that global inequality has declined since 1975. The results of the current paper show a third way of calculating inequality. When measured in terms of wages, the results do also show an increase in inequality from trade liberalization as in Galbraith (2002). However, measuring inequality at the household level, that is, taking into account all income sources from household members, the results show an overall decline in inequality as in Dollar and Kray (2002), although using a different measure.

7 Conclusion

This paper combines a new variation of an econometrically estimated microsimulation model of household income generation with a Computable General Equilibrium macro model. In a "top-down" approach, and using six different specification assumptions about labor and capital markets, the model tests the effects on poverty and income distribution of a trade liberalization scenario under the World Trade Organization. Trade liberalization can help promote economic development and poverty alleviation, therefore a simulation of a future multilateral trade scenario would show what benefits Argentina could potentially receive from a less protectionist domestic and world environment.

The macro-level results for a given policy change determine new levels of employment in each economic sector and new wages and relative prices. However, the results in large part depend on the factor market closures that are assumed to represent the economy. Therefore, after imposing a macro shock (in this case in the form of the trade liberalization scenario), the paper traces the effects of these labor and capital market assumptions on the final welfare results. Focusing on movements at this level catches the interactions within the labor market that are not captured at the household level.

At the micro level, the methodological issue was how to select those individuals who will change sectors when there is a change in labor demand and what new level of income to assign them. Rather than randomly selecting the individuals in the simulations, the paper uses econometric analysis to determine who moves and their new income levels. This paper estimates a multinomial logit model for the sector of work and uses the full set of estimated coefficients in the prediction of probabilities. Therefore, this approach determines the probability of movement of each individual to the different production sectors based on personal characteristics, and estimates the potential wages of non-workers who enter the labor force.

The results show that a less protectionist domestic and world environment through trade liberalization generally does increase the economy's GDP level and decreases the poverty rate. The headcount index (P0), which is the proportion of people who are below the poverty line, decreases between 0.5% and 6.8% across the 6 labor and capital market closure assumptions. The distribution of household per adult equivalent income, as measured by the Theil index, decreases between 0.4% and 6.4%.

However, the results at the level of the extreme poor show very different results depending on the assumptions about the structure of the labor and capital markets. Under both full employment scenarios (that is, with mobile versus fixed capital), the purchasing power of the poorest takes a heavy hit while employment decreases in four of the five sectors. Therefore, extreme poverty increases by 5.3%, the average normalized poverty gap increases by 14% and its square by 21%. The latter two indices show the negative effects on the poorest of the poor who are those in the furthest tails of the distribution. Although the Theil index for the distribution of household per adult equivalent income improves, the

Gini coefficient worsens for the two full employment simulations.

On the other hand, the other four labor and capital market closures show that the combined effects of employment, wages, and prices in a trade liberalization scenario leaves the poor and the extreme poor better off overall. Allowing the more realistic assumption of unemployment, under the scenario of mobile capital and fixed real wages, the headcount index for the poor decreases by 1.4% and for the extreme poor by 10%. When capital is also fixed by sector, however, the poor and extreme poor still benefit, but by less (0.6% and 1%, respectively). The benefits are smaller in the short-run scenario because capital cannot adjust to the new demands in the economy. Overall, for all four scenarios, the poor's purchasing power ability increases even given the increased cost of the basic basket of commodities.

As in the export-led growth project undertaken across the Latin America and Caribbean region (Ganuza et al., 2003), the impact of trade liberalization, as measured in this new version of the model, could be generalized to a number of developing countries other than Argentina. Although each particular country has its own economic structure, the framework to analyze the effects of this and other similar policy changes can be applied more broadly. The econometric microsimulation model would need to be re-estimated given the household survey data from each country's statistical institution and the macroeconomic model would need to calculate the effects on employment, wages, and relative prices taking into account the different factor market assumptions.

In terms of the overall macro-micro approach, a recent paper that is still a work-in-progress focuses on a way to try and integrate both the macro and micro models (Cogneau and Robilliard, 2004). The framework attempts to incorporate a feedback effect from the micro to the macro model rather than follow a top-down approach as done in this paper. The authors explain the comparative advantages and disadvantages of using their integrated micro-macro approach, arguing that trade-offs must be made among the issues of household heterogeneity, the amount of sectoral detail, and dynamics. In particular, this approach has to sacrifice the otherwise rich structure of the economy that could be modeled at the macro level. Turning to the heterogeneity issue, the availability of panel data would be useful in estimating the responses of individuals to changes in labor incentives over time. These are interesting issues to keep in mind for future work.

