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Trade and Labor Outcomes in Latin America's Rural Areas: A Cross-Household Surveys Approach

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A cross-household surveys approach [#]

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Abstract

This paper explores the potential link between trade and labor outcomes in rural areas in Latin America by estimating cross household-survey regression models with microdata from 60 Latin American household surveys and country aggregate data. We find a significant positive association between labor outcomes in rural areas and some measures of international trade, in particular exports, trade as a share of GDP, and the price of exports. International trade has been associated with higher wages and labor income in rural areas, in particular for those workers located in the bottom quantiles of the conditional wage distribution. Instead, our results suggest that all individuals in rural areas benefit about the same due to higher export prices. Results for urban areas are rarely statistically significant.

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I. Introduction

The welfare effects of international trade are a topic of permanent heated debate. During the 1990s most Latin American countries increased their trade openness to the world. Increased integration, trade agreements and trade liberalization programs were widespread across the region. Although the positive economic effects of trade are well known, it has long been recognized that not all agents may benefit from increased international trade. In fact, some people argue that the recent trend toward trade liberalization in Latin America has had negative effects on the demand for unskilled labor, which has translated into lower wages, unemployment, and poverty.

This paper provides some evidence of the potential effect of trade on labor outcomes in the rural areas of Latin America and the Caribbean (LAC thereafter) by estimating cross household-survey regression models. We merge microdata for more than 4 million individuals surveyed in 60 household surveys in 17 Latin American and Caribbean (LAC) countries between 1989 and 2002 with aggregate data on some trade indicators, mostly drawn from the SIMA database at the World Bank. The resulting dataset combines variability of aggregate variables with heterogeneity at the country level.[1]

In this paper we take advantage of this dataset to explore the links between measures of international trade (exports, imports and trade as a share of GDP, and prices of exports, imports and agricultural products) and wages, employment and labor income. Although we are aware of the endogeneity problems among these variables, our preferred interpretation of the results stresses the causality from international trade to labor outcomes. When prices are used as regressors, this presumption is even stronger since small countries (such as individual LAC countries) will have small impacts on equilibrium international prices.

[1] Behrman, Birdsall and Székely (2003) and Sánchez Páramo and Schady (2003) are two of the few examples where the cross-household survey regression methodology is applied to a sample of LAC household surveys.

We find a significant association between individual labor outcomes and some measures of trade, in particular exports, trade as a share of GDP, and the price of exports. According to our results, international trade has been associated with higher wages and labor income in rural areas. The benefits of trade in terms of labor income do not differ by groups of formal education. Instead, those workers located in the bottom quantiles of the conditional wage distribution appear to benefit more from increased openness to international trade. Higher export prices are also associated with higher wages, employment, and labor income. The relationship seems to be non-linear and similar across groups of formal education and unobservable factors. All individuals in rural areas benefit about the same due to higher export prices. Interestingly, the results for urban areas are rarely statistically significant: urban hourly wages seem not to be affected by measures of trade, and employment appears to increase with trade (although this effect is sometimes only marginally significant). In the end, total labor income in urban areas is not affected by trade as measured either by volumes or prices.

Our results are consistent with a model of comparative advantage. A higher exposure to trade may bring about an expansion of the agricultural sector and benefits to those factors intensively utilized in rural areas, including labor. Notice, however, that the LAC surveys are not designed to capture the rural sector and that areas identified as rural may actually be small semi-urban centers. Under this interpretation, our results are consistent with models of trade and convergence, whereby economic activity relocate from large urban centers to smaller cities. Our findings support this view.

The rest of the study is organized as follows. In section II we briefly discuss the potential links between international trade and wages, employment, and income. In section III we develop the empirical methodology used in the paper. In section IV we briefly describe household surveys data and the aggregate regressors. In section V we present some preliminary results that come out of the application of the methodology. Section VI concludes with an assessment of the results and future work.

II. The links

Modern economies tend to be increasingly open to international trade. As a result, we expect trade policies and openness to have important effects on individual outcomes. In this section, we briefly provide economic arguments linking international trade with wages and employment.

In general, international trade is thought to be beneficial for a country as a whole. There are different sources of gains from trade. First, some gains arise because countries specialize in those activities in which they have a comparative advantage. By exporting goods that can be produced more efficiently domestically and by importing goods that can be produced more efficiently abroad, countries maximize the value of their outputs. Second, countries may take advantage of economies of scale. Indeed, specialization on export goods that are subject to increasing return to scale allows countries to exploit a larger scale of production brought about by international trade. Third, trade may introduce competition into the economy. This may cause some distortions to disappear thereby maximizing per capita GDP. Finally, there may be growth effects if openness to international markets boosts productivity, encourages a more efficient allocation of resources, promotes investments in human and physical capital, etc.

In a typical cross-country regression, these gains from trade would be captured by a positive association between measures of trade and openness with both growth rates and per capita GDP. In our framework, we will explore the sign and magnitudes of the association between measures of trade and individual wages, employment, and labor income.

When focusing on the effects of trade on wages at an individual level, it is important to have in mind that trade may have differential effects on the earnings of individuals with different labor endowments. For instance, if trade is liberalized in skilled-intensive sectors, then openness may benefit skilled workers relative to unskilled workers. In a simplified 2-by-2 model, this result follows from the Stolper-Samuelson theorem. Notice, however, that the result is more general and that trade models deliver a general relationship between product prices and factor prices.

In our empirical analysis, we provide evidence on the relationship between trade and labor outcomes in Latin America. Since the region is relatively well endowed with unskilled labor (relative to the rest of the world), we would expect trade to be positively associated with the wages of unskilled workers. However, the observed impacts may depend on which sectors are actually relatively affected. In the case of tariff liberalization, for instance, it may happen that the tariff on unskilled labor sectors is reduced by a larger extent than the tariff on skilled labor sectors. This would imply a change of relative prices in favor of the skill-intensive good, and lead to an increase in the wages on skilled workers (relative to unskilled workers). Finally, it should be noticed that if trade fosters growth in the economy, the wages earned by all type of workers might increase. This ambiguity will be resolved empirically in section V.

The effects of trade on employment may also be ambiguous. On the one hand, a more open economy allows the export sector to face a larger world market. These sectors may expand, attracting more factors of production and causing employment to increase. On the other hand, increasing competition from the rest of the world may force import-competing sectors to contract and employment to decline as a result. The total effect is ambiguous. Notice that there is a role to be played by the flexibility of the labor market. A rigid labor market may cause employment to remain relatively stable. A very flexible labor market could also be relatively stable, if workers laid off in the import-competing sectors are absorbed by the expanding exporting sector. With adjustment costs, we may observe delays in the job-creation and job-destruction process. For example, it may be easier for import competing firms to close down than for exporting firms to adapt to international markets and invest.

There are several other economic effects of trade. Here, we want to highlight some results that may appear in models with increasing returns, economies of scale, or imperfect competition. In those models, the localization of economic activity may well depend on international trade. In fact, an expansion of international markets may pull resources out of large urban centers and towards smaller cities (or semi-rural areas). This relocalization of economic activity can help generate a process of convergence of poor, less-developed regions to richer, more developed cities. Since many less-developed regions in Latin America are in fact rural (or semi-rural areas), international trade can lead to a process of decentralization of industrial activity and of convergence in wages and employment. We shall see some of these effects in our empirical results.

A key element in the relationship between trade, openness and labor markets is the role of complementary public policies and complementary individual factors. Complementary policies refer to the set of policies that allow trade to reach individuals. Infrastructure, access to finance, and regulations are examples. These policies create a wedge between local labor markets and international trade. A similar role applies to individual factors that may cushion or strengthen the impacts of trade.

III. The Empirical Methodology

Cross-country regressions are one of the tools often used in the literature to empirically establish the relationship between certain explanatory policy variables and a variety of socio-economic outcomes. These regressions provide an opportunity to do practical evaluation of economic hypothesis, particularly when the availability of microeconomic data, in the form of household surveys or firm databases, is not widespread. There are numerous applications of cross-country regressions. They have been applied in the health literature, in the growth literature, in the political economy literature, in development economics, labor economics and many other fields.

Although cross-country regressions are a useful empirical instrument, it is well known that they suffer from several technical problems. Perhaps the main concern is the aggregative nature of these regression models. In fact, cross-country regressions fail to capture, and to take advantage, of the heterogeneity within each country. By using aggregate data on the dependent variable, useful information is lost. For example, consider the case in which a researcher wishes to identify the impacts of growth on poverty using data on many different countries. By identifying aggregate conditional expectations, cross-country regressions will not be able to capture the heterogeneous effects of growth on the income of individual families.

One alternative methodology is to use detailed household survey data to assess the economic relationship in which the researcher is interested. These methods take full advantage of household heterogeneity so that the regression model is carefully set up, including all necessary and available controls at the micro level. This allows the researcher to specify the regression function as correctly as possible given the data. Perhaps the main problem with this technique is that it is not very useful to investigate the impact of aggregate macroeconomic variables. This is so because there is generally very little variability of the aggregate variables at the household level. For example, suppose that we are interested in the impact of trade policies on the level (or growth) of household per capita expenditure and that we have a household survey at hand. In general, data on trade policies include aggregate tariff rates at the national level so that this would be an instance in which there is no variability of the trade policy data at the level of the household. Identification of the policy impacts becomes difficult.

Some authors have proposed merging household surveys for different countries so that there is variability of aggregate variables and heterogeneity at the country level. We call this method the *cross household-survey regression model*. We claim that this extension of the cross-country regression model can be fruitfully used to deal with many interesting questions involving individual socio-economic outcomes and variables that are available only at an aggregate level, such as many international trade indicators.

The regression model explains a variable (outcome) y_{ict}, for household i in country c at time t. y_{ict} may refer to per capita household expenditure, educational attainments, health status, wages, income, poverty, etc. The data on y_{ict} come from household surveys. There are individual covariates of the economic outcome y_{ict}. Let us define $\mathbf{x_{ict}}$ as the vector of those covariates. The elements in $\mathbf{x}_{ict}$ may refer to gender, education, race, marital status, etc.

The whole point of the methodology is that there are some variables for which we only have aggregate information. Let $\mathbf{p}_{ct}$ be a vector of such variables, which may include prices (of exports and imports, for instance), macroeconomic variables, trade measures, indicators of rural development, etc. These data may vary by country *c* and by time period *t*, so that we can use this variation to identify the coefficients of interest.

We write the empirical model as

$$(1) \qquad y_{ict} = \mathbf{x}'_{ict}\boldsymbol{\alpha} + \mathbf{p}'_{ct}\boldsymbol{\beta} + u_{ict}\,,$$

where u_{ict} is an error term and α and β are the vector of coefficients.

The implementation of the methodology requires two pieces of data. One big piece is the household surveys. The other piece is the aggregate regressors. We discuss the data used in this project in section IV. The combination of microdata with aggregate regressors means that, in practice, several dozen household surveys need to be used in order to guarantee some aggregate variability. The fact that we are putting together several household datasets raises a number of additional practical problems.

