wps 3015

POLICY RESEARCH WORKING PAPER 3015

Off and Running?

Technology, Trade, and the Rising Demand for Skilled Workers in Latin America

Carolina Sánchez-Páramo
Norbert Schady

The World Bank
Development Research Group
Public Services
April 2003

Abstract

Sánchez-Páramo and Schady describe the evolution of relative wages in five Latin American countries—Argentina, Brazil, Chile, Colombia, and Mexico. They use repeated cross-sections of household surveys, and decompose the evolution of relative wages into factors associated with changes in relative supply and relative demand. The authors have three main conclusions:

- Increases in the relative wages of the most skilled (university-educated) workers took place concurrently with increases in their relative abundance in all of the countries except Brazil. This is strong evidence of increases in the demand for skilled workers.
- Increases in the wage bill of skilled workers occurred largely within sectors, and in the same sectors in different countries, which is consistent with skill-biased technological change.
- Trade appears to be an important transmission mechanism. Increases in the demand for the most skilled workers took place at a time when countries in Latin America considerably increased the penetration of imports, including imports of capital goods.

The authors show that changes in the volume and research and development intensity of imports are significantly related to changes in the demand for more skilled workers in Latin America. Their research complements earlier work on the effects of technology transmitted through trade on productivity and on the demand for skilled labor.

This paper—a product of Public Services, Development Research Group—is part of a larger effort in the group to understand the impact of globalization on human capital outcomes. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Hedy Sladovich, room MC3-607, telephone 202-473-7698, fax 202-522-1154, email address hsladovich@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at csanchezparamo@worldbank.org or nschady@worldbank.org. April 2003. (42 pages)

Off and Running? Technology, Trade, and the Rising Demand for Skilled Workers in Latin America*

Carolina Sánchez-Páramo
The World Bank
csanchezparamo@worldbank.org

Norbert Schady
The World Bank
nschady@worldbank.org

* This paper was prepared as a background paper for a regional report on Closing the Gap in Education and Technology in Latin America, managed by the Office of the Chief Economist in the Latin America and the Caribbean region of the World Bank. We thank Daron Acemoglu, Harold Alderman, Orazio Attanasio, Indermit Gill, William Maloney, Nina Pavcnik, Guillermo Perry, Michael Walton, participants at seminars at Princeton University, the Inter-American Development Bank, the World Bank, the LAMES Conference held in Sao Paulo on July 25-27, 2002, and the LACEA Conference held in Madrid on October 11-13, 2002 for useful comments. We thank Marcelo Olarreaga, Maurice Schiff and Yanling Wang for the data on R&D, Wendy Cunningham for the data on minimum wages, Martın Rama for the data on unionization rates, and Gabriel Montes-Rojas, Andreas Blom, Diego Angel, and Miguel Urquiola for providing us with the labor force survey data for Argentina, Brazil, Colombia, and Chile, respectively.

1. Introduction

There is considerable evidence of an increase in the wage premium associated with skill for workers in the United States and many OECD countries since (at least) the 1980's. In the United States, for example, Katz and Autor (1999) estimate that the real wages of high school drop-outs, the least skilled workers, fell over the 1963-1995 period (by about –4.5 percent), while the real wages of university graduates rose sharply (by about 22.4 percent). Most of the change appears to have been concentrated in the first half of the 1980's: Card and DiNardo (2002) show a deceleration in the skill wage gap since then, including in the second half of the 1990's. There is some disagreement about the underlying causes of these changes, in particular about the extent to which they are driven by changes in the relative supply of workers with different amounts of education, or changes in the relative demand for these workers (for example, Katz and Murphy 1992; Katz and Autor 1999; Autor, Katz, and Krueger, 1998; Card and DiNardo, 2002; Card and Lemieux, 2001). Still, most authors believe that changes in demand favoring the skilled are responsible for a substantial fraction of the observed changes in relative wages.

Changes in relative demand favoring skilled workers in industrialized countries could be driven by a number of factors: Skill-biased technological change (SBTC), Heckscher-Ohlin effects of trade, labor market reform, or outsourcing are all potential candidates. Here too there is some controversy about the relative importance of competing explanations (for example, Wood 1994; Feenstra and Hanson 1996; DiNardo, Fortin, and Lemieux 1996; Berman, Bound, and Machin 1998; Machin and Van Reenen 1998; Autor, Katz, and Krueger 1998). The bulk of the evidence suggests, however, that skill-biased technological change is an important factor.

Evidence of changes in the demand for workers with different amounts of skill from developing countries is more scarce. In this paper, we consider the evolution of relative wages in five Latin American countries: Argentina, Brazil, Chile, Colombia, and Mexico. These are the countries with the five largest economies in the region. Jointly, they accounted for 85 percent of the GDP and 70 percent of the population of Latin America and the Caribbean in 2000. We use repeated cross-sections of household surveys, and decompose the evolution of relative wages into factors associated with changes in relative supply and relative demand. The main conclusions of the paper are three. First, increases in the relative wages of the most skilled (university-educated) workers took place concurrently with increases in their relative abundance in all of the countries in our sample except Brazil. This is strong evidence of increases in the demand for skilled workers. Second, increases in the wage bill of skilled workers occurred largely within sectors, and in the same sectors in different countries. This is consistent with skill-biased technological change, although similar patterns of labor market reform across countries could also account for some of the observed changes. Third, trade appears to be an important transmission mechanism. Increases in the demand for the most skilled workers took place at a time when countries in Latin America considerably increased the penetration of imports, including imports of capital goods. We show that changes in the volume and R&D intensity of imports are significantly related to changes in the demand for more skilled workers in Latin America.