The framework presented in this paper instead focuses on a top-down approach that incorporates a new econometrically estimated microsimulation model and also focuses on the welfare effects of different factor market closures given a trade liberalization scenario. A clear conclusion from the results is that assumptions about the structure of labor and capital markets do strongly matter. Assumptions of full employment, as most commonly used in many CGE analyses, may result in negative welfare effects. A growing economic sector can only increase its number of workers by pulling them from other productive sectors leading to smaller allocative improvements relative to a potentially negative terms-of-trade effect. A scenario that incorporates the more realistic case of unemployment, on the other hand, leads to positive welfare results for poverty, extreme poverty, and household income distribution. Although wage inequality increases some in this case, the overall results point to the benefits to the Argentine economy of worldwide trade liberalization.

References

[1] Almeida dos Reis, J.G. and R. Paes de Barros. 1991. "Wage inequality and the Distribution of Education: A Study of the Evolution of Regional Differences in Inequality in Metropolitan Brazil," *Journal of Development Economics*, 34, pp. 117-143.

[2] Bergmann, B. 1973. "Combining Microsimulation and Regression: A 'Prepared' Regression of Poverty Incidence on Unemployment and Growth," *Econometrica*, Vol. 41, No. 5, pp. 955-963.

[3] Bergmann, B. 1990. "Micro-to-Macro Simulation: A Primer With a Labor Market Example," *Journal of Economic Perspectives*, Vol. 4, No. 1, pp. 99-116.

[4] Blau, F. and L. Khan. 1996. "International Differences in Male Wage Inequality: Institutions versus Market Forces," Journal of Political Economy, 104(4), pp. 791-837.

[5] Blinder, A.S. 1973. "Wage Discrimination: Reduced Form and Structural Estimates," *Journal of Human Resources*, 8, 436-455.

[6] Bourguignon, F. 1979. "Decomposable Income Inequality Measures," *Econometrica*, 47, pp. 901-20.

[7] Bourguignon, F., F. Ferreira, and N. Lustig. 1998. "The Microeconomics of Income Distribution Dynamics in East Asia and Latin America, a Research Proposal," the Inter-American Development Bank and the World Bank. Washington, D.C.

[8] Bourguignon, F., F. Ferreira, and N. Lustig (eds). 2002. *The Microeconomics of Income Distribution Dynamics In Developing Countries*, mimeo, The World Bank, Washington.

[9] Bourguignon, F., A.S. Robilliard, and S. Robinson. 2002. "Representative versus Real Households in the Macro-Economic Modeling of Inequality," mimeo, World Bank and IFPRI (draft April).

[10] Cowell, F. 1980. "On the Structure of Additive Inequality Measures," *Review of Economic Studies*, 47, pp. 521-31.

[11] Devarajan, S., J.D. Lewis, and S. Robinson. 1993. "External Shocks, Purchasing Power Parity, and the Equilibrium Exchange Rate," *World Bank Economic Review,* Vol. 7, No. 1, pp. 45-63.

[12] Diao, X., E. Díaz-Bonilla, and S. Robinson. 2003. "Scenarios for Trade Integration in the Americas," *Économie Internationale*, 94-95, p. 33-52.

[13] Díaz-Bonilla, C. 2004. "A Multinomial Logit Sectoral Choice Model Pre- and Post-Reforms," Ph.D. Manuscript, Baltimore: The Johns Hopkins University.

[14] Díaz-Bonilla, E., C. Díaz-Bonilla, V. Piñeiro, and S. Robinson. 2003. "The Convertibility Plan, Trade Openness, and Employment in Argentina: A Macro-Micro Simulation of Poverty and Inequality," in Ganuza, Morley, Robinson, and Vos (eds.), *Quién se Beneficia del Libre Comercio? Promoción de Exportaciones y Pobreza en América Latina y el Caribe en los 90*, UNDP and Alfaomega Colombiana, pp. 107-133.

[15] Díaz-Bonilla, E., M. Thomas, S. Robinson, and A. Cattaneo. 2000. "Food Security and Trade Negotiations in the World Trade Organization: A Cluster Analysis of Country Groups," Trade and Macroeconomics Division, Working Paper no. 59. IFPRI.

[16] DiNardo, J., N. Fortin, and T. Lemieux. 1996. "Labor Market Institutions and the Distribution of Wages, 1973-1992: A Semi-Parametric Approach," *Econometrica*, 64(5), pp. 1001-1044.

[17] Duan, N. 1983. "Smearing estimate: a nonparametric retransformation method," *Journal of the American Statistical Association*, 78:605-610.

[18] Ferreira, F., P. Leite, L. da Silva, and P. Picchetti. 2004. "Can the Distributional Impacts of Macroeconomic Shocks be Predicted? A Comparison of the Performance of Macro-Micro Models with Historical Data for Brazil," mimeo, World Bank.

[19] Foster, J., J. Greer, and E. Thorbecke. 1984. "A Class of Decomposable Poverty Measures," *Econometrica*, 52, pp. 761-765.