Under standard assumptions, and particularly in our applications in this paper, the model can be estimated with OLS. Household surveys are generally a random sample, and when the independent regressors are predetermined, OLS provides consistent estimates of the parameters of the model. In this sense, the asymptotic properties of the model are simple and very well known. This is not true for the estimation of the standard errors. This issue is of particular importance given the clustering induced by the use of aggregate explanatory variables (Kloek, 1981). Clustering in residuals arises when there are shocks that are common to a group of observation in the sample. In our case, for instance, we are merging datasets for different countries, using aggregate variables as regressors. Thus, if there are aggregate shocks at the national level, then all households interviewed in a given country in a given year will be affected by this shock causing clustering in the errors.

More technically, the consequence of clustering is to introduce correlation in the error terms. In these cases the OLS coefficients are still consistent, but the estimation of their variance can be severely biased. Although the problem may be severe in practice (Deaton, 1997), the solution is relatively simple. One way to think about clustering is as an analogy with heteroskedasticity. In a heteroskedastic model, coefficients are consistently estimated by OLS, but their variance is not. This bias can be corrected by parameterizing the variance or by using a White (1980) correction. In the case of correlation in the errors, the correction can be done parametrically or non-parametrically as well. Under some assumptions about the nature of the aggregate shocks, the estimated residuals can be used to recover the parameters that characterize the correlation in the errors (induced by the aggregate shock). Standard errors are then corrected with a procedure that is similar to the White correction for heteroskedasticity.

In some cases, the linear regression model may not be appropriate. An instance when this is the case would be when the outcome y_{ict} is a dichotomous variable. This case would arise, for example, if we build a dummy indicator for those individuals who are employed, and we attempt to use our cross household-survey model to assess the impacts of aggregate variables on the probability of being employed. In an application like this, the model may have to be estimated with discrete choice models, such as probit or logit. The correction of the standard errors for clustering can still be done parametrically or non-parametrically.

IV. The Data

The methodology outlined in the previous section is applied to investigate the impact of trade on wages, employment and earnings in Latin America. Two sources of data are used in this study: household surveys and aggregate indicators of trade. In this section we describe these data sources and discuss the variables used in the regressions.

Household Surveys

Household surveys are the main source of information at the individual and household level for many labor and socio-economic variables. A typical LAC household survey covers a representative sample of the national population and reports the answers to a set of questions including demographic, housing, labor and socio-economic variables.

Despite its relevance for economic and social analysis household surveys were not common before the 1970s. While Mexico and some Caribbean countries (Barbados, Guyana, Jamaica and Trinidad and Tobago) started to conduct household surveys in the 50s, only Mexico has continued with a systematic program of surveying household incomes and expenditures. Most countries either consolidated or introduced household surveys in the 70s. The last decade witnessed some relevant improvements in household surveys across the region. First, surveys became nationally representative in most countries (e.g. Bolivia, Ecuador, Paraguay, Peru). Second, in many countries questionnaires were enlarged and improved. Third, surveys were conducted more frequently and with an increasingly regular schedule. Forth, the LSMS program of the World Bank was extended to cover some LAC countries.[2] Finally, the MECOVI program of the World Bank, the Inter-American Development Bank (IADB) and the United Nations Economic Commission for Latin America contributed to the sharing of information from household surveys among researchers. Most surveys for this study were obtained through the MECOVI program.

We assemble a dataset containing 60 household surveys covering the period 1989-2002. We take advantage of the dataset assembled in Gasparini (2003) and significantly enlarged the sample by adding several additional household surveys. The sample comprises more than 4 millions individuals surveyed in 17 LAC countries: Bolivia,

[2] Ecuador, Perú, Nicaragua, Guatemala, and some surveys in Brazil and Bolivia.

Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, and Venezuela. The sample represents more than 85% of LAC total population. The data used in this project will be collected and made available in a CD-ROM.

All household surveys included in the sample are nationally representative. We exclude Argentina and Uruguay from the analysis, since in these countries surveys cover only urban population. All surveys record a basic set of demographic, education, labor and income variables at the household and individual level. Although there are differences across countries, surveys are roughly comparable in terms of questionnaires and sampling techniques.

Table IV.1 presents the main characteristics of each household survey. The table shows the names of the surveys and the sample size (in individuals). Surveys that include questions for non-monetary labor income in addition to monetary earnings are identified in column (iv). For most countries we have at least three data points that roughly correspond to the early 90s, mid 90s and late 90s or early 2000s.[3]

We have used similar definitions of variables in each country/year, and have applied consistent methods of processing the data. However, perfect comparability is not assured, since the coverage and questionnaires of household surveys differ among countries, and frequently also within countries over time.

Some problems are particularly severe for the purposes of studying the rural economy. One is rather obvious: some household surveys in LAC have only urban coverage. This is the case of Argentina and Uruguay, and it was the case of Bolivia, Ecuador, Peru and Paraguay until around a decade ago.

[3] The exceptions are Bolivia, where national coverage started in mid 90s, Dominican Republic and Ecuador, with available surveys only between 1994 and 1998, and Guatemala, where the first available LSMSs was for the year 2000.

Under-reporting is a permanent concern for statistical offices and researchers. Under-reporting can be the consequence of the deliberate decision of the respondent to misreport, or to the absence of questions to capture some income sources (e.g. non-monetary payments), or to the difficulties in recalling or estimating income from certain sources (earnings from informal activities, in-kind payments, home production, capital income). This problem likely implies a downward bias on the measured living standards of people who rely on a combination of informal activities and/or production for own consumption. This bias is likely more relevant in rural areas than in cities.

The measurement of well-being with data from household surveys has an additional very important drawback. LAC countries do not have long panel surveys and the period of recall in the cross-sections is usually just one month. When incomes are very volatile from month to month, measured incomes may severely under or overestimates intertemporal living standard, which for most studies is the relevant variable to measure. Again, income volatility tends to be higher in rural areas than in cities.

As argued elsewhere (Gasparini, 2003) we think we should avoid any of the two extreme positions toward household surveys: to discard them or to use them without qualifications. With all their limitations household surveys still provide valuable information, being the best available source to generate representative statistics of the population. However it is important to be aware of their drawbacks. Despite LAC governments and international organizations have taken important steps in the last decade (*e.g*. the MECOVI program), they still have a long way to go in order to have a more reliable, richer and more homogeneous set of national household surveys.

The aim of this paper is to measure the impact of trade on individual living standards. However, as discussed above, the measurement and cross-country comparisons of well-being face several problems. In this study we limit the analysis to three variables: wages, employment, and household labor income.

The main dependent variable in this study is hourly wages in the main occupation. All LAC household surveys include questions on monetary income from salaried work, but many of them do not include estimates of non-monetary payments. We include a dummy in the regressions to control for this difference. All wages are expressed in PPP dollars using World Bank Indicators price indices. Despite many authors have highlighted the importance of considering spatial variations of prices within a country (*e.g.* Deaton (1997), Ravallion and Chen (1997)), we did not perform price adjustments since most LAC countries do not routinely collect information on local prices. We also run regression with the employment status as the dependent variable. All surveys in LAC record whether the individual was employed or not in the week previous of the survey. We group the unemployed and those out-of-the-labor-market as not employed. In all the analysis we restrict the sample to adults aged 25 to 55.

The impact of rural development on wages and employment may be different in rural and urban areas and may also differ across skill groups. The classification urban-rural is taken from each household survey. The threshold to define a rural area is different across countries, a fact that introduces another comparability problem. In some countries “rural” means essentially small towns. Table IV.2 shows the share of what household surveys record as rural population in each country. Male adults are divided into three skills groups according to their formal education reported in the surveys. The unskilled comprise all individuals without any educational degree. The semi-skilled group includes from primary school graduates to college drop-outs, while the rest belongs to the skilled group. Another comparability problem arises from the fact that the educational systems vary across countries and frequently within a country over time. Years of education can be alternatively used in the analysis, although sheep-skin effects would be missed in this case.

Aggregate Data

Country data on international trade is gathered from a variety of different sources. The SIMA database at the World Bank is the major source consulted. We have considered six variables for which there is country data: (i) exports of goods and services (% of GDP), (ii) imports of goods and services (% of GDP), (iii) trade (% of GDP), (iv) exports price index, (v) imports price index, and (vi) unit value of exports of agricultural products.

V. The Impact of Trade on Labor Outcomes

In this section we report the main results of applying the methodology outlined in section III to the data described in section IV, in order to provide some evidence for the potential links between international trade and some labor outcomes: wages, employment and labor income.

The next equation reproduces one of the typical models estimated by weighted OLS for wages of prime-age males living in rural areas.

$$\ln w_i = \beta^0 + \sum_{c=1}^{17}\sum_{g=2}^{3} D_i^c E_i^g \beta_{cg}^E + \sum_{c=1}^{17}\left(D_i^c A_i \beta_c^A + D_i^c A_i^2 \beta_c^{A2}\right) + \tag{2}$$
$$+ \sum_{t=1989}^{2002} D_i^t \beta_t^T + \sum_{c=1}^{17} D_i^c \beta_c^C + \sum_{j=1}^{3} E_i^j k_i \beta_j^k + \beta^g g_i + \varepsilon_i$$

where w_i is the hourly wage of individual *i*. Each individual *i* is observed in one specific year *t* in a country *c*. D_i^t and D_i^c denote the year and country dummies corresponding to individual *i*. People are classified into one of the three educational groups indexed with *j*: unskilled, semi-skilled and skilled. E_i^j labels the educational dummy for skill group *j* while *A* denotes the age of the individual. k_i labels the value of the variable that measures international trade, and g_i denotes the GDP growth rate in the year and country to which individual *i* belongs. This variable, together with the country dummies, capture the role of specific macrovariables that may be correlated with both wages and exports. For example, in periods of macroeconomic crisis and devaluations, exports may grow (this is debatable, though) and real wages may decline. The variable g_i tries to capture these effects. Finally, the βs are parameters to be estimated and ε is the individual error term.

In the estimations we take variables k_i both contemporaneously and lagged one year. Two reasons justify the alternative of considering lags. On the one hand, the impact of trade on socio-economic outcomes may not be contemporaneous. On the other hand a (weak) way to alleviate endogeneity problems is to lag the relevant regressors. Since results do not significantly vary as we take different alternatives, we show only those results obtained with the regressors lagged one year. In the estimations we also include dummies identifying individuals interviewed in household surveys that do not include a question for non-monetary payments, and in some specifications we include regional dummies (for regions within each country).

We estimate the wage equations using weighted OLS. The weights, provided by the statistical offices in the surveys, are needed as we combine surveys with different degree of representation. Most of the analysis is conducted for males aged 25 to 55. Sample selection may not be an important problem, since most of these men are in the labor force. In addition, in absence of a good model for the labor market participation decision the Heckman correction for sample selection is not necessarily better than OLS. We do correct for sample selection when analyzing women aged 25 to 55, since participation rates are substantially lower.