Our results complement earlier empirical and theoretical work on the relationship between trade, technology, and relative wages in developing countries. Berman, Bound and Machin (1998) and Berman and Machin (2000a and 2000b) use United Nations data for a sample of developed and developing countries on industry shares of production and non-production workers to argue that there has been pervasive skill-biased technological change around the world, including in middle-income countries. In Latin America, papers based on firm-level data for Chile (Pavcnik 2002) and Colombia (Kugler 2002) suggest a complementary relationship between skill-upgrading and adoption of new technology by firms, although the direction of causality is not always clear. Two recent studies based on household data for a large number of countries (Behrman, Birdsall, and Szekely 2001; Inter-American Development Bank 2002) show an increase in the wages of university graduates relative to secondary school graduates in Latin America, and argue that some of the observed changes could be explained by trade reform.[1] In addition to these cross-country studies, recent papers on Colombia (Attanasio, Goldberg, and Pavcnik 2002) and Brazil (Pavcnik, Blom, Goldberg, and Schady 2002) both attribute an important role to skill-biased technological change transferred through trade as an explanation for the observed changes in the wage distribution. Finally, theoretical work by Acemoglu (2003) shows that trade opening could induce an increase in the skill-bias of technological change because trade increases the relative price of skill-intensive products in the North, where R&D is conducted. Insofar as these new technologies are then transferred to the South, trade opening could also increase wage differences between skilled and unskilled workers there.

Our results also have important policy implications. Keller (2002) argues that the positive impact of technology diffusion on productivity affects the optimal policy stance of a country. It stands to reason, however, that the technology that is transferred from the North will not be factor-neutral in nature. Skill-biased technologies can worsen income inequalities but,

[1] Both studies have limitations: First, they are based on a large number of countries (18) but a small number of surveys per country (in half the countries in the analysis there are three surveys or less), raising the possibility that the estimates reflect, at least in part, levels differences across countries. Second, these papers do not explicitly address changes in the supply of workers with different amounts of education which could themselves account for the observed changes in wage premia.

because they increase the returns to education, they may also provide an incentive for workers to acquire more schooling. Like the effects on productivity, the effects of technology transmission on relative wages should be taken into account by policy-makers in the South making choices about the pattern and speed of trade opening.

The rest of the paper proceeds as follows. In section 2, we briefly discuss our data sources. Section 3 presents descriptive evidence on the evolution of relative wages and the relative supply of workers with different amounts of education. In section 4, we identify aggregate demand shifts. Section 5 shows that changes in the wage bill for skilled workers take place largely within sectors, and in the same sectors in different countries. In Section 6 we explore the connection between changes in relative demand, relative wages, and trade. We also briefly discuss competing explanations for the observed changes which emphasize labor market reform, or changes in the relative quality of education. Section 7 concludes.

2. The data

The analysis in this paper is based on individual-level data from labor force surveys for Argentina, Brazil, Chile, Colombia and Mexico. Table 1 provides some details on the data sources, their sampling frequency, and the periods covered by each of them. In keeping with much earlier work, where data are collected more than once a year (Brazil, Colombia, and Mexico), we simply append data from the different rounds of a survey within a year, treating multiple surveys as a single survey. We also treat the data as a series of repeated cross-sections, even though some of the surveys (Argentina and Mexico) include a rotating panel.

Table 2 reports the mean sample size, as well as the minimum and maximum for each of the surveys. The table shows wide variation: The largest surveys are carried out in Brazil (with a sample size of more than 150,000 observations per year), and Mexico (about 50,000); sample sizes are much smaller in Colombia (about 10,000), Argentina and Chile (about 2,000 each). In every instance, the surveys are limited to urban areas. In Argentina and Chile, the coverage includes only Buenos Aires and Santiago, respectively, while the coverage in Brazil, Colombia, and Mexico includes most of the larger cities.

For most of our calculations, we restrict the sample to individuals aged 25-60, and include both females and males. Surprisingly, comparable calculations which were limited to males only were qualitatively very similar to those for both genders—this, in spite of the much lower labor market participation of women, and the much higher variability in female participation. Finally, we limit the sample to all workers who are salaried and employed—that is, all those who report earning a wage, regardless of whether they are in the formal or informal sectors. The analysis does not include the self-employed, as it is not clear that the wage is a particularly meaningful concept for this group.

Table 3 gives the summary statistics for the fraction unemployed, and the fraction of the employed who are salaried, by education category. Salaried workers make up about two-thirds of all workers in urban areas in the five countries in our sample. Figure 1 shows that the ratio of salaried tertiary equivalents to salaried secondary equivalents is roughly unity in all countries, and has not changed noticeably over the period covered in our analysis—see below for a definition of education equivalents. Unemployment is generally higher among secondary than tertiary equivalents in all countries other than Mexico, and the relative unemployment rate is highly cyclical. An important message from Figure 1 is that tertiary equivalents enjoy both higher wages and lower unemployment rates, so it does not appear that they are compensated with high (or rising) wages because of their high (or rising) unemployment rates.