[20] Ganuza, E., S. Morley, S. Robinson, and R. Vos (eds.). 2003. *Quién se Beneficia del Libre Comercio? Promoción de Exportaciones y Pobreza en América Latina y el Caribe en los 90*, UNDP and Alfaomega Colombiana.

[21] Hausman, J. 1978. "Specification Tests in Econometrics," *Econometrica*, 46, pp. 1251-1272.

[22] Hausman, J. and D. McFadden. 1984. "A Specification Test for the Multinomial Logit Model," Econometrica, Vol. 52, Issue 5, pp. 1219-1240.

[23] Heckman, J.J. 1976. "The Common Sturcture of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models," *Annals of Economic and Social Measurement* 5: 475-492.

[24] Heckman, J.J. 2001. "Accounting for Heterogeneity, Diversity, and General Equilibrium in Evaluating Social Programmes," *Economic Journal*, Vol. 11(111), no. 475, pp. 654-99.

[25] Hertel, T, K. Itakura, and R. McDougall. 2000. GTAP Model Version 5. GTAP Resource #575.

[26] INDEC. 1993. Instituto Nacional de Estadísticas y Censo, Ministerio de Economia, Buenos Aires.

[27] Juhn, C., K. Murphy, and B. Pierce. 1993. "Wage Inequality and the Rise in Returns to Skill," *Journal of Political Economy*, Vol. 101, no. 3, pp. 410-442.

[28] Lofgren, H., R.L. Harris, and S. Robinson, with M. Thomas and M. El-Said. 2001. "A Standard Computable General Equilibrium (CGE) Model," IFPRI, Trade and Macroeconomics Division, Discussion Paper no. 75.

[29] Manning, W.G. 1998. "The logged dependent variable, heteroscedasticity, and the retransformation problem," *Journal of Health Economics*, 17(3):283-295.

[30] Manning, W.G. and J. Mullahy. 2001. "Estimating log models: to transform or not to transform," *Journal of Health Economics,* 20:461-494.

[31] Manski, C. 1977. "The Stucture of Random Utility Models," *Theory and Decision*, 8:229-254.

[32] McFadden, D. 1973. "Conditional Logit Analysis of Quantitative Choice Behavior," in Frontiers in Econometrics, ed. by P. Zarambka. New York: Academic Press.

[33] Mincer, J. 1962. "Labor Force Participation of Married Women: A Study of Labor Supply," in National Bureau of Economic Research, *Aspects of Labor Economics*, pp. 63-97. Princeton, N.J.: Princeton University Press.

[34] Oaxaca, R. 1973. "Male-Female Wage Differentials in Urban Labor Markets," *International Economic Review*, Vol. 14, no. 3, pp. 693-709.

[35] Orcutt, G. 1960. "Simulation of Economic Systems," *American Economic Review*, 50, pp. 893-907, May.

[36] Robilliard, A.S., F. Bourguignon, and S. Robinson. 2001. "Crisis and Income Distribution: A Macro-Micro Model for Indonesia," mimeo.

[37] Robinson, S. 1991. "Macroeconomics, Financial Variables, and Computable General Equilibrium Models." *World Development*, 19(11): 1509-25.

[38] Shorrocks, A. 1980. "The Class of Additively Decomposable Inequality Measures," *Econometrica*, 48, pp. 613-25.

[39] Taylor, E. and I. Adelman. 1996. *Village Economies: the Design, Estimation, and Use of Villagewide Economic Models*, Cambridge University Press.

[40] Theil, H. 1967. *Economics and Information Theory.* Rand McNally.

[41] Vos, R., E. Ganuza, S. Morley, S. Robinson, and V. Piñeiro. 2004. "Are Export Promotion and Trade Liberalization Good for Latin America's Poor? A Comparative Macro-Micro CGE Analysis," Institute of Social Studies, Working Paper Series No. 399, The Hague: The Netherlands.

[42] Walsh, C. 1998. *Monetary Theory and Policy.* Cambridge: MIT Press.

[43] WTO. 2001. World Trade Organization Ministerial Conference, Fourth Session, Doha, 9-14 November. Ministerial Declaration adopted on 14 November, 2001.