We run separate regressions for wages in rural and urban areas. Although our main interest is on rural areas, urban wages are analyzed for comparative purposes. A typical regression has more than 100 coefficients. Some consistent results emerge from them. In all countries returns to education are positive. Wages of men with a college education are higher than those without it, while having a primary education means also higher wages compared to not having a primary school degree. The wage-age profile has an inverse U-form in all countries. Mean wages, controlling for the rest of the factors, are different across LAC countries, and have significantly varied over time in the period under analysis. Rural wages in those countries where the household survey includes questions for non-monetary incomes are significantly higher than rural wages in the rest of the countries. Differences are not statistically significant for urban wages.

Although these results are interesting on their own, they are mostly well-know in the literature. This paper is mainly interested in the association between measures of international trade and labor outcomes, so we only report the β^k coefficients. Table V.1 shows the results from estimating two different models. In Model 1 we include the indicators of trade without any interactions; instead, in Model 2 variable *k* is interacted with the educational dummies, as in equation (2). In Table V.1 we consider three variables related to international trade (*k*): exports, imports and trade (computed as exports+imports as a share of GDP). Below each estimated coefficient we report the corresponding robust *t*-statistic. As explained in section III, the errors are corrected to take into account the clustering effects generated by merging microdata with aggregate regressors. In our applications, a cluster is defined as a year-country combination.

According to the results in Table V.1 international trade has been associated to higher wages in rural areas. The coefficients of the exports, imports, and trade variables are positive and highly significant. There is some evidence that the beneficial effect of trade is slightly larger for skilled workers in rural areas, although wages for the unskilled also grow with trade (see column (iii)).[4] Hourly wages of urban workers do not seem to be affected by trade.

The results highlight the asymmetric effects that trade can have on hourly wages. While more trade is associated with higher wages in rural areas, this positive effect does not show up in urban areas. Also, trade seems to have benefited more (or hurt less) the skilled workers. Latin America is a region relatively abundant in natural resources, which are exploited in rural areas. Increasing trade may imply an increase in the demand for products and labor in rural areas, which under certain circumstances may translate into higher wages for rural workers. Wages seems to have increased somewhat more for the skilled, which could be the consequence of the likely introduction of skilled-biased technological change along with the increase in trade.

[4] On the unequalizing impact of trade see Behrman *et al*. (2003) and Galiani and Sanguinetti (2003).

There is an additional economic story that is also consistent with our results. In a model with increasing returns, fixed costs of production and/or imperfect competition, international trade can generate a process of convergence or divergence of economic activity. For instance, by providing a sufficient scale of production, trade can facilitate the payment of the fixed costs of production in semi-rural areas. If these are areas that happen to be closer to the "international markets", then industrial and other activities (like services) may relocate. Examples may include Northern Argentina and Southern Brazil in the context of Mercosur, or Northern Mexico in the context of NAFTA.

In short, our findings suggests that trade would have a positive impact on wages in rural areas and a generally negligible (i.e., not statistically significant) in urban areas. If we interpret the definition of "rural" in the LAC surveys as indicating actually small semi-urban centers (see Table IV.2), then our findings are consistent with the convergence effect described above. Even though we cannot isolate the effects of relocalization and trade opportunities, we emphasize this consistency.

Next, we turn to discuss the regressions for women. Notice that in the case of women the rate of participation in the labor market is much smaller than for men. This increases the possibility of observing selection bias in a OLS model without selection correction. We address this issue by estimating a Heckman model. Participation of women is modeled as a function of household characteristics and measures of the reservation wage (like the number of children, indicators of whether the spouse works, etc.). The model for wages includes all the same variables as in the model for men. Results for women are slightly different than for men (see Table V.2). In general, we find that trade, as measured by exports and imports (as a share of GDP), has a positive and significant effect on hourly wages. This is particularly so for the cases of imports and aggregate trade (imports plus exports). The case of exports is less clear. Whereas we find positive effects, the coefficients are of lower statistical significance. In contrast to the case of males, the positive impact of trade appears to be larger for the unskilled women.

In this paper we are interested in assessing not only the link between trade and *mean* wages, but especially the link between trade and the *distribution* of wages. Trade may increase mean rural wages, but is this increase generalized across wage strata? An attempt to shed some light on this issue was introduced in type-2 models, where interactions between trade indicators and individual education were considered. The correlations between some trade measures and wages seem to be stronger for some education groups than for others.

In order to understand the impact of trade over the whole distribution, we divide male workers into five groups according to their wages. Then, we run separate regressions (type-1 model) for each quintile. Table V.3 shows the parameters and their t-statistic and Figure V.1 presents the parameters and the 95% confidence intervals. It can be seen that almost all male workers in rural areas benefit from trade. Those located at the top of the wage distribution seem to benefit slightly more.

Another possibility for studying the potential different correlations between trade and wages across groups is to implement a quantile regression strategy. Mean linear regression models provide only a limited characterization of the dependent variable as a function of covariates, since the response variable is modeled as a unique function of the impulse variables. In particular, models seek to find the relationship between the observed covariates and the mean of the conditional distribution of the response variable. This characterization leaves useful distributional information outside the model. The technique of quantile regression, introduced by Koenker and Basset (1978), can provide a richer characterization of the conditional distribution of the dependent variable when the regression errors are not *iid*. Although quantile regression was originally proposed as a robust alternative to OLS for estimating the parameters of a linear model, the literature has used this technique for revealing how the covariates affect the entire shape of the conditional distribution.[5] To provide a brief idea of quantile regression, write a wage equation as

[5] See Koenker and Portnoy (1997) for an overview of the motivation, models and estimation strategies for quantile regression.

$$w = X\beta + \varepsilon$$

where w is the (log) hourly wage, X is a vector of covariates, β a vector of parameters, and ε a vector of independent error terms. The θ-th conditional quantile of w can be written as

$$Q_{\theta}(w \setminus X) = X\beta(\theta)$$

where the θ-th conditional quantile of the error term is assumed to be zero. This equation can be defined for a set of quantiles θ, giving rise to a family of quantile regression curves, which provide a more detailed characterization of the relationship between X and w. Naturally, the most interesting case is when the estimated $\beta(\theta)$ coefficients differ across quantiles θ, suggesting that the marginal effect of a particular explanatory variable differs across quantiles of the conditional distribution of w.

Suppose X is a measure of trade, *e.g.* (exports+imports)/GDP. OLS provides a single β, and hence a single estimate of the "returns" to international trade in terms of rural wages. These returns, however, may depend on some individual unobservable factors. Suppose two individuals, *A* and *B*, with the same formal education, age and gender, living and working in the same rural area. Individual *A* may have higher values of unobservable factors than *B*. For instance, s(he) may be working in a rural firm with better access to international markets, in contrast to *B* who may be producing for own consumption. In this scenario individual *A* may enjoy higher labor income than *B*, although not necessarily s(he) will get a greater income increase as the country where they live increases its openness to international trade. One possibility is that the pressure of increasing international demand for agricultural products drives traditional farmers to adopt new technologies and produce for the international market. In this scenario type-B rural workers may enjoy higher income growth than type-A rural workers, who were already in a more "modern" sector.

Quantile regressions provide a parametric way to assess these potential differences. By modeling the conditional distribution of wages by quantile regression, we allow the unobserved component of wages to interact with the available measures of trade. Tables V.4 to V.6 present the results of the wage equations estimated by OLS and quantile regression techniques for males aged 25 to 55 in rural areas. Each table reports the OLS coefficient for each indicator of trade along with the coefficients for quantiles 0.1 to 0.9. The results are plotted in Figures V.2 to V.4, which show the estimated quantile regression (QR) coefficients, the mean effect estimated by OLS, and the corresponding 95% confidence intervals.

Most QR coefficients for exports, imports and trade have a clear decreasing pattern. This suggests a greater effect of trade indicators on wages for those workers with lower levels of unobservable factors, *i.e*. at lower quantiles of the conditional wage distribution. In the case of trade (Table V.6), for example, the OLS coefficient estimated in Model 1 is 0.007. For the first quintile the coefficient is 0.016, while for the ninth quintile the coefficient is 0.001. Similar results are obtained in Model 2. In Model 1 the QR coefficients for the bottom and top conditional quantiles lie outside the 95% confidence interval for the OLS estimate, implying that the differential effect by quantile is significantly large.

A plausible story for these differentials was outlined above. The pressure of increasing international demand for agricultural products may "convince" traditional farmers to update their technologies and jump to the formal markets. This jump may imply a sizeable increase in wages and income.[6] Another possibility should not be ignored. The change from own consumption to production for international markets likely implies a reduction in the under-estimation of rural income by household surveys. In any case, in this story the increase in wages and incomes (either real or reported) is larger for those traditional farmers located at the bottom tail of the conditional wage distribution. Figures

[6] Changes in utility however could be marginal, since farmers reduce non-market activities that give them utility but not income recorded in household surveys.

V.2 to V.4 show evidence supporting this hypothesis, although, of course, they could also be explained by other arguments.

The probability of being employed might depend on the size of the international trade. We investigate this hypothesis by running probit models with a similar structure of the above equation for wages. In this case the dependent variable is a dummy taking the value 1 if the individual is employed and 0 otherwise (unemployed or out of the labor market). We run this regression for prime-age males, separately for those who live in rural and in urban areas. Table V.7 shows the estimation results. In contrast to the results for wages trade does not seem to affect the level of employment in rural areas, while there is a positive effect on urban areas. This is an interesting result that is consistent with our results for wages. In rural areas, trade seems to affect wages positive, but not employment; in urban areas, instead, trade seems to affect employment more than wages.

Finally, Table V.8 shows the results of models for labor income of prime-age men in rural and urban areas. Most of the results are similar to the wage models. Trade increases wages in rural areas, while the effect on urban areas appears to be non-significant. Again, this is consistent (as it should be) with our previous results since labor income is simply the product of hourly wages and employment.

Prices

In Table V.9 we show models of wages where the *k* variable is a price indicator of exports, imports, the ratio price of exports/price of imports and the price of exports of agricultural products. Given that the data suggests a non-linear relationship between wages and these prices, we include the square of each price variable as a regressor. The price of exports are associated to higher wages in rural areas. Higher exports prices benefit all rural workers. There is some evidence of a larger beneficial effect for the unskilled. Wages are not affected by export prices in urban areas. The relative price exports/imports is positively associated to wages in rural areas for all workers, while there seems to be no significant relationship for urban workers. Perhaps surprisingly, we do not find any significant relationship between wages and the price of exports of agricultural products. Table V.10 shows the estimations for females, where most of the results are non-significant. The fact that we find a positive association between prices and wages in rural areas, but insignificant effects on wages in urban areas is in line with hour previous results using alternative measures of trade, like exports, imports, or aggregate trade. It appears that our results are relatively robust.