Construction of education groups: Much of the analysis in the paper is concerned with differences in the supply and wage levels of workers with different amounts of education, when these workers are grouped into categories. This raises a number of questions. First, education systems vary across countries, so that a person who has completed secondary school in Chile has not necessarily spent the same number of years in school as a person who has completed secondary school in Mexico. Table 4 summarizes the number of years within a given education cycle for each of the countries in our analysis.

A second issue that deserves attention is the way in which we assign individuals to education groups. In the literature for developing countries, this is commonly done according to partial or full completion of a certain education level. For instance, a person with seven years of education in Mexico would be assigned to the primary school category if the criterion were completion of a cycle, but to the secondary school category if the criterion were some schooling within a cycle.

In this paper we have opted for an alternative method of classification that essentially combines the two described above. Specifically, we assign individuals to two different education groups: The group corresponding to the highest education level they have completed and the group corresponding to the next education level they can complete. We construct weights that reflect the individual's relative progress between both education levels.

This procedure can best be illustrated with an example. Consider again an individual with seven years of education in Mexico. As described above, this person will have completed her primary studies plus one year of secondary studies, and will therefore be included in both the primary education and secondary education groups. Notice that secondary school requires a total of six years of schooling in Mexico, out of which she has only completed one. This implies that she has completed one sixth of secondary school. We therefore give her a weight of 1/6 when including her in the secondary education group and a weight of 5/6 (1-1/6) when including her in the primary education group. Similarly, a person with four years of education in Brazil would be given a weight of ½ to the no education and primary education groups each, while a person with twelve years of education in Chile would be given a weight of one in the secondary education group and zero in the tertiary group. By weighting all of our observations in this way, we transform the data into primary, secondary, and tertiary *equivalents*.

There are two reasons why this seems to us a preferable way of assigning workers to schooling categories. First, in many Latin American countries large shares of the population have only a few years of education. Restricting the analysis to only those individuals who have actually completed at least one education level would therefore discard a significant fraction of the population. Similarly, assigning these individuals to the no education group would also be misleading, since most of them do have some education. Second, a substantial amount of the educational progress that takes place in developing countries over time occurs *within* rather than *between* levels. We would miss this skill upgrading altogether if we were simply to assign workers to education categories corresponding to the levels they have completed or begun. Our procedure, by contrast, accounts for these within-category changes with changes in the weights.[2]

Table 5 summarizes the fractions of the population aged 25 to 60 who are primary school, secondary school, and tertiary equivalents, by country and year. (Tertiary education includes all formal post-secondary schooling, regardless of whether this was acquired in university or technical schools). The table shows that the distribution of education in the population was generally comparable across countries, except for Chile, which had better schooling outcomes (in particular, a larger fraction of the population who were secondary school equivalents), and Brazil, which had worse schooling outcomes (in particular, a larger fraction of primary school equivalents). In general, one-third to one-half of the population are primary equivalents, another third are secondary school equivalents (with the exceptions of Brazil and Chile), and one-fifth to one-quarter are tertiary equivalents. In all of the countries in the sample there is clear evidence of skill upgrading: The fraction of primary equivalents diminishes, and the fractions of secondary and tertiary equivalents increase over time. As a check, we also present data on the fractions of

[2] To ensure that our results are not driven by the way in which we construct our education groups, we re-estimated all of the relationships we report in the paper with alternative education measures—those in which workers are assigned to the highest education cycle they have *started*, as well as those in which they are assigned to the highest cycle they have *completed*. These results, which are available from the authors upon request, are qualitatively very similar to the ones which we report.

the population in these countries who have some education within a level, based on the international data from Barro and Lee (2000). These figures cannot be compared strictly to our estimates, because of differences in data sources, in the way in which the education groups were computed, and (critically) because the Barro and Lee data purport to be representative of both the urban and rural sectors in a country. Still, as Table 6 shows, the patterns in Barro and Lee are reasonably similar to those from the labor force survey data, showing lower levels of education in Brazil, and skill upgrading in all of the countries in our sample.

3. Trends in relative wage and supply measures by education level

We start our analysis by looking at trends in the evolution of relative wages and relative supplies by education groups, focusing on the comparisons between tertiary and secondary equivalents, and between secondary and primary equivalents. After grouping workers into education categories, we calculate relative wages for education groups *i* and *j* in year *t* as the difference in their average (log) hourly wages:

(1) $W^t_{i,j}$ = log (hourly wage)$_{it}$ – log (hourly wage)$_{jt}$,

where i=tertiary or secondary, and j=secondary or primary, respectively. Similarly, we calculate the relative supply in year t as the ratio of the percentage share of groups i and j among those employed in salaried jobs:

(2) $S^t_{i,j}$ = (% education level i of salaried workers in year t) / (% education level j of salaried workers in year t)

We then discuss our findings in the context of a simple supply-demand framework.

A concern with simple estimates of the relationship between relative wages and relative supply based on equations (1) and (2) is the changing composition of the workforce. The five countries in our sample are relatively advanced in their demographic transitions. The fraction of workers who are older is therefore higher in later than in earlier years. Older workers generally earn more than younger workers, and a life-cycle model of earnings determination suggests that the wage gap between more and less educated workers should also increase with age (Mincer 1974; Heckman, Lochner, and Todd 1998). The increase in the relative wage of the skilled we observe could, therefore, be a product not of the changing supply or demand for educated workers, but rather of the changing age profile. Many countries in Latin America are also witnessing important changes in the participation of women in the labor force. If the difference in wages by education is larger (or smaller) for women than for men, this too could distort uncorrected estimates of relative wages.