Table 1
Variable Definitions and Descriptive Statistics

Variable		Obs	Mean	Std. Dev.	Min	Max
VARIABLES FOR WAGE REGRESSIONS						
log_wgse	Log of wages and self-employment income	68293	6.21	0.73	-0.04	9.90
realwgse	Real wages and self-employment income	77015	565.99	618.94	0	20000
age	Age	81509	37.38	13.00	15	70
age2	Age squared	81509	1566.37	1037.61	225	4900
male	Male 1/0 dummy variable	81509	0.62	0.48	0	1
EDUCATION 1/0 dummies:						
eduPn	Incomplete Primary School	81509	0.09	0.29	0	1
eduP	Complete Primary School	81509	0.29	0.45	0	1
eduSn	Incomplete Secondary School	81509	0.15	0.35	0	1
eduS	Complete Secondary School	81509	0.14	0.34	0	1
eduVn	Incomplete Vocational education	81509	0.06	0.24	0	1
eduV	Complete Vocational education	81509	0.05	0.21	0	1
eduUn	Incomplete University education	81509	0.10	0.30	0	1
eduU	Complete University education	81509	0.12	0.33	0	1
REGION 1/0 dummies:						
GBA	Gran Buenos Aires region	81509	0.69	0.46	0	1
CU	Cuyo region	81509	0.05	0.21	0	1
NO	North West region	81509	0.06	0.23	0	1
PP	Pampas region	81509	0.18	0.38	0	1
PT	Patagonia region	81509	0.02	0.15	0	1
YEAR 1/0 dummies:						
dum92	1992	81509	0.30	0.46	0	1
dum93	1993	81509	0.34	0.47	0	1
dum94	1994	81509	0.35	0.48	0	1
INDUSTRY 1/0 dummies:						
AG	Primary Activities & Food Processing	81509	0.01	0.09	0	1
IND	Industry: Textile, Chemical, Metal Prodn	81509	0.20	0.40	0	1
CON	Construction & Other Manufacturing	81509	0.08	0.27	0	1
EL	Electricity, Gas, & Water	81509	0.01	0.09	0	1
SERV	Services	81509	0.70	0.46	0	1
VARIABLES FOR MULTINOMIAL LOGIT MODEL						
ind	Industry (Dependent Variable)	26323	4.27	1.23	1	5
male	Male 1/0 dummy variable	45895	0.48	0.50	0	1
age	Age	45895	38.13	15.78	15	70
eduPn	Incomplete Primary School	45895	0.11	0.32	0	1
eduP	Complete Primary School	45895	0.28	0.45	0	1
eduSn	Incomplete Secondary School	45895	0.19	0.39	0	1
eduS	Complete Secondary School	45895	0.12	0.33	0	1
edUn	Incomplete University or Vocational	45895	0.16	0.37	0	1
edU	Complete University or Vocational	45895	0.12	0.32	0	1
GBA	Gran Buenos Aires region	45895	0.66	0.47	0	1
NO	Cuyo region	45895	0.06	0.24	0	1
CU	North West region	45895	0.05	0.22	0	1
PP	Pampas region	45895	0.20	0.40	0	1
PT	Patagonia region	45895	0.02	0.15	0	1

Table 1 (continued)

Variable		Obs	Mean	Std. Dev.	Min	Max
VARIABLES FOR HOUSEHOLD CALCULATION OF POVERTY AND INEQUALITY						
cod	Household ID number	64739	1701.29	1291.90	1	4496
componen	Household member	64739	2.80	1.83	1	88
age	Age (-1 = newborn)	64739	31.82	22.20	-1	98
sex	Sex	64739	1.52	0.50	1	2
estado	Employment Status	64739	2.23	0.95	1	3
eduPn	Incomplete Primary School	64739	0.23	0.42	0	1
eduP	Complete Primary School	64739	0.22	0.41	0	1
eduSn	Incomplete Secondary School	64739	0.15	0.36	0	1
eduS	Complete Secondary School	64739	0.09	0.28	0	1
eduVn	Incomplete Vocational education	64739	0.04	0.20	0	1
eduV	Complete Vocational education	64739	0.02	0.15	0	1
eduUn	Incomplete University education	64739	0.07	0.25	0	1
eduU	Complete University education	64739	0.05	0.23	0	1
ramat	Industry of work	24430	5.55	2.33	1	9
region	Region of residence	64739	2.20	1.76	1	6
male	Male	64739	0.48	0.50	0	1
adeq	Adult equivalency scale	64739	0.80	0.17	0.33	1.06
wgse	Wages and self-employment income	64737	224.43	481.22	0	20000
aemembers	Adult equivalent members of hhd	64739	3.58	1.67	0.64	14.14
hpciae	Household per cap adult equivalent income	64739	375.26	404.39	0	13414.63
lp	Poverty line for different regions	64739	135.93	7.38	129.25	199.05
li	Extreme poverty line for different regions	64739	62.96	3.38	62.44	96.16
hpciae1	New hpciae for simulation 1	64739	399.03	426.84	0	14547.63
hpciae2	New hpciae for simulation 2	64739	398.52	409.87	0	13103.7
hpciae3	New hpciae for simulation 3	64739	392.36	415.13	0	13971.14
hpciae4	New hpciae for simulation 4	64739	380.45	408.95	0	13649.23
hpciae5	New hpciae for simulation 5	64739	373.95	400.82	0	13223.78
hpciae6	New hpciae for simulation 6	64739	375.09	402.59	0	13333.49
wgse1	New income for simulation 1	41329	100.91	361.79	0	10929.05
wgse2	New income for simulation 2	41329	125.74	352.38	0	9745.036
wgse3	New income for simulation 3	41329	103.02	349.10	0	10456.33
wgse4	New income for simulation 4	41329	94.70	337.96	0	10192.37
wgse5	New income for simulation 5	41329	95.18	328.82	0	9843.5
wgse6	New income for simulation 6	41329	94.50	331.01	0	9933.461