Table V.11 is analogous to Table V.3: we divide workers into quintiles and run separate regression for each group. Figure V.5 shows the linear coefficients and the 95% confidence intervals. There is no evidence on a significantly different impact of prices across groups.

We also run quantile regression models to investigate possible differential effects of price variables on wages across quantiles of the conditional distribution of wages (see Tables V.12 to V.15 and Figures V.6 to V.9). Changes in export prices and in the relative price exports/imports do not seem to affect different groups of workers who share the same unobservables in significantly different ways. In contrast, there is some evidence of a non-homogeneous relationship between the price of agricultural products and wages. The benefits from the rise of agricultural products seem to be captured by the most skilled in terms of unobservables.

According to Table V.16 higher export prices are associated to higher employment in both urban and rural areas. The relationship again seems to be non-linear. Finally, Table V.17 suggests that export prices are associated to higher labor income in rural areas. This positive relationship does not appear to vary by education. All individuals in rural areas benefit about the same due to higher exports prices.

VI. Concluding Remarks

This paper has explored the potential links between trade and labor outcomes in Latin America. We assemble a large dataset comprised by microdata from 60 Latin American household surveys and country aggregate data, and run cross-household surveys regression models.

The paper shows a significant association between individual labor outcomes and some measures of trade, in particular exports, trade as a share of GDP, and the price of exports. According to our findings, international trade has been associated to higher wages and labor income in Latin American rural areas during the 1990s and the early 2000s. There is some evidence that the benefits have been particularly large for those rural workers located in the bottom quantiles of the conditional wage distribution. Higher export prices are also associated to better labor outcomes in rural areas. In those areas, the impacts of trade are revealed through higher wages rather than through higher employment opportunities. In urban areas, instead, results are different. We find non-significant results in the case of wages and stronger results in the case of employment, with statistically insignificant results overall.

Our results are consistent with several economic theories. The predictions of neoclassical models depend on factor abundance and factor intensity but are consistent with our findings. More interestingly, perhaps, the results support the idea that trade has initiated a process of convergence whereby rural areas (i.e., semi-urban areas or small urban centers) are predicted to catch-up with larger urban centers. The results are also consistent with a model with larger pools of unemployed workers in urban areas (perhaps through migration from rural areas).

In principle, it would be interesting to see how the model behaves when several indicators of trade are simultaneously included in the regressions. It should be noticed, however, that the aggregate indicators vary by country and year, not by individuals. This means that the simultaneous inclusion of several variables may cause strong colinearity among the regressors, leading to inflated standard errors. There are signs of these problems in our analysis. When we estimate the model including all the trade variables together, most coefficients become non-significant. This should not cloud the relevance of the partial conditional correlations reported in the paper, but calls for an increase in the dataset.

Future research should focus on data improvements, especially in terms of the comparability of household surveys and aggregate data across LAC countries. As it was suggested above, changes in the measurement of income in rural areas by household surveys as international trade move farmers to the formal economy may be driving some results. Ideally the definition urban-rural should also be made homogeneous across countries. Also, as it was also mentioned above, it is important to recognize that we cannot attach a causal interpretation to the coefficients estimated here. Although our preferred interpretation of the regressions is from trade to labor outcomes, the other direction of the link may also be quite relevant. We should look for other methodologies (*e.g*. quasi-experiments) for evidence of causality. In the meantime, although results as those presented in this paper are unlikely to provide definite answers, they can contribute to the thinking of the determinants and effects of trade on rural development.

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Table IV.1
Household surveys used in the estimations
LAC countries, 1989-2002

Country	**Year**	**Name of Survey**	**Sample size Individuals**	**Non-monetary income**
	(i)	(ii)	(iii)	(iv)
Bolivia	1997	ECH	36,752	No
	2002	ECH	24,933	Yes
Brazil	1990	PNAD	306,493	No
	1995	PNAD	334,106	No
	2001	PNAD	402,212	No
Chile	1990	CASEN	105,189	Yes
	1996	CASEN	134,262	Yes
	1998	CASEN	188,360	Yes
	2000	CASEN	252,748	Yes
Colombia	1992	ENH-FT	69,683	Yes
	1995	ENH-FT	13,936	Yes
	1996	ENH-FT	137,423	Yes
	1999	ENH-FT	152,298	Yes
Costa Rica	1990	EHPM	36,272	No
	1995	EHPM	40,613	No
	1997	EHPM	41,277	No
	2000	EHPM	40,509	No
	2001	EHPM	41,841	No
Dominican Republic	1995	ENFT	23,730	No
	1997	ENFT	15,842	Yes
Ecuador	1994	ECV	20,873	Yes
	1998	ECV	26,129	Yes
El Salvador	1991	EHPM	90,624	No
	1995	EHPM	40,004	No
	1998	EHPM	56,766	No
	2000	EHPM	71,665	Yes
	2002	EHPM	71,665	
Guatemala	2000	ENCOVI	37,771	Yes
	2002	ENCOVI	10,615	
Honduras	1990	EPHPM	47,056	No
	1995	EPHPM	29,804	No
	1997	EPHPM	32,526	No
	1999	EPHPM	33,772	Yes
Jamaica	1990	JSLC/LFS	7,485	No
	1996	JSLC/LFS	6,680	No
	1999	JSLC/LFS	6,274	No
Mexico	1989	ENIGH	57,289	Yes
	1992	ENIGH	50,862	Yes
	1994	ENIGH	60,363	Yes
	1996	ENIGH	64,916	Yes
	1998	ENIGH	48,115	Yes
	2000	ENIGH	42,535	Yes
	2002	ENIGH	73,325	Yes

Table IV.1 (cont.)
Household surveys used in the estimations
LAC countries, 1989-2002

Country	**Year**	**Name of Survey**	**Sample size Individuals**	**Non-monetary income**
	(i)	(ii)	(iii)	(iv)
Nicaragua	1993	EMNV	25,162	Yes
	1998	EMNV	22,423	Yes
	2001	EMNV	22,810	Yes
Panamá	1991	EH-MO	38,000	No
	1995	EH-MO	40,320	No
	2000	EH-MO	39,562	No
Paraguay	1995	EH-MO	21,910	Yes
	1997	EPH	20,664	Yes
	1999	EPH	24,193	Yes
	2001	EPH	37,437	Yes
Perú	1991	ENNIV	11,845	Yes
	1994	ENNIV	18,662	Yes
	2000	ENNIV	19,961	Yes
Venezuela	1989	EHM	224,172	No
	1995	EHM	92,450	Yes
	1998	EHM	80,311	Yes
	2000	EHM	80,417	Yes

ECH	Encuesta Continua de Hogares
PNAD	Pesquisa Nacional por Amostra de Domicilios
CASEN	Encuesta de Caracterización Socioeconómica Nacional
ENH-FT	Encuesta Nacional de Hogares-Fuerza de Trabajo
EHPM	Encuesta de Hogares de Propositos Multiples
ENFT	Encuesta Nacional de Fuerza de Trabajo
ECV	Encuesta de Condiciones de Vida
ENCOVI	Encuesta Nacional sobre Condiciones de Vida
EPHPM	Encuesta Permanente de Hogares de Propositos Multiples
JSLC	Jamaica Survey of Living Conditions
LFS	Labor Force Survey
ENIGH	Encuesta Nacional de Ingreso Gasto de los Hogares
EMNV	Encuesta Nacional de Hogares Sobre Medicion de Niveles de Vida
EH-MO	Encuesta de Hogares-Mano de Obra
EPH	Encuesta Permanente de Hogares
ENNIV	Encuesta Nacional de Hogares Sobre Medicion de Niveles de Vida
EHM	Encuesta de Hogares por Muestreo

Table IV.2
Share of rural population in household surveys
Weighted statistics
LAC countries

	Year	Share
Bolivia	1999	37.1
Brazil	2001	16.1
Chile	2000	14.1
Colombia	1999	38.1
Costa Rica	2000	52.8
Dominican R.	1997	44.0
Ecuador	1998	42.1
El Salvador	2000	41.6
Guatemala	2000	61.4
Honduras	1999	55.2
Jamaica	1999	54.7
Mexico	2000	25.4
Nicaragua	1998	45.7
Panama	2000	39.0
Paraguay	1999	46.1
Peru	2000	34.7
Venezuela	1998	31.4

Source: own estimates based on household surveys.

Table V.1
Models of wages in rural and urban areas
Exports, imports and trade
Males aged 25 to 55

A. Rural

	expo (i)	impo (ii)	trade (iii)
Model 1			
variable alone	0.009	0.017	0.007
	[3.31]***	[6.10]***	[4.66]***
Model 2			
variable*edu1	0.012	0.018	0.008
	[3.80]***	[5.17]***	[4.59]***
variable*edu2	0.006	0.012	0.005
	[1.78]*	[3.31]***	[2.42]**
variable*edu3	0.012	0.029	0.011
	[2.25]**	[5.38]***	[3.30]***
R-squared	0.19	0.19	0.19
Observations	96130	96130	96130

B. Urban

	expo (i)	impo (ii)	trade (iii)
Model 1			
variable alone	-0.009	-0.002	-0.004
	[1.78]*	[0.24]	[1.27]
Model 2			
variable * edu1	-0.011	-0.006	-0.005
	[1.81]*	[0.83]	[1.63]
variable * edu2	-0.008	-0.001	-0.003
	[1.75]*	[0.15]	[1.07]
variable * edu3	-0.009	0.001	-0.003
	[1.84]*	[0.17]	[0.96]
R-squared	0.31	0.30	0.30
Observations	150642	150642	150642

Robust t statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table V.2
Models of wages in rural and urban areas
Exports, imports and trade
Females aged 25 to 55

A. Rural

	expo	impo	trade
	(i)	(ii)	(iii)
variable alone	0.014	0.026	0.013
	[1.87]*	[3.92]***	[3.31]***
variable * edu1	0.018	0.028	0.015
	[2.30]**	[3.98]***	[3.62]***
variable * edu2	0.012	0.023	0.012
	[1.87]*	[3.50]***	[3.21]***
variable * edu3	0.008	0.026	0.010
	[1.09]	[2.63]***	[2.23]**
Observations	62688	62688	62688

Table V.3
Models of wages of prime-age men in rural areas
Exports, imports and trade by wage quintile

	Unconditional quintil				
	1	2	3	4	5
exports	0.0054	0.0128	0.0006	0.0107	0.0159
	[1.69]*	[3.79]***	[0.21]	[2.47]**	[5.58]***
imports	0.0119	0.0184	0.0106	0.0159	0.0283
	[3.66]***	[5.48]***	[3.03]***	[4.25]***	[9.04]***
trade	0.0046	0.0087	0.0027	0.0075	0.0121
	[2.66]**	[4.85]***	[1.57]	[3.21]***	[7.08]***

Figure V.1
Models of wages of prime-age men in rural areas by wage quintile
Estimated coefficients and 95% confidence intervals

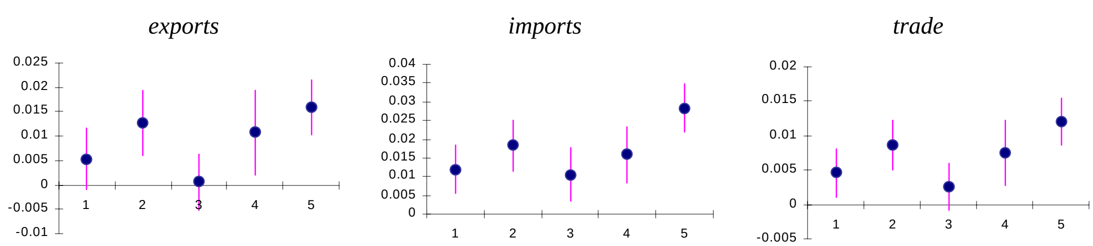

Table V.4
Models of wages of prime-age men
Rural areas
Quantile regression and OLS coefficients for exports

	OLS	Quantile regression								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Model 1										
variable alone	0.009	0.025	0.013	0.010	0.006	0.005	0.005	0.002	0.001	-0.002
Model 2										
variable*edu1	0.012	0.022	0.012	0.012	0.008	0.008	0.008	0.007	0.006	0.004
variable*edu2	0.006	0.025	0.013	0.009	0.004	0.003	0.002	-0.003	-0.002	-0.007
variable*edu3	0.012	0.026	0.015	0.013	0.005	0.004	0.007	0.002	0.004	0.001

Note: estimated from microdata of a sample of 61 household surveys and aggregate data.