Following Katz and Murphy (1992) we correct for compositional changes in the labor force by holding constant other characteristics—in our case, gender and age (in five-year brackets). Specifically, for any education group, we calculate the average share of total employment which is given by workers in 14 age-gender cells *over the entire period.* We then use these weights to calculate mean wages for an education group in any given year. This procedure holds constant the age and gender composition of the workforce, so that the observed changes can more convincingly be attributed to demand or supply factors determining the relative wage.[3] In practice, however, the corrected relative supply and wage series are very similar to those which do not take into account changes in composition.

<u>Relative wages and supply of tertiary and secondary equivalents</u>: The five panels in Figure 2 graph the measures of relative supply and relative wages of tertiary and secondary equivalents. Since our sample sizes are relatively small, in particular in Argentina and Chile, and especially when we consider tertiary equivalents, we graph three-year moving averages for the values of relative supply and wages in a given year. All series have been normalized, so that the relative wages and relative supplies are given a value of 100 in the first year for which data are available. Figure 2 shows that in all of the countries in the sample except Chile the wages of tertiary equivalents rise steadily relative to those of secondary equivalents. In spite of these common patterns, however, Figure 2 shows that the *magnitude* of changes in relative wages varies a great deal by country. Calculating growth rates for the series, $(W^1_{t,J} - W^0_{t,J})/ W^0_{t,J}$, and focusing on the 1990's, the relative wages of tertiary workers increased by an incredible 72.9% in Colombia and 48.3%, in Mexico, but only by 19.7% and 11.7% in Argentina and Brazil, respectively. In Chile, meanwhile, the relative wages grew by 27.2% in the 1980's, and fell by 13.5% in the 1990's.

The second striking feature of Figure 2 is the fact that in all of the countries except Brazil, this increase in relative wages took place in spite of an *increase* in the relative supply of tertiary equivalents. Calculating growth rates for the series, $(S^1_{t,J} - S^0_{t,J})/ S^0_{t,J}$ and once again focusing on the 1990's, the biggest increase in the relative supply occurred in Mexico (34.0%), which makes the magnitude of the change in relative wages there even more remarkable. In the

[3] Note that in holding constant age, we are comparing workers with different amounts of experience: This is because we calculate experience in the standard way, as age-schooling-6, and the number of years of schooling is obviously different for workers with (say) tertiary and secondary education. We do this because we would otherwise be using observations for very young workers. For example, a worker with 1 year of experience and exactly 7 years of schooling would be 14 years old, and unlikely to be in the labor market (or, at least, to report credible estimates of wages).

other countries the relative supply of tertiary equivalents increased by little in Colombia (7.2%), and moderately in Chile (16.9%) and Argentina (25%). In Brazil, the relative supply of tertiary equivalents fell by 7.3%, a change which can be explained by increases in the workforce with secondary education. Increases in relative wages which coincide with increases in relative supply are highly suggestive of demand-side changes favoring the most skilled workers. Indeed, these patterns suggest that the demand-side shifts towards tertiary equivalents would have to be so large as to more than offset the downward pressure on wages which results from their increasing relative supply. Only in Brazil is it at least possible that the change in the relative wage over the period is driven entirely by changes in relative supply.[4]

Relative wages and supply of secondary and primary equivalents: Although this paper is concerned primarily with the evolution of relative wages of tertiary and secondary equivalents, Figure 3 presents a comparable panel of graphs for the evolution of relative wages and relative supply for secondary and primary equivalents. These figures show increases in the relative supply of secondary equivalents of more than 18% in every country in the 1990's, with particularly sharp increases in Colombia (32.8%), Mexico (29.2%), and Argentina (29.1%). In Chile, the most dramatic skill upgrading at this level took place in the 1980's, with an increase in the relative supply of secondary equivalents of 63.1%. These changes reflect widespread public efforts to increase secondary school enrolments. Figure 3 also shows that the relative wage of secondary equivalents generally decreased over the period. As with Figure 2, and focusing on the 1990's, the magnitude of these changes varies a great deal by country—from a very small decrease in Colombia (-0.4%), to much larger decreases in Argentina (-32.3%) and Brazil (-20.3%). Only in Mexico did the relative wage of secondary equivalents actually increase over the period (by 8.9%). A combined look at Figures 2 and 3 makes obvious that the wages of secondary equivalents in every country but Mexico therefore fell relative to *both* primary and tertiary equivalents. Given that in every case but Mexico the supply and wages of secondary equivalents relative to those of primary equivalents moved in opposite directions, it is unclear

[4] In separate results, we consider possible changes in the return to different *types* of education. In addition to their level and years of schooling, the ENEU survey in Mexico asks respondents about their field of study. We group respondents into two categories: Those with scientific degrees (including those who studied mathematics, natural sciences, physics, chemistry, engineering, health, and technology-related fields) and those with humanistic degrees. These results suggest increases in the demand for tertiary equivalents with both scientific and humanistic degrees—at least until the integration of Mexico in NAFTA in 1994, after which the demand-side changes are most clearly apparent for workers with scientific degrees. These results are available from the authors upon request.

what effect, if any, demand-side changes may have had. Further analysis is necessary to isolate changes in relative demand from changes in relative supply.[5]