Table 2
Multinomial Logit

Industry	**Primary Activities/Food Processing**			**Industry**			**Electricity, Gas, & Water**			**Construction**		
	Coef.		**S.E.**	**Coef.**		**S.E.**	**Coef.**		**S.E.**	**Coef.**		**S.E.**
male	1.92	**	0.33	0.98	**	0.06	1.19	**	0.31	3.40	**	0.23
age	0.00		0.01	-0.01	**	0.00	0.03	**	0.01	-0.01	**	0.00
eduP	-0.89	**	0.26	0.06		0.10	2.51	**	0.51	-0.61	**	0.10
eduSn	-1.21	**	0.31	-0.22	**	0.11	0.87		0.54	-1.63	**	0.15
eduS	-0.99	**	0.33	-0.38	**	0.12	2.36	**	0.56	-2.05	**	0.19
edUn	-1.31	**	0.31	-0.31	**	0.11	2.51	**	0.52	-1.81	**	0.14
edU	-0.58	*	0.31	-0.68	**	0.11	2.67	**	0.52	-2.07	**	0.17
NW	1.41	**	0.26	-0.69	**	0.07	0.76	**	0.28	0.24	**	0.09
CU	1.43	**	0.28	-0.29	**	0.07	0.95	**	0.32	0.28	**	0.10
PP	0.73	**	0.26	-0.36	**	0.05	0.53	**	0.26	0.16	**	0.08
PT	2.65	**	0.23	-0.89	**	0.06	1.50	**	0.25	0.31	**	0.08
constant	-5.68	**	0.52	-1.28	**	0.14	-9.19	**	0.65	-3.66	**	0.27
Number of obs			26323									
Wald chi2(44)			1641									
Prob > chi2			0									
Log likelihood			-20044									

Note: (**) 5% Significance Level; (*) 10% Significance Level
"Services" industry is the comparison group.

Table 3
Relative Risk Ratios

Industry	**Primary Activities/Food Processing**		**Industry**		**Electricity, Gas, & Water**		**Construction**	
	RRR	**t-stat**	**RRR**	**t-stat**	**RRR**	**t-stat**	**RRR**	**t-stat**
male	6.79	5.83	2.66	15.71	3.30	3.89	29.90	14.94
age	1.00	0.33	0.99	-3.22	1.03	3.16	0.99	-2.35
eduP	0.41	-3.46	1.06	0.64	12.30	4.95	0.54	-5.88
eduSn	0.30	-3.91	0.80	-1.97	2.38	1.62	0.20	-11.23
eduS	0.37	-2.98	0.68	-3.30	10.58	4.21	0.13	-10.71
edUn	0.27	-4.23	0.74	-2.77	12.33	4.85	0.16	-12.49
edU	0.35	-1.85	0.50	-6.01	14.39	5.15	0.13	-12.30
NW	4.12	5.48	0.50	-10.13	2.15	2.73	1.27	2.70
CU	4.17	5.06	0.75	-3.93	2.58	2.97	1.32	2.66
PP	2.07	2.81	0.70	-6.91	1.70	2.06	1.18	2.16
PT	14.09	11.31	0.41	-13.97	4.49	5.99	1.36	3.75
Number of obs		26323						
Wald chi2(44)		1641						
Prob > chi2		0						
Log likelihood		-20044						