Figure V.2
Models of wages of prime-age men
Rural areas
Quantile regression and OLS coefficients for exports

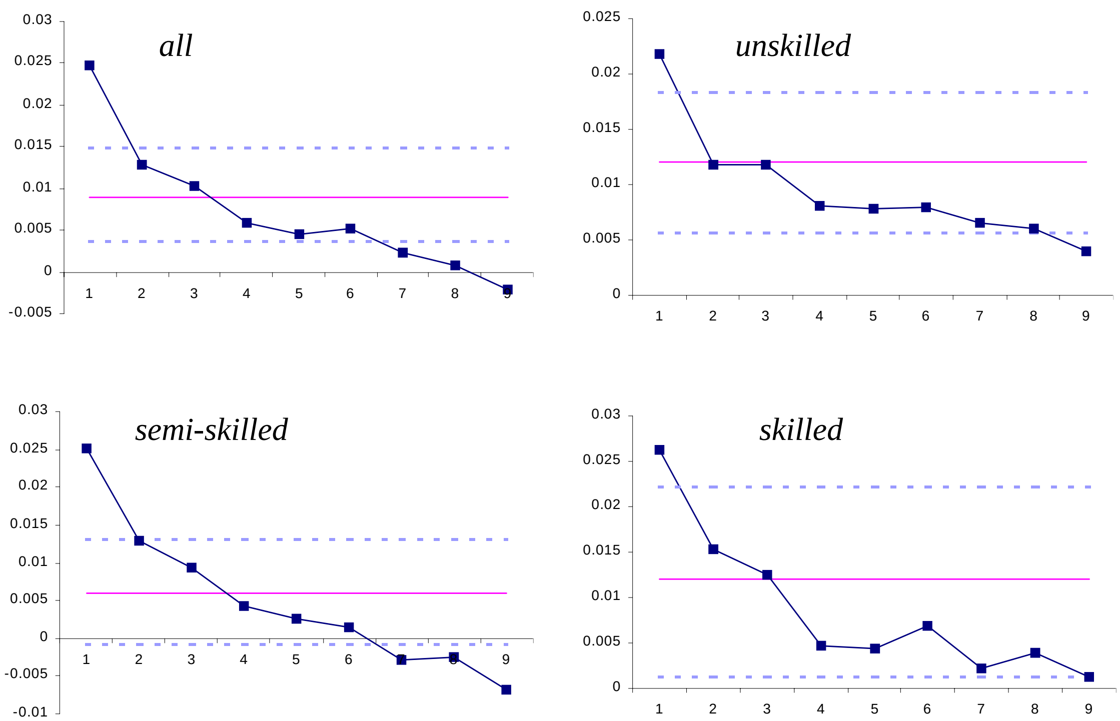

Table V.5
Models of wages of prime-age men
Rural areas
Quantile regression and OLS coefficients for imports

	OLS	Quantile regression								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Model 1										
variable alone	0.017	0.030	0.023	0.020	0.015	0.013	0.014	0.011	0.012	0.007
Model 2										
variable*edu1	0.018	0.028	0.021	0.019	0.015	0.013	0.014	0.013	0.013	0.010
variable*edu2	0.012	0.035	0.024	0.017	0.012	0.009	0.007	0.005	0.002	0.001
variable*edu3	0.029	0.037	0.033	0.035	0.032	0.024	0.022	0.027	0.028	0.022

Note: estimated from microdata of a sample of 61 household surveys and aggregate data.

Figure V.3
Models of wages of prime-age men
Rural areas
Quantile regression and OLS coefficients for imports

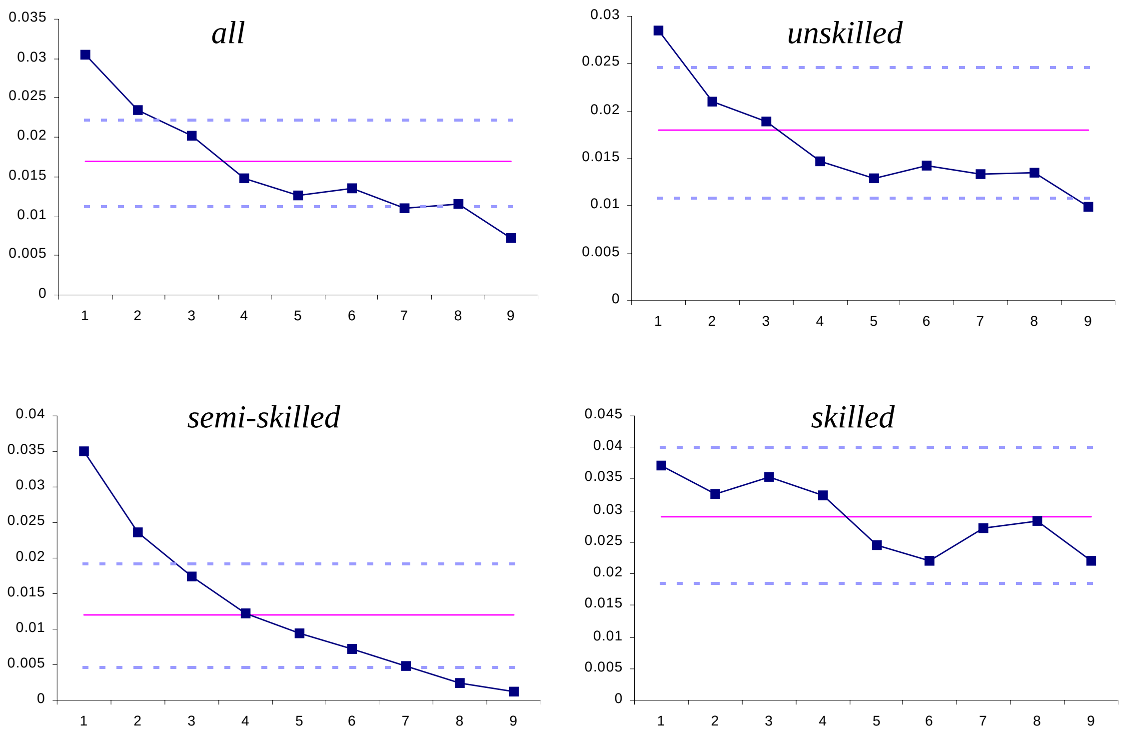

Table V.6
Models of wages of prime-age men
Rural areas
Quantile regression and OLS coefficients for trade

	OLS	Quantile regression								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Model 1										
variable alone	0.007	0.016	0.010	0.008	0.005	0.004	0.005	0.003	0.003	0.001
Model 2										
variable*edu1	0.008	0.014	0.009	0.009	0.006	0.006	0.006	0.006	0.005	0.003
variable*edu2	0.005	0.017	0.009	0.007	0.004	0.002	0.002	0.000	-0.001	-0.004
variable*edu3	0.011	0.020	0.015	0.013	0.008	0.006	0.007	0.007	0.007	0.004

Note: estimated from microdata of a sample of 61 household surveys and aggregate data.

Figure V.4
Models of wages of prime-age men
Rural areas
Quantile regression and OLS coefficients for trade

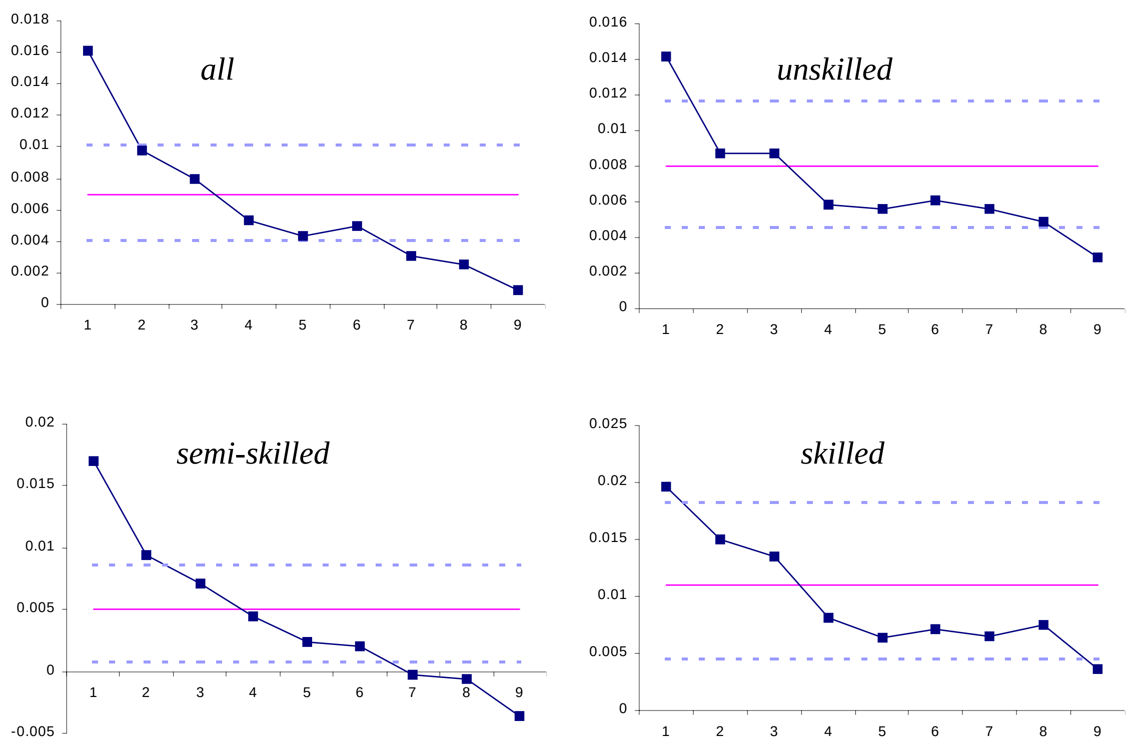

Table V.7
Models of employment of prime-age men in rural and urban areas
Exports, imports and trade