Changes in inequality: Changes in the relative wages of workers with different amounts of education have had important effects on the distribution of earnings in Latin America. Table 7 presents calculations for the Gini coefficient of monthly wages for the five countries in our sample.[6] In Argentina, where the biggest change over the period appears to be an increase in the earnings of primary equivalents (relative to secondary equivalents), the earnings Gini is lower in the 1990's than in the 1980's. In Brazil, we see only small changes in the Gini, which is not unexpected given the small changes in relative wages. In Colombia, a comparison of the results for 1985-90 and 1990-95 suggests that the period with the most dramatic increase in the relative wages of tertiary equivalents coincides with a sharp increase in the Gini. In Mexico, the Gini increases steadily over time, which is not surprising given the increase in the earnings of both tertiary equivalents (relative to secondary equivalents) and secondary equivalents (relative to primary equivalents). In Chile, finally, there were large increases in the Gini in the late 1970's and in the 1980's, and a decrease in the 1990's, so that by the late 1990's the Gini was only marginally higher than it had been in the late 1970's, and significantly lower than in the 1980's. Changes in the Gini are particularly important given the already very high levels of inequality in many Latin American countries.

[5] In the United States, the increase in the returns to schooling has occurred concurrently with sharp increases in the returns to experience, and in the unexplained (or residual) wage inequality (Katz and Murphy 1992; Juhn, Murphy and Pierce 1993). To test for this possibility in our sample of countries, we run country-specific regressions of $\log(w_{it}) = \alpha + \beta_t S_{it} + \gamma_t E_{it} + \varepsilon_{it}$, where $\log(w_{it})$ is log hourly wages, S_{it} is an unrestricted set of dummies for years of education, E_{it} is an unrestricted set of dummies for years of experience, and t takes on values of 1 around 1980 (corresponding to the 1979-81 surveys in Chile, and the 1982-84 surveys in Brazil and Colombia), 2 around 1990 (corresponding to the 1989-91 surveys in all countries), and 3 around 2000 (corresponding to the latest three surveys in all countries). We graph the coefficients γ_t, but find no consistent change in the experience profiles over time. Similarly, when we graph the log wage residuals at the 90th, 50th and 10th percentiles of the distribution, we find no increase in the dispersion, suggesting (puzzlingly) that there has not been an increase in the returns to unobserved ability for the five countries in our sample.

[6] We also calculated the Gini of hourly wages, which corresponds to our measure of relative wages. These results, which are not reported but are available from the authors upon request, are qualitatively very similar to those for monthly wages. In general, however, the changes in the Gini are larger for monthly wages because changes in hourly wages over time tend to be *positively* correlated with changes in hours worked for the countries in our sample. For example, mean hours worked for the lowest 30% of the earnings distribution are lower in 1995-99 than in 1985-90 in every country in our sample except Mexico, and higher for the highest 30 percent of the distribution in every country in our sample except Argentina and Chile.

4. Identifying demand effects on changes in relative wages

In the remainder of the paper, we focus on the wages and employment shares of tertiary equivalents relative to secondary equivalents only. To assess the magnitude of the demand changes favoring tertiary equivalents, we follow Katz and Murphy (1992). In a simple supply-demand model, and under the assumption of a constant elasticity of substitution (CES), relative wages have to satisfy the condition:

(3) $\text{Log}[w_1(t)/w_2(t)] = (1/\sigma)[D(t) - \log [x_1(t)/x_2(t)]$

where $w_1(t)/w_2(t)$ is the ratio of relative wages, $x_1(t)/x_2(t)$ is the ratio of relative supplies, σ is the elasticity of substitution between workers in the two education levels, and D(t) is the time series of relative demand shifts. The economy is assumed to be operating on the demand curve, and supply is taken to be perfectly inelastic in the short run. Both D(t) and σ are unknown parameters. As Katz and Murphy show, a working value of σ can be estimated if the demand side shifts are taken to be linear by running a regression of the (log) relative wages on the (log) relative supplies and a time trend. With this procedure, Katz and Murphy obtain an estimate of σ which is 1.41 in the United States. They then re-arrange terms in (3) to obtain:

(4) $D(t) = \sigma \log[w_1(t)/w_2(t)] + \log [x_1(t)/x_2(t)]$

Since all of the parameters on the right-hand side of (4) are now given, this can in theory be used to estimate demand-side shifts.

In the United States data, identification of the parameter σ conditional on the time trend D is possible because of clearly non-linear patterns in both the measure of relative wages $\log[w_1(t)/w_2(t)]$ and the measure of relative supply $\log [x_1(t)/x_2(t)]$. Unfortunately, this is not the case for any of the countries in our sample—rather, all of the series are rising (or falling) almost monotonically. As a result, our estimates of σ conditional on a time trend are very imprecise (with t-statistics of one or lower), and often wildly improbable. (In Chile, for example, the estimated elasticity of substitution between tertiary equivalents and secondary equivalents is higher than 10, but the t-value is 0.2). In our calculations, we therefore follow the second approach outlined in Katz and Murphy, which estimates D(t) *directly*, under plausible values for σ. Specifically, we allow for values of σ between 1 and 3, which is the range of international estimates summarized in Katz and Autor (1999, p. 1521). (The Cobb-Douglas production function corresponds to a value of σ of 1).