Table 4
Hausman Statistic

	Coefficients			
	(b)	**(B)**	**(b-B)**	**sqrt(diag(V_b-V_B))**
	Current	**Prior**	**Difference**	**S.E.**
Industry				
male	0.94	0.94	0.00	0.00
age	-0.01	-0.01	0.00	0.00
eduP	0.09	0.10	-0.01	0.00
eduSn	-0.17	-0.16	-0.01	0.00
eduS	-0.41	-0.40	-0.01	0.00
edUn	-0.24	-0.23	-0.01	0.00
edU	-0.71	-0.70	-0.01	0.00
NO	-0.77	-0.77	0.00	0.00
CU	-0.08	-0.08	0.00	0.00
PP	-0.57	-0.57	0.00	0.00
PT	-0.84	-0.84	0.00	0.00
constant	-1.15	-1.16	0.01	0.01
Electricity, Gas, & Water				
male	1.46	1.46	0.00	0.00
age	0.02	0.02	0.00	.
eduP	1.13	1.13	0.01	0.01
eduSn	0.66	0.66	0.00	0.01
eduS	1.19	1.20	0.00	0.01
edUn	1.52	1.52	0.00	0.01
edU	1.52	1.51	0.01	0.01
NO	0.89	0.89	0.00	.
CU	0.77	0.77	0.00	0.00
PP	0.89	0.89	0.00	0.00
PT	1.34	1.34	0.00	0.00
constant	-7.99	-7.99	-0.01	0.02
Construction				
male	3.64	3.63	0.01	0.00
age	-0.01	-0.01	0.00	0.00
eduP	-0.70	-0.69	-0.01	0.00
eduSn	-1.65	-1.64	-0.02	0.01
eduS	-2.30	-2.28	-0.02	0.01
edUn	-1.85	-1.83	-0.02	0.01
edU	-2.10	-2.09	-0.01	0.01
NO	0.30	0.29	0.00	0.00
CU	0.11	0.11	0.00	0.00
PP	0.12	0.12	0.00	0.00
PT	0.20	0.20	0.00	0.00
constant	-3.64	-3.66	0.02	0.01

b = estimates obtained recently from MNL
B = estimates obtained previously from MNL

Test:
Ho: difference in coefficients not systematic
chi2(35) = (b-B) [(V_b-V_B)^(-1)](b-B) = 9.93
Prob>chi2 = 1.00

Hausman Statistics for the other sectors relative to the base (Services)

Omitting:	chi2(35)	Prob>chi2
Manufacturing	36.55	0.40
Electricity, Gas, and Water	1.04	1.00
Construction	13.23	1.00

Table 5
Log Wage Regressions for Men and Women

Log Men's Wages	Primary Activities/Food Processing			Industry			Electricity, Gas, & Water			Construction			Services		
	Coef.		**S.E.**	**Coef.**		**S.E.**	**Coef.**		**S.E.**	**Coef.**		**S.E.**	**Coef.**		**S.E.**
age	0.14	**	0.03	0.08	**	0.01	0.08	**	0.01	0.05	**	0.01	0.09	**	0.00
age2	0.00	**		0.00	**		0.00	**		0.00	**		0.00	**	
eduPn															
eduP				0.18	**	0.03				0.09	**	0.04	0.24	**	0.03
eduSn	0.39	**	0.10	0.30	**	0.04				0.19	**	0.05	0.41	**	0.03
eduS	0.61	**	0.15	0.51	**	0.05	0.18	**	0.06	0.26	**	0.06	0.61	**	0.03
eduVn	0.54	**	0.09	0.43	**	0.04	0.18	**	0.06	0.28	**	0.07	0.43	**	0.03
eduV	0.70	**	0.08	0.55	**	0.04	0.35	**	0.08	0.49	**	0.09	0.55	**	0.03
eduUn	0.92	**	0.19	0.73	**	0.05	0.39	**	0.12	0.57	**	0.08	0.69	**	0.03
eduU	1.60	**	0.21	1.27	**	0.06	1.08	**	0.15	1.36	**	0.12	1.13	**	0.03
GBA	-0.57	**	0.14												
NO	-0.79	**	0.08	-0.47	**	0.02	-0.38	**	0.08	-0.56	**	0.03	-0.49	**	0.01
CU	-0.66	**	0.07	-0.28	**	0.02	-0.34	**	0.08	-0.40	**	0.03	-0.37	**	0.02
PP	-0.51	**	0.06	-0.22	**	0.02	-0.18	**	0.07	-0.27	**	0.03	-0.25	**	0.01
PT				0.16	**	0.02	0.12	*	0.07	-0.12	**	0.03	0.09	**	0.01
dum92							-0.16	**	0.06	0.08	**	0.03			
dum93										0.06	*	0.03			
dum94															
constant	3.55	**	0.53	4.38	**	0.09	4.84	**	0.25	4.95	**	0.12	4.10	**	0.06
N. obs	1296			7324			763			5999			26894		
R2	0.557			0.345			0.502			0.262			0.334		