A. Rural

	exports (i)	imports (ii)	trade (iii)
Model 1			
variable alone	0.008	0.008	0.006
	[1.29]	[1.22]	[1.54]
Model 2			
variable*edu1	0.008	0.008	0.006
	[1.22]	[1.09]	[1.43]
variable*edu2	0.011	0.01	0.007
	[1.66]*	[1.23]	[1.84]*
variable*edu3	0.001	0.004	-0.0001
	[0.07]	[0.31]	[0.03]
Observations	163701	163701	163701

B. Urban

	exports (i)	imports (ii)	trade (iii)
Model 1			
variable alone	0.004	0.008	0.004
	[1.36]	[1.97]**	[1.98]**
Model 2			
variable*edu1	0.007	0.012	0.006
	[1.82]*	[2.30]**	[2.30]**
variable*edu2	0.006	0.011	0.005
	[1.74]*	[2.13]**	[2.16]**
variable*edu3	-0.002	0.0003	0.0002
	[0.46]	[0.06]	[0.06]
Observations	274309	274309	274309

Robust z statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table V.8
Models of labor income of prime-age men in rural and urban areas
Exports, imports and trade

A. Rural

	exports	imports	trade
	(i)	(ii)	(iii)
Model 1			
variable alone	0.008	0.008	0.005
	[2.50]**	[2.28]**	[2.53]**
Model 2			
variable*edu1	0.011	0.01	0.006
	[3.28]***	[3.06]***	[3.33]***
variable*edu2	0.005	0.002	0.002
	[1.32]	[0.45]	[0.91]
variable*edu3	0.007	0.013	0.006
	[1.81]*	[2.14]**	[2.21]**
Observations	143012	143012	143012
Average R-square	0.32	0.32	0.32

B. Urban

	expo	impo	trade
	(i)	(ii)	(iii)
Model 1			
variable alone	-0.009	-0.001	-0.004
	[1.79]*	[0.09]	[1.21]
Model 2			
variable * edu1	-0.014	-0.007	-0.006
	[1.82]*	[1.00]	[1.87]
variable * edu2	-0.007	0.001	-0.003
	[1.62]	[0.09]	[0.88]
variable * edu3	-0.009	0.003	-0.003
	[1.72]*	[0.42]	[0.77]
Observations	150819	150819	150819
R-squared	0.30	0.30	0.30

Robust t statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table V.9
Models of wages in rural and urban areas
Prices of exports, imports and agricultural products
Males aged 25 to 55

A. Rural

	px	pm	px/pm	agricul
	(i)	(ii)	(ii)	(iv)
Model 1				
variable alone	0.0246	0.0140	4.3030	-0.0106
	[5.48]***	[2.42]**	[3.17]***	[1.92]*
variable squared	-0.0001	0.0000	-1.8779	0.00004
	[5.91]***	[1.57]	[3.46]***	[1.78]*
Model 2				
variable*edu1	0.027	0.007	4.374	-0.011
	[4.93]***	[1.04]	[3.01]***	[1.74]*
variable*edu2	0.021	0.008	4.423	-0.007
	[4.46]***	[1.18]	[3.06]***	[1.09]
variable*edu3	0.022	0.026	3.630	-0.010
	[3.08]***	[2.36]**	[2.59]**	[1.22]
var sq*edu1	-0.0001	0.0000	-1.8770	0.0001
	[4.90]***	[0.33]	[3.25]***	[1.79]*
var sq*edu2	-0.0001	-0.00003	-1.9210	0.00002
	[4.85]***	[0.86]	[3.33]***	[0.75]
var sq*edu3	0.000	-0.0001	-1.636	0.00004
	[3.64]***	[2.16]**	[2.92]***	[0.86]
R-squared	0.19	0.19	0.19	0.19
Observations	96130	96130	96130	96130

B. Urban

	px	pm	px/pm	agricul
	(i)	(ii)	(ii)	(iv)
Model 1				
variable alone	0.0040	-0.0065	2.2540	0.0151
	[0.81]	[1.63]	[1.79]*	[1.77]*
variable squared	0.0000	0.0000	-1.1350	-0.00007
	[1.06]	[1.57]	[2.09]**	[2.33]**
Model 2				
variable*edu1	-0.014	-0.016	-0.362	0.016
	[1.28]	[2.38]**	[0.15]	[1.65]
variable*edu2	0.001	-0.010	1.657	0.015
	[0.29]	[2.01]**	[1.33]	[1.74]*
variable*edu3	0.013	0.000	3.257	0.016
	[1.79]*	[0.03]	[2.39]**	[1.79]*
var sq*edu1	0.0001	0.0001	0.2950	-0.0001
	[1.16]	[1.99]*	[0.25]	[2.17]**
var sq*edu2	0.0000	0.00005	-0.8310	-0.00007
	[0.63]	[1.84]*	[1.56]	[2.28]**
var sq*edu3	0.000	0.0000	-1.667	-0.00008
	[1.97]*	[0.10]	[2.87]***	[2.21]**
R-squared	0.3	0.3	0.3	0.3
Observations	163920	163920	163920	163920

Robust t statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table V.10
Models of wages in rural and urban areas
Prices of exports, imports and agricultural products
Females aged 25 to 55

A. Rural

	px	pm	px/pm	agricul
	(i)	(ii)	(iii)	(iv)
Model 1				
variable alone	0.007	0.001	-2.365	-0.001
	[1.97]**	[0.10]	[1.10]	[0.16]
variable squared	0.000	0.000	0.885	0.000
	[2.68]***	[0.24]	[0.99]	[0.13]
Model 2				
variable * edu1	0.009	0.006	-3.999	0.002
	[1.78]*	[0.86]	[1.65]*	[0.22]
variable * edu2	0.002	-0.006	-2.620	0.000
	[0.55]	[0.73]	[1.34]	[0.02]
variable * edu3	0.009	0.003	-1.074	-0.006
	[2.05]**	[0.42]	[0.51]	[0.79]
var sq * edu1	0.000	0.000	1.618	0.000
	[1.94]*	[0.74]	[1.63]	[0.13]
var sq * edu2	0.000	0.000	1.004	0.000
	[1.14]	[0.54]	[1.24]	[0.09]
var sq * edu3	0.000	0.000	0.316	0.000
	[2.88]***	[0.70]	[0.36]	[0.48]
Observations	62688	62688	62688	62688

B. Urban

	px	pm	px/pm	agricul
	(i)	(ii)	(iii)	(iv)
Model 1				
variable alone	-0.009	0.001	3.926	0.005
	[1.19]	[0.13]	[1.86]*	[0.53]
variable squared	0.000	0.000	-1.763	0.000
	[0.89]	[0.43]	[2.00]**	[0.84]
Model 2				
variable * edu1	-0.034	-0.014	0.060	0.000
	[4.25]***	[1.78]*	[0.02]	[0.04]
variable * edu2	-0.011	0.001	4.056	-0.002
	[1.03]	[0.12]	[1.99]**	[0.20]
variable * edu3	0.000	0.003	4.325	0.011
	[0.03]	[0.28]	[1.96]*	[1.24]
var sq * edu1	0.000	0.000	0.192	0.000
	[4.07]***	[1.30]	[0.18]	[0.29]
var sq * edu2	0.000	0.000	-1.754	0.000
	[0.88]	[0.54]	[2.03]**	[0.08]
var sq * edu3	0.000	0.000	-2.019	0.000
	[0.13]	[0.38]	[2.19]**	[1.55]
Observations	106574	106574	106574	106574

Robust z statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table V.11
Models of wages of prime-age men in rural areas
Prices of exports, imports and agricultural products by wage quintiles

	Unconditional quintil				
	1	2	3	4	5
px	0.0281	0.0194	0.0251	0.0255	0.0290
	[6.69]***	[3.17]***	[6.99]***	[4.42]***	[4.68]***
px sq	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	[7.36]***	[3.09]***	[7.54]***	[4.83]***	[4.82]***
pm	0.0199	0.0058	0.0108	0.0160	0.0177
	[2.54]**	[0.87]	[2.25]**	[2.14]**	[2.20]**
pm sq	-0.0001	0.0000	0.0000	-0.0001	-0.0001
	[1.84]*	[0.16]	[1.38]	[1.77]*	[1.37]
px/pm	3.4206	5.9229	0.8103	5.0775	6.9522
	[2.33]**	[4.36]***	[0.60]	[3.04]***	[5.52]***
px/pm sq	-1.5263	-2.4630	-0.4939	-2.1561	-3.0541
	[2.59]**	[4.54]***	[0.90]	[3.26]***	[6.03]***
agricul	-0.0077	-0.0134	-0.0042	-0.0099	-0.0179
	[1.18]	[2.44]**	[0.78]	[1.82]*	[2.60]**
agricul sq	0.0000	0.0001	0.0000	0.0000	0.0001
	[1.04]	[2.26]**	[0.44]	[1.77]*	[2.61]**

Figure V.5
Models of wages of prime-age men in rural areas
Prices of exports, imports and agricultural products by wage quintiles
Estimated linear coefficients and 95% confidence intervals

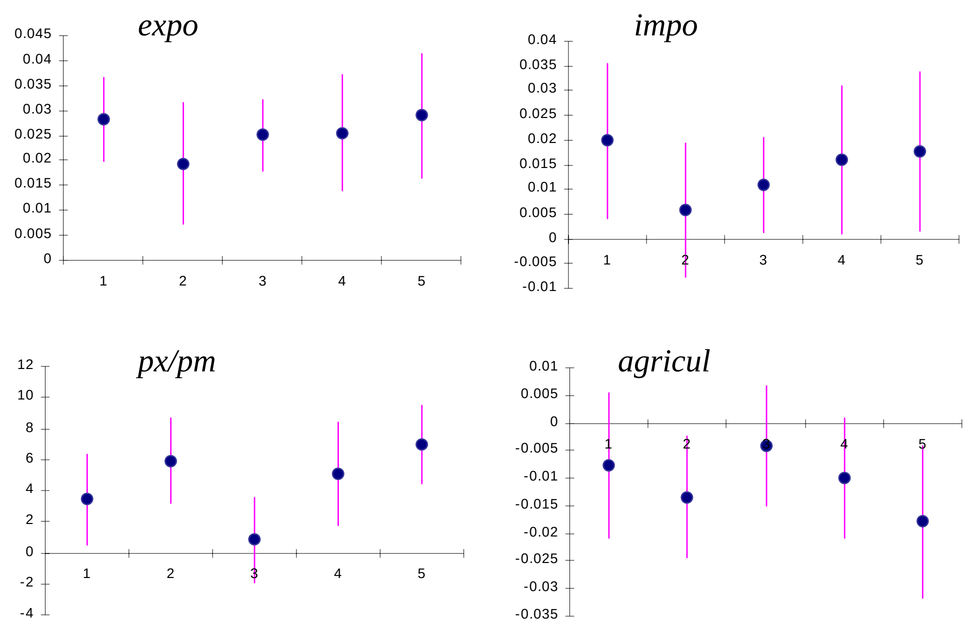

Table V.12
Models of wages of prime-age men
Rural areas
Quantile regression and OLS coefficients for price of exports

	OLS	Quantile regression								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Model 1										
variable alone	0.0246	0.0260	0.0238	0.0253	0.0222	0.0209	0.0266	0.0248	0.0246	0.0187
variable alone sq	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
Model 2										
variable*edu1	0.0270	0.0240	0.0289	0.0278	0.0266	0.0242	0.0286	0.0247	0.0282	0.0204
variable*edu2	0.0211	0.0251	0.0195	0.0208	0.0186	0.0182	0.0230	0.0240	0.0228	0.0159
variable*edu3	0.0218	0.0275	0.0300	0.0265	0.0200	0.0160	0.0199	0.0182	0.0092	0.0202
variable sq*edu1	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
variable sq*edu2	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
variable sq*edu3	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001

Note: estimated from microdata of a sample of 61 household surveys and aggregate data.