<u>Aggregate demand shifts for tertiary equivalents</u>: Figure 4 presents a series of graphs of D(t) for tertiary equivalents relative to secondary equivalents for the five countries in our sample,

for values of σ between 1 and 3. (Here, as before, we present three-year moving averages.) The graphs confirm that in Argentina, Brazil, Colombia and Mexico there have been increases in relative demand for tertiary equivalents in the 1990's. In Chile, the steep demand-side shifts favoring skilled workers took place in the late 1970's and in the 1980's, with the overall pattern in the 1990's being essentially flat. With the exception of Brazil, these demand shifts are not sensitive to the choice of σ, the parameter for the elasticity of substitution. (In Brazil, the same pattern holds for the higher values of σ, but not for an elasticity of one.) In addition to the evidence of a secular increase in the demand for tertiary equivalents in Latin America, Figures 2 and 4 show that sudden economic downturns have generally been associated with a decrease in the relative wages and in the demand for these most skilled workers, a finding which is inconsistent with much of the literature on the effects of macroeconomic crises in developing countries.[7]

As with the relative wage series in Figure 2, Figure 4 shows that the magnitude of the demand shifts favoring tertiary equivalents varied a great deal by country, and over time. To look at these patterns more carefully, Table 8 presents annual increases in relative demand for tertiary equivalents over five-year periods. The table confirms the very large increases in relative demand in Mexico and Colombia, in particular during the first half of the 1990's; large increases in relative demand in Chile in the 1975-90 period, and in Argentina throughout the 1990's; and anemic demand shifts in Brazil. Table 9 presents similar results for the United States from Autor, Katz, and Krueger (1998). A comparison of the results in the two tables shows that the demand shifts in some Latin American countries were as large or larger than those in the United States.

The similarity of patterns in the United States and in Latin America is intriguing. The 1980's and 1990's were a period of increasing trade liberalization in many countries in Latin America. It seems likely that some of the technological changes that account for the rising wage of skilled workers in OECD countries, in particular in the United States, were transmitted through trade, and helped determine the evolution of relative wages in Latin America. Since the

[7] The countries in our sample present at least six important macroeconomic crises for the period for which we have wage data: Chile in 1972-75, and again in 1982-83, Argentina in 1988-1990, Brazil in 1981-83, and again in 1990-92, Colombia in 1999, and Mexico in 1995. With the exception of the Mexican tequila crisis of 1995 and the Colombian recession of 1999, all of these crises have been associated with pronounced decreases in the relative demand for the most educated workers. Put differently, virtually all of the important downturns we observe in the relative demand for tertiary educated workers in the region are correlated with economic downturns. The only exceptions to this pattern are the decrease in relative wages for tertiary workers in Colombia in 1989-90, and the decrease in Chile in 1991-93. This finding is at odds with much of the existing literature which emphasizes the relative advantage of educated workers during macro-economic downturns (see, for example, World Bank 2001, and Glewwe and Hall 1998 for such an explanation applied to Peru).

technological changes in the United States were complementary with skill, we would expect that new technologies adopted in Latin America would also favor more educated workers.

5. Indirect evidence of skill-biased technological change: Within- and between sector decompositions of the wage bill for tertiary workers

Trade liberalization in a country will generally change the relative price of goods produced in different sectors. This, in turn, will have an effect on the relative size of sectors, and on the relative wages of workers with different amounts of education. Specifically, in a two-sector economy with different skill intensities, the H-O theorem of international trade predicts that trade reform in a skill-abundant country will increase the relative price of goods produced in the skill-intensive sector. The accompanying Stolper-Samuelson theorem predicts that this change in product prices will be translated into an increase in the wages of workers in the skill-intensive sector of the economy. Since the skill-intensive sector, by definition, employs more skilled workers, changes in product demand could therefore lead to an aggregate rise in the wages of skilled labor in a skill-intensive country.

There are a number of problems with a straightforward application of the H-O Stolper-Samuelson framework to the Latin American data. First, the skill-bias of technology may itself be endogenous to the amount of trade between countries in the North and South (Acemoglu 2003). Second, it is not clear *a priori* whether Latin American countries are relatively skill-abundant or skill-scarce, as they vary considerably both in education levels, and in their trading partners. Third, in Mexico, Colombia, and Brazil, tariff protection prior to liberalization was highest in those sectors which employed the highest fraction of unskilled workers.[8] As a result, tariff declines were largest in those sectors which were relatively skill-unintensive.[9] Trade liberalization therefore reduced the relative price of goods produced by the skill-unintensive sector, and this could have translated into a reduction in the relative wages of the unskilled through Stolper-Samuelson effects.

These complications notwithstanding, a critical prediction of an H-O Stolper-Samuelson type explanation is that economy-wide skill upgrading is a result of an increase in the relative size of skill-intensive sectors. This, in turn, increases the aggregate demand and the relative wage of

[8] On Brazil, see Pavcnik, Blom, Goldberg, and Schady 2002; on Colombia, Attanasio, Goldberg, and Pavcnik 2002; on Mexico, Hanson and Harrison 1999.

[9] In Brazil, for example, an industry with ten percentage points more unskilled labor could expect to see, on average, a four point bigger reduction in tariffs between 1987 and 1998. A regression of the annual change in tariffs against the share of unskilled workers in 1987 yields a coefficient of -3.97 for the share of unskilled workers (t-statistic=-1.88). See Pavcnik et al. 2002, p. 13.

skilled labor. Because skilled workers are now relatively more expensive, however, we would expect to see *within-sector* substitution *away* from skilled labor and into unskilled labor. By contrast, skill-biased technological change is consistent with within-sector increases in both the relative wage and employment share of skilled workers.