Log Women's Wages	Primary Activities/Food Processing			Industry			Electricity, Gas, & Water			Construction			Services		
	Coef.		**S.E.**	**Coef.**		**S.E.**	**Coef.**		**S.E.**	**Coef.**		**S.E.**	**Coef.**		**S.E.**
age	0.01	**	0.00	0.06	**	0.01	0.08	*	0.04	0.02	**	0.01	0.06	**	0.00
age2				0.00	**		0.00		0.00	0.55	**	0.21	0.00	**	
eduPn															
eduP							-1.46	**	0.30				0.23	**	0.03
eduSn				0.09	*	0.05	-1.31	**	0.37				0.39	**	0.03
eduS	0.35	**	0.16	0.40	**	0.06	-1.02	**	0.29	0.75	**	0.17	0.64	**	0.03
eduVn	0.35	**	0.16	0.22	*	0.12	-1.02	**	0.29				0.39	**	0.07
eduV	0.92	**	0.22	0.25	*	0.13	-1.02	**	0.29	0.39	**	0.18	0.55	**	0.06
eduUn	1.60	**	0.38	0.44	**	0.09	-1.28	**	0.32	1.34	**	0.20	0.72	**	0.04
eduU	1.03	**	0.18	0.82	**	0.11				1.05	**	0.26	0.93	**	0.03
GBA							0.54	**	0.12	0.55	**	0.14			
NO				-0.78	**	0.06							-0.47	**	0.02
CU				-0.54	**	0.06							-0.37	**	0.02
PP	-0.44	*	0.25	-0.38	**	0.04				0.42	**	0.16	-0.23	**	0.01
PT	0.42	**	0.16	0.21	**	0.05	0.54	**	0.12	0.52	**	0.15	0.07	**	0.02
dum92	-0.41	**	0.15												
dum93										0.52	**	0.19	-0.03	*	0.02
dum94										0.28	**	0.14			
constant	5.43	**	0.20	4.78	**	0.18	5.77	**	0.84	4.20	**	0.33	4.32	**	0.07
N. obs	97			2344			147			121			23308		
R2	0.664			0.253			0.64			0.568			0.253		

Note: (**) 5% Significance Level; (*) 10% Significance Level

Table 6
CGE Results: Employment

Total Employment	1993 BASE	WTO1	WTO1-N	WTO1-R	WTO2-K	WTO2-KN	WTO2-KR
	('000)	Percent Changes					
Primary Activities							
Unskilled Men	528.69	3.57	18.69	6.68	4.25	6.80	6.34
Semi-Skilled Men	286.58	4.99	20.46	8.11	4.90	7.08	6.62
Skilled Men	273.79	13.95	35.43	20.34	6.26	9.05	8.57
Unskilled Women	16.00	5.76	20.75	8.31	5.66	7.29	6.82
Semi-Skilled Women	59.07	5.31	20.42	8.08	5.23	7.03	6.57
Skilled Women	58.79	5.33	20.61	8.21	5.32	7.18	6.72
Manufacturing							
Unskilled Men	456.99	-1.27	13.12	1.71	-1.21	0.95	0.59
Semi-Skilled Men	420.38	-1.60	11.80	0.98	-1.11	0.33	0.00
Skilled Men	138.88	-4.28	11.56	0.77	-2.03	0.14	-0.18
Unskilled Women	176.04	-0.67	13.83	1.61	-0.11	1.02	0.62
Semi-Skilled Women	206.46	-1.16	12.94	1.30	-0.55	0.69	0.32
Skilled Women	63.59	-1.62	11.74	0.70	-0.99	0.09	-0.24
Electricity							
Unskilled Men	25.99	-0.78	14.71	2.31	-0.93	1.29	0.91
Semi-Skilled Men	27.32	-0.56	14.71	2.31	-0.37	1.29	0.91
Skilled Men	17.39	-3.09	14.71	2.31	-1.13	1.29	0.91
Unskilled Women	2.93	0.27	14.71	2.31	0.44	1.29	0.91
Semi-Skilled Women	10.36	-0.09	14.71	2.31	0.16	1.29	0.91
Skilled Women	4.25	-0.22	14.71	2.31	0.09	1.29	0.91
Construction							
Unskilled Men	494.44	-0.77	9.70	1.34	-0.14	0.00	0.00
Semi-Skilled Men	172.15	-0.55	9.70	1.34	0.42	0.00	0.00
Skilled Men	51.88	-3.08	9.70	1.34	-0.34	0.00	0.00
Unskilled Women	6.21	0.28	9.70	1.34	1.23	0.00	0.00
Semi-Skilled Women	8.73	-0.08	9.70	1.34	0.95	0.00	0.00
Skilled Women	6.22	-0.21	9.70	1.34	0.88	0.00	0.00
Services							
Unskilled Men	1315.89	-0.69	13.43	2.15	-1.21	1.42	0.97
Semi-Skilled Men	1669.12	-0.39	12.50	2.00	-0.60	1.32	0.90
Skilled Men	1034.35	-2.91	12.40	1.98	-1.35	1.31	0.90
Unskilled Women	878.78	0.03	17.38	2.78	-0.09	1.83	1.26
Semi-Skilled Women	1143.69	-0.06	14.28	2.28	-0.18	1.51	1.03
Skilled Women	966.07	-0.21	14.53	2.32	-0.26	1.53	1.05