Figure V.6
Models of wages of prime-age men
Rural areas
Quantile regression and OLS coefficients for price of exports

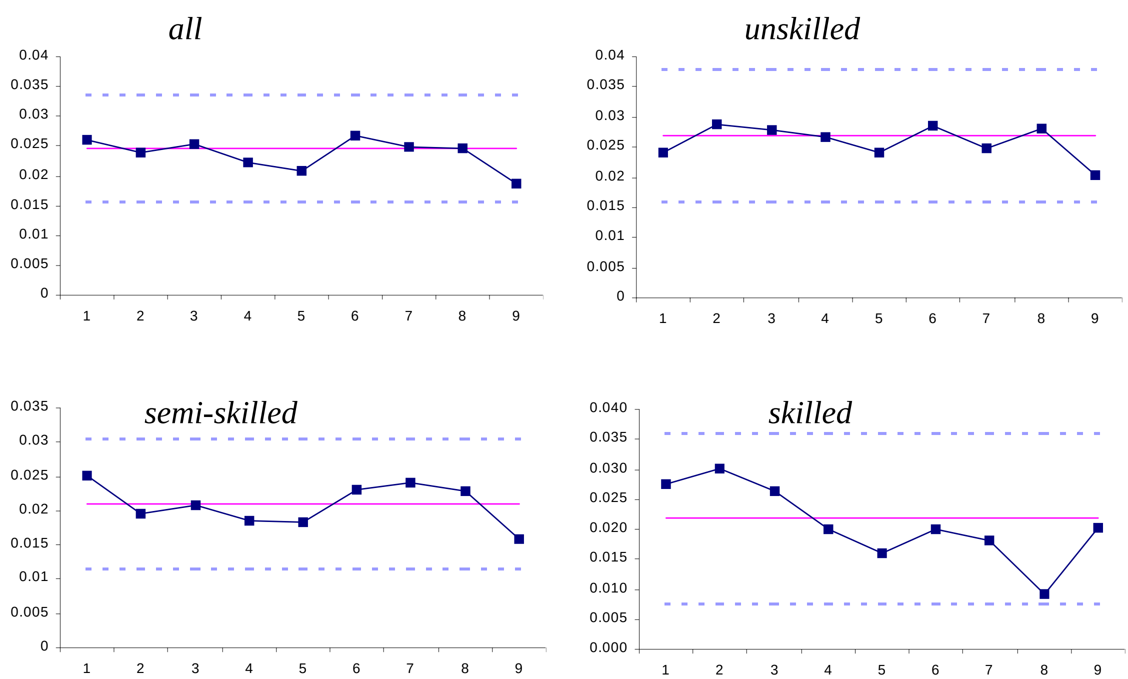

Table V.13

Models of wages of prime-age men

Rural areas

Quantile regression and OLS coefficients for price of imports

	OLS	Quantile regression								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Model 1										
variable alone	0.0140	0.0011	0.0084	0.0089	0.0095	0.0101	0.0177	0.0175	0.0229	0.0204
variable alone sq	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0001	-0.0001	-0.0001	-0.0001
Model 2										
variable*edu1	0.0069	-0.0273	0.0012	0.0117	0.0126	0.0119	0.0193	0.0123	0.0130	0.0148
variable*edu2	0.0080	0.0038	0.0037	0.0058	0.0001	0.0063	0.0083	0.0118	0.0195	0.0110
variable*edu3	0.0256	0.0141	0.0281	0.0230	0.0119	0.0140	0.0193	0.0257	0.0251	0.0346
variable sq*edu1	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	-0.0001	0.0000	0.0000	0.0000
variable sq*edu2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0001	-0.0001	-0.0001
variable sq*edu3	-0.0001	-0.0001	-0.0001	-0.0001	0.0000	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002

Note: estimated from microdata of a sample of 61 household surveys and aggregate data.

Figure V.7

Models of wages of prime-age men

Rural areas

Quantile regression and OLS coefficients for price of imports

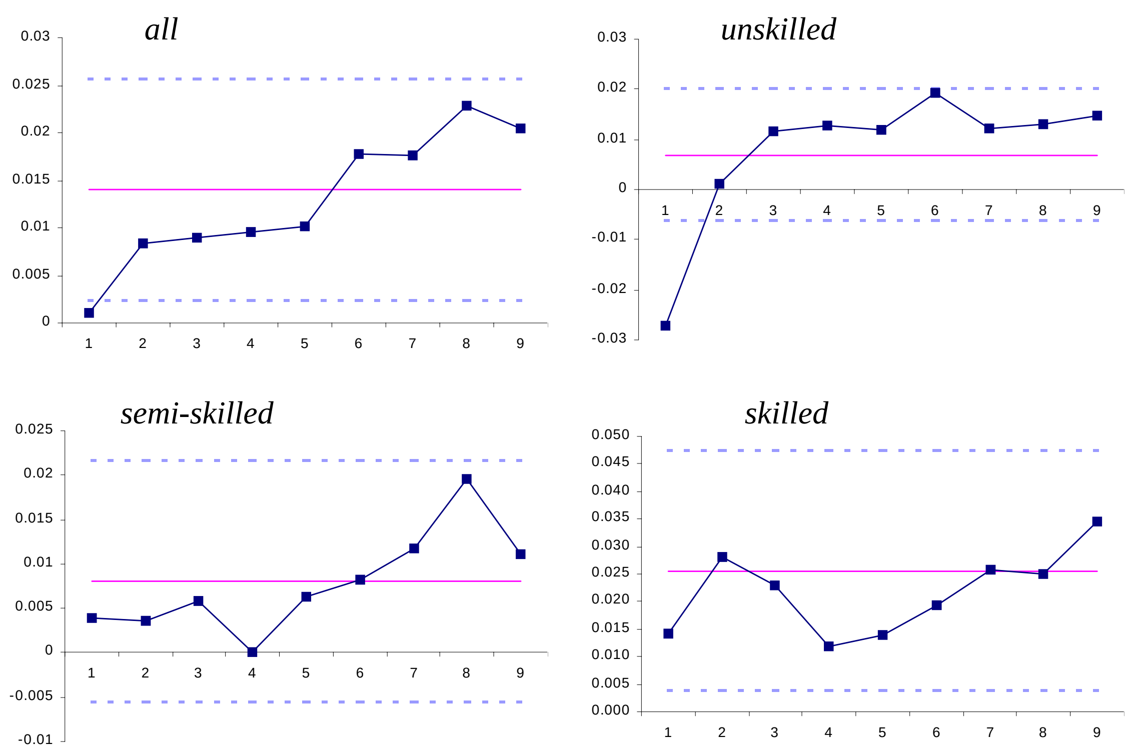

Table V.14
Models of wages of prime-age men
Rural areas
Quantile regression and OLS coefficients for price exports/price imports

	OLS	Quantile regression								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Model 1										
variable alone	4.3030	7.3066	4.9479	4.4211	3.6385	3.9763	4.1090	3.4002	3.1835	1.6362
variable alone sq	-1.8779	-3.0597	-2.1647	-1.9476	-1.6255	-1.7668	-1.8174	-1.5451	-1.4554	-0.7754
Model 2										
variable*edu1	4.3740	7.1893	5.3847	4.1536	4.1096	4.1632	4.5293	3.6859	4.2480	1.6643
variable*edu2	4.4230	7.3693	4.5727	4.2402	3.5457	3.8630	4.1662	3.6569	3.6177	1.5888
variable*edu3	3.6300	7.4399	4.8413	3.9872	3.1509	3.1852	2.8833	1.8474	1.3880	1.6449
variable sq*edu1	-1.8770	-3.0013	-2.3039	-1.7878	-1.7921	-1.8047	-1.9444	-1.6209	-1.8981	-0.7670
variable sq*edu2	-1.9210	-3.0928	-2.0181	-1.8583	-1.5749	-1.7166	-1.8507	-1.6619	-1.6082	-0.7381
variable sq*edu3	-1.6360	-3.1162	-2.1343	-1.8151	-1.4817	-1.4798	-1.3509	-0.9233	-0.7553	-0.8118

Note: estimated from microdata of a sample of 61 household surveys and aggregate data.