A standard way of considering the importance of these competing explanations is to decompose the change in the aggregate wage bill, given by the product of employment and the wage, into between- and within industry components, as follows:

$$(5) \qquad \Delta St = \sum_i \Delta St_i \overline{W_i} + \sum_i \Delta W_i \overline{St_i}$$

where St is the wage bill share of tertiary (skilled) workers defined as:

$$(6) \qquad St = \frac{w_t T}{w_t T + w_s S}$$

and W_i is the wage bill share of industry *i* defined as:

$$(7) \qquad W_i = \frac{WB_i}{\sum_i WB_i}$$

where T and S are tertiary and secondary equivalents, respectively, W_t and W_s are the wages paid to these two groups, WB stands for wage bill, *i* is an industry index and an overstrike indicates an average between the initial and final periods considered.[10]

We turn again to the household data for Argentina, Brazil, Chile, Colombia, and Mexico, and disaggregate the wage and employment data into the greatest number of sectors possible—from 25 in Argentina to 75 in Mexico. The results from this decomposition are presented in Table 10. Table 10 shows clearly that the bulk of the increase in the aggregate wage bill for tertiary equivalents took place *within* industries. The fractions vary by country. In Mexico, despite the greatest number of sectors in the data, which should allow for a more accurate measurement of shifts across sectors, fully 95 percent of the observed skill upgrading can be explained by within-sector changes. In Chile, the labor force survey data shows that just over 90 percent of the skill upgrading in the 1980's took place within sectors. Similar estimates based on firm-level data for Chile for the 1979-86 period suggest that 66 percent of the changes in the wage bill occurred within very detailed four-digit ISIC industries (Pavcnik 2002). Finally, calculations by Berman and Machin (2002b) based on a United Nations classification of industrial employment into non-production (skilled) and production (unskilled) workers for the

[10] See Autor, Katz and Krueger 1998, Katz and Autor 1999, Berman, Bound, and Machin 1998, and Berman and Machin 2000b.

1980's show a similar pattern for the six Latin American countries for which data are available: The proportion of the increase in the wage bill of non-production workers which takes place *within* industries is 51 percent in Uruguay, 62 percent in Venezuela, 69 percent in Guatemala, 84 percent in Colombia, 103 percent in Peru, and 153 percent in Chile.

The decompositions in Table 10 suggest that skill-biased technological change is a serious contender to explain the observed changes in real wages in Latin America.[11] Further evidence comes from the similarity of patterns of skill upgrading across countries. Insofar as skill-biased technological change is *pervasive*, we would expect to find a positive correlation between the degree of skill upgrading across sectors in different countries. In Table 11, we present weighted correlations of the changes in the wage bill share of tertiary equivalents across sectors, similar to those found in Berman, Bound and Machin (1998). To do these correlations, we have to aggregate the data for different countries to the lowest common denominator of comparable sectors, which is eleven. Moreover, because the patterns we observe in Chile *in the 1980's* resemble those in other countries *in the 1990's*, we correlate wage bill shares for Chile in the 1980's with those for Argentina, Brazil, Colombia, and Mexico in the 1990's.[12] If there were no relationship between the pattern of skill upgrading in different countries, we would expect half of these correlations to be positive, and the other half negative. Instead, 8 of the 10 correlations are positive, three significantly so at the 10 percent level. The only two negative coefficients involve Brazil, a country with by far the lowest education levels in our sample. This would likely have made technologies transferred from the North most inappropriate in Brazil, and may have made employers reluctant to use them (Acemoglu and Zilibotti 2001). Consider the implications of this: Despite profound differences in the productive structure of the five countries, skill upgrading at the tertiary level appears to have taken place in the same sectors. These results are highly suggestive of technological changes which affected some sectors more than others, and

---

[11] Within-industry upgrading is also consistent with a complementary relationship between capital and skill together with a falling relative price of capital. Empirically, skilled labor and capital do appear to be complements (Berman, Bound, and Griliches 1994). Capital is likely to have become relatively more abundant and cheaper in Latin America as a result of trade liberalization, rising FDI, and other developments which increased investment. A careful analysis of the changes in the use of skilled labor by Colombian firms between 1983 and 1998 which takes into account the effect of the changing price of capital, suggests that skill upgrading has been driven both by capital-skill and technology-skill complementarity (Kugler 2002). Berman and Machin (2002b) argue that the changes in the price of capital in Latin America and other developing countries appear to be much too small to account for the observed changes in demand for skilled workers.

[12] Observations are weighted by the sector employment shares averaged over time and across countries, in a similar fashion to the correlations for industrialized countries presented in Berman, Bound, and Machin 1998.

which were transmitted to Chile in the 1980's and to the other countries in the region in the 1990's.

6. Direct evidence of skill-biased technological change: Industry patterns of skill upgrading, trade, and the R&D intensity of imports

If skill-biased technologies developed in the North were transmitted to Latin America through trade, we would expect industries and countries with a high degree of import penetration, in particular imports which are intensive in new technologies to have a high degree of skill upgrading. Data on imports, and on the R&D content of these imports are available for three countries in our sample—Chile, Colombia, and Mexico—and only for the manufacturing sector. These data can be disaggregated into 8 categories in Chile, 8 in Colombia, and 16 in Mexico, where each category corresponds to a particular industry, and can be used to create an (unbalanced) panel of country-industry-year observations—see Machin and van Reenen (1998) and Keller (2002) for a similar empirical approach.[13]

We construct three different measures of exposure to foreign technologies. The first is import penetration, defined as total imports over value added in an industry, M_j/VA_j. Here, and in all measures of imports, only intermediate imports are considered—sales of imports for final consumption are excluded. For the second measure of foreign technology, we follow Schiff, Wang, and Olarreaga (2002) and construct the North R&D stock available in an industry-country-year cell.