Table 7
CGE Results

	1993 BASE	WTO1	WTO1-N	WTO1-R	WTO2-K	WTO2-KN	WTO2-KR
		Percent Changes					
Exports	16237	8.03	16.49	10.04	4.37	5.32	5.14
Imports	-20870	11.41	18.77	13.21	6.80	7.58	7.43
Real GDP	274246	0.31	6.31	1.69	-0.05	0.63	0.50
Wages (Pesos)							
Unskilled Men	579	8.30	0.00	6.65	1.99	0.00	0.33
Semi-Skilled Men	732	8.10	0.00	6.65	1.51	0.00	0.33
Skilled Men	1226	10.45	0.00	6.65	2.16	0.00	0.33
Unskilled Women	378	7.36	0.00	6.65	0.83	0.00	0.33
Semi-Skilled Women	552	7.68	0.00	6.65	1.07	0.00	0.33
Skilled Women	706	7.79	0.00	6.65	1.12	0.00	0.33
Money	466206	6.41	14.23	8.36	0.27	1.09	0.93
Real Exchange Rate	0.98	-5.94	-7.43	-6.44	-0.37	-0.56	-0.53
Exchange Rate	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Foreign Savings	7547	0.00	0.00	0.00	0.00	0.00	0.00
PPI	1.00	6.61	8.09	7.12	0.65	0.77	0.75
CPI	1.04	6.03	7.96	6.65	0.11	0.37	0.33

Table 8
Poverty Results

	1993 BASE	WTO1	WTO1-N	WTO1-R	WTO2-K	WTO2-KN	WTO2-KR
		Percent Changes					
Price Changes (a)							
P0 (c)	19.92%	-1.19	-6.83	-1.39	-1.84	-0.56	-0.59
EP0	5.08%	5.32	-34.66	-9.92	4.34	-0.21	-0.98
P1	7.28%	1.31	-17.88	-4.03	-0.05	-1.23	-1.06
EP1	2.16%	13.68	-48.96	-16.39	10.22	-5.56	-4.37
P2	4.01%	5.86	-28.37	-7.80	3.21	-2.79	-2.36
EP2	1.46%	20.96	-58.47	-20.88	15.02	-8.85	-6.67
CPI Changes (b)							
P0	19.92%	-0.49	-3.60	-0.27	-2.36	-0.68	-0.73
EP0	5.08%	6.39	-31.01	-7.96	2.95	-2.29	-1.43
P1	7.28%	2.04	-15.38	-3.23	-0.55	-1.68	-1.36
EP1	2.16%	15.43	-45.44	-15.41	9.58	-6.42	-5.04
P2	4.01%	6.61	-26.14	-7.30	2.90	-3.37	-2.66
EP2	1.46%	22.47	-56.11	-20.34	14.91	-9.28	-7.13

Note: (a) Indigence (Extreme Poverty) line based on price changes for food items; Poverty line based on price changes for food and non-food items. The latter include clothing, electricity, and some service items.
(b) Poverty and Indigence lines based on changes in the Consumer Price Index.
(c) Poverty measures from Foster, Greer, and Thorbecke (1984).
P0 and EP0: Headcount index for Poverty and Indigence line, respectively
P1 and EP1: Average normalized poverty gap for Poverty and Indigence Line, respectively
P2 and EP2: Average squared normalized poverty gap for Poverty and Indigence Line, respectively
Columns 3-5: Capital mobile across sectors; Columns 6-8: Capital fixed by sector.
Columns 3 & 6: Full Employment
Columns 4 & 7: Unemployment, Fixed Nominal Wages
Columns 5 & 8: Unemployment, Fixed Consumption Real Wages

Table 9
Inequality Results

	1993 BASE	WTO1	WTO1-N	WTO1-R	WTO2-K	WTO2-KN	WTO2-KR
		Percent Changes					
Labor Income							
Gini	0.3994	5.36	2.99	5.50	5.13	4.59	5.21
Theil	0.2956	7.60	2.84	8.92	7.00	5.85	7.53
Household Adult Equivalent Income							
Gini	0.4451	0.13	-3.79	-1.09	0.03	-0.54	-0.32
Theil	0.3531	-0.91	-6.39	-1.75	-0.65	-0.77	-0.38

Note: Columns 3-5: Capital mobile across sectors; Columns 6-8: Capital fixed by sector.
Columns 3 & 6: Full Employment
Columns 4 & 7: Unemployment, Fixed Nominal Wages
Columns 5 & 8: Unemployment, Fixed Consumption Real Wages