Figure V.8
Models of wages of prime-age men
Rural areas
Quantile regression and OLS coefficients for price exports/price imports

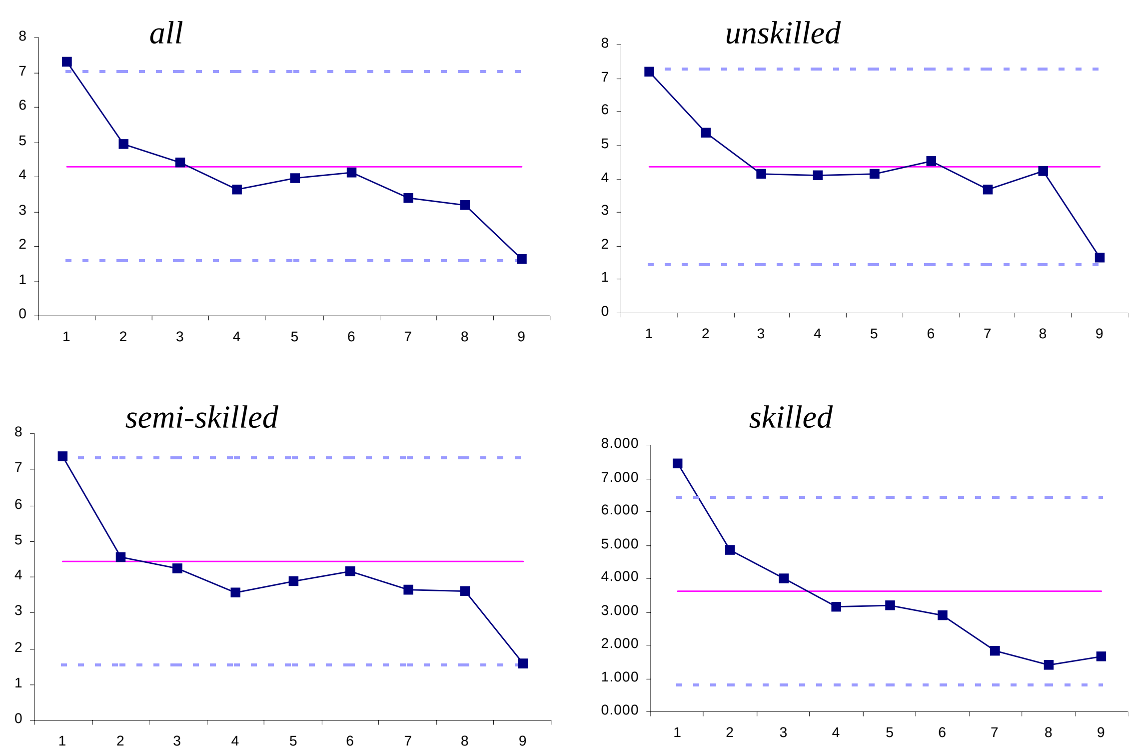

Table V.15

Models of wages of prime-age men

Rural areas

Quantile regression and OLS coefficients for price of agricultural products

	OLS	Quantile regression								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Model 1										
variable alone	-0.0106	-0.0237	-0.0153	-0.0156	-0.0148	-0.0149	-0.0129	-0.0091	-0.0069	0.0033
variable alone sq	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
Model 2										
variable*edu1	-0.0110	-0.0224	-0.0094	-0.0106	-0.0138	-0.0142	-0.0121	-0.0091	-0.0090	0.0006
variable*edu2	-0.0070	-0.0243	-0.0155	-0.0132	-0.0124	-0.0129	-0.0104	-0.0058	-0.0045	0.0094
variable*edu3	-0.0100	-0.0141	-0.0179	-0.0218	-0.0181	-0.0149	-0.0177	-0.0114	-0.0120	-0.0003
variable sq*edu1	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
variable sq*edu2	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0001
variable sq*edu3	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0000

Figure V.9

Models of wages of prime-age men

Rural areas

Quantile regression and OLS coefficients for price of agricultural products

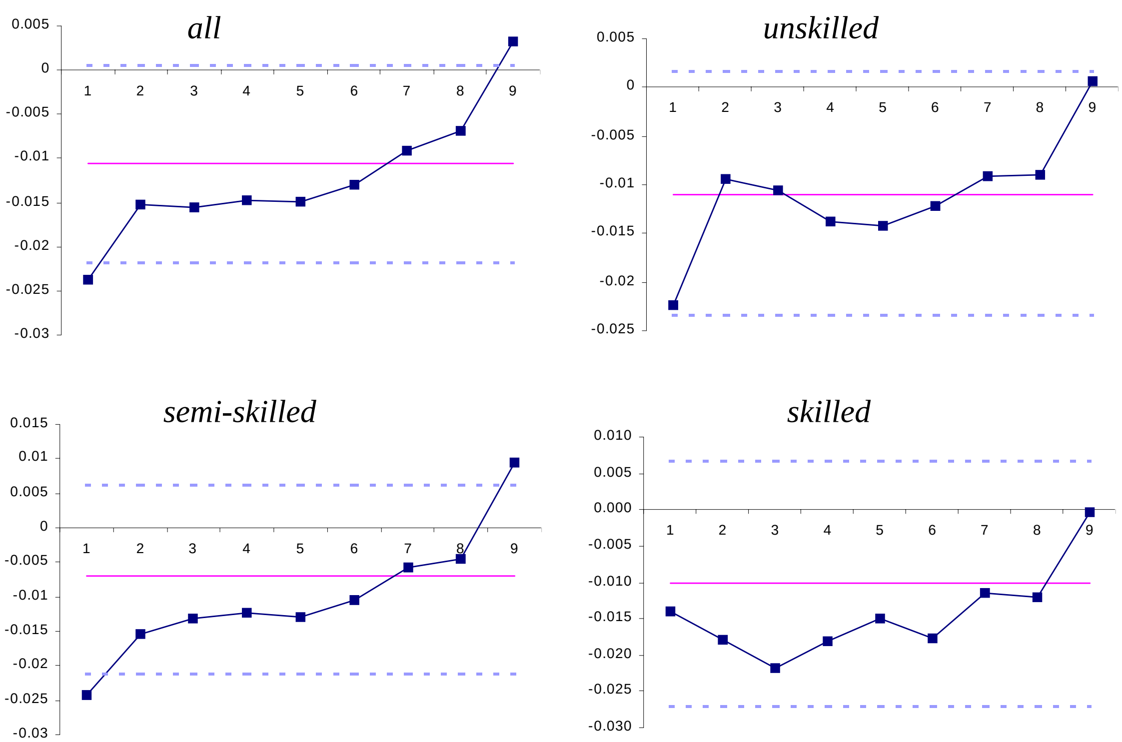

Table V.16
Models of employment of prime-age men in rural and urban areas

A. Rural

	px	pm	px/pm	agricul
	(i)	(ii)	(iii)	(iv)
Model 1				
variable alone	0.0103	0.0050	-0.772	0.0088
	[2.75]***	[0.98]	[0.31]	[1.62]
square variable	-0.00005	-0.00001	0.314	-0.00004
	[2.87]***	[0.40]	[0.31]	[1.81]*
Model 2				
variable*edu1	0.00939	-0.00008	-0.532	0.0065
	[2.25]**	[0.01]	[0.20]	[1.03]
variable*edu2	0.00826	0.00484	-1.12	0.0115
	[1.52]	[0.63]	[0.45]	[2.16]**
variable*edu3	0.01758	0.01077	-0.51	0.0120
	[1.49]	[0.55]	[0.20]	[1.71]*
sq variable*edu1	-0.00004	0.00002	0.197	-0.00003
	[2.25]**	[0.45]	[0.18]	[1.15]
sq variable*edu2	-0.00003	-0.00001	0.507	-0.00005
	[1.34]	[0.25]	[0.50]	[2.14]**
sq variable*edu3	-0.00009	-0.00004	0.134	-0.00006
	[1.69]*	[0.48]	[0.13]	[2.01]**
Observations	163701	163701	163701	163701

B. Urban

	px	pm	px/pm	agricul
	(i)	(ii)	(iii)	(iv)
Model 1				
variable alone	0.01217	0.00488	2.279	0.00511
	[3.75]***	[1.37]	[1.53]	[1.07]
square variable	-0.00006	-0.00002	-1.04	-0.00002
	[3.29]***	[1.12]	[1.69]*	[1.30]
Model 2				
variable*edu1	0.01785	0.01019	3.449	0.00778
	[2.47]**	[0.98]	[1.92]*	[1.61]
variable*edu2	0.00984	0.00272	2.593	0.00168
	[2.27]**	[0.77]	[1.72]*	[0.33]
variable*edu3	0.01238	0.00505	1.758	0.00732
	[3.31]***	[1.07]	[1.17]	[1.45]
sq variable*edu1	-0.00009	-0.00004	-1.691	-0.00004
	[2.23]**	[0.71]	[2.10]**	[1.80]*
sq variable*edu2	-0.00005	-0.00001	-1.171	-0.00001
	[1.94]*	[0.51]	[1.90]*	[0.35]
sq variable*edu3	-0.00007	-0.00002	-0.779	-0.00003
	[3.02]***	[1.07]	[1.25]	[1.75]*
Observations	274309	274309	274309	274309

Robust z statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table V.17
Models of labor income of prime-age men in rural and urban areas

A. Rural

	px	pm	px/pm	agricul
	(i)	(ii)	(iii)	(iv)
Model 1				
variable alone	0.02491	0.02079	2.215	-0.00126
	[8.61]***	[4.06]***	[1.93]*	[0.37]
square variable	-0.0001	-0.0001	-0.902	0.00001
	[8.18]***	[2.91]***	[1.95]*	[1.04]
Model 2				
variable*edu1	0.02649	0.01917	2.363	-0.00260
	[7.93]***	[2.73]***	[1.90]*	[0.64]
variable*edu2	0.02123	0.01465	2.076	0.00125
	[6.72]***	[2.69]***	[1.81]*	[0.27]
variable*edu3	0.02862	0.03311	1.949	0.00251
	[4.39]***	[4.50]***	[1.58]	[0.38]
sq variable*edu1	-0.00011	-0.00005	-0.928	0.00002
	[7.39]***	[1.45]	[1.86]*	[1.36]
sq variable*edu2	-0.00009	-0.00004	-0.844	-0.00001
	[6.48]***	[1.84]*	[1.83]*	[0.26]
sq variable*edu3	-0.00013	-0.00012	-0.827	0.0000
	[4.28]***	[3.97]***	[1.67]	[0.01]
Observations	143012	143012	143012	143012
Average R-squared	0.32	0.32	0.32	0.32

B. Urban

	px	pm	px/pm	agricul
	(i)	(ii)	(iii)	(iv)
Model 1				
variable alone	-0.00541	0.00185	2.292	0.01004
	[0.63]	[0.37]	[1.41]	[1.20]
square variable	0.00002	-0.00002	-1.105	-0.00005
	[0.35]	[0.87]	[1.62]	[1.60]
Model 2				
variable*edu1	-0.02241	-0.00085	-0.152	0.01242
	[1.94]*	[0.13]	[0.05]	[1.42]
variable*edu2	-0.00734	-0.00024	1.296	0.00562
	[0.88]	[0.05]	[0.87]	[0.67]
variable*edu3	0.00378	0.00510	3.659	0.01414
	[0.44]	[0.97]	[2.11]**	[1.59]
sq variable*edu1	0.00012	-0.00001	0.314	-0.00007
	[1.82]*	[0.36]	[0.22]	[1.87]*
sq variable*edu2	0.00002	-0.00002	-0.681	-0.00003
	[0.49]	[0.56]	[1.10]	[1.03]
sq variable*edu3	-0.00003	-0.00004	-1.789	-0.00007
	[0.60]	[1.31]	[2.50]**	[1.90]*
Observations	249593	249593	249593	249593
Average R-squared	0.42	0.42	0.42	0.42

Robust t statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

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- Nro. 9 (Mayo, 2004). Julieta Trías. "Determinantes de la Utilización de los Servicios de Salud: El Caso de los Niños en la Argentina".

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