(8) $$NRDstock_{ci} = \sum_j a_{cij} \left(\sum_k \frac{M_{kj}}{VA_{cj}} RD_{kj} \right)$$

where *NRDstock* is the North R&D stock in industry i of Latin American country c, $c(k)$ indexes Latin American (OECD) countries, j indexes industries, M, VA and RD denote imports, value added and R&D, respectively, and a_{cij} is the input-output coefficient (which measures the share of imports in industry j that is sold to industry i in country c). Data on import input-output flows are not available, so they are proxied by domestic input-output flows in the estimation. The North R&D stock can be thought of as a measure of import penetration by industry, when the imports are weighted by their R&D content.[14]

---

[13] We thank Marcelo Olarreaga, Maurice Schiff, and Yanling Wang for making these data available to us, Because of the smaller size of the Chilean data sets, the Chilean observations are two-year averages.
[14] The data on R&D expenditures for these calculations in the North is available from the ANBERD 2000 (OECD) database; it covers 15 OECD countries from 1973 onwards, and is available at the two-, three- or four-digit level. Cumulative R&D stocks are computed from these flows using the perpetual inventory method with a 10 percent depreciation rate. The input-output matrices are derived from GTAP (1998),

Finally, we follow Coe, Helpman and Hoffmaister (1997) and disaggregate changes in the foreign R&D stock in an industry into changes in *volume* and changes in *composition* (increases in the R&D content of imports, holding constant the volume). Here too the measure of volume is given by import penetration, M_j/VA_j. The measure of trade composition, *NRDcomposition*, is defined as:

$$(9) \qquad NRDcomposition_{ct} = \sum_j a_{cij} \left(\sum_k \frac{M_{kj}}{M_j} RD_{kj} \right)$$

Note that the only difference between this measure and the measure of foreign R&D stock in (8) is the denominator in the expression in parentheses: The measure of *NRDcomposition* expresses all imports from a given OECD country *k* in industry *j* as a fraction of total imports to industry *j*, rather than as a fraction of value added in industry *j*. Put differently, because imports from a given country are normalized by total imports, the measure of *NRDcomposition* refers only to the source and R&D intensity of imports, abstracting from the volume, while the measure of *NRDstock* refers both to the volume and composition of imports.

Figure 5 graphs national averages of the evolution of import penetration (as a fraction of total GDP), and the North R&D stock (in millions of 1990 US $) in Chile, Colombia, and Mexico. The figure clearly shows large increases in both measures, but particularly in the measure of North R&D. Since the R&D stock is itself a function of import penetration and the R&D content of these imports, Figure 11 suggests that the R&D intensity of a given volume of imports increased in the 1980's and 1990's, at least in Chile and Colombia. Table 11 presents percentage changes in import penetration and in the R&D stock, by industry, between the first and last years for which data on import penetration, R&D stock, and labor force are all available (1981-98 in Chile, 1982-98 in Colombia, and 1987-98 in Mexico). The table shows some common patterns across countries: For example, there are very large increases in import penetration in the textiles, clothing apparel, footwear and leather products sector in all three countries, and very large increases in the North R&D stock in the paper, printing and publishing and non-metallic products sectors in Chile and Colombia.

We next turn to regression analysis to estimate the effect of exposure to foreign technology on skill upgrading. We consider five different measures of skill upgrading: The relative wages, relative wage bill (defined, as before, as the product of employment and the

---

while the bilateral openness are from World Bank databases—see Schiff, Wang and Olarreaga (2002) for details. The estimations take into account only the R&D of OECD countries because comparable data for middle- and low-income countries are not available. This is unlikely to be a problem, however, as well over 90 percent of total R&D in the world is conducted in eight OECD countries—namely Canada, France, Germany, Italy, Japan, Sweden, the United Kingdom, and the United States. See Keller (2002, p. 10).

wage), relative demand, and relative employment (separately, measured as the number of workers and the number of hours worked) of tertiary to secondary equivalents. In the first set of regressions, the explanatory variable is import penetration, in the second set of regressions the explanatory variable is the log of the North R&D stock, while the third set of regressions includes both the measure of import volume and import composition in industry i in country c at time t.

An obvious problem with our data is that all of the series—relative demand, wages, employment shares and import penetration—are trending upwards. A simple regression of any measure of skill upgrading on any measure of imports would therefore find a (likely spurious) association. We correct for this by removing a country-industry-specific linear trend from all of the series. The regressions also include country-industry-specific intercepts.[15] A second estimation problem is related to the possible endogeneity of our measures of import penetration. This could happen, for example, if firms import more intermediate goods or more R&D-intensive intermediate goods precisely because they have an increased abundance of skilled workers. As a partial correction for this, we lag our measures of import penetration by one period.[16] All estimations are by GLS, and observations are weighted by employment in a given country-industry-year cell.

Results are summarized in Table 13. The top panel shows that increases in import penetration are consistently associated with skill upgrading—regardless whether this upgrading is measured in terms of relative wages, demand, wage bill or employment share of tertiary workers. The effects are large: A one percent increase in import penetration is associated with a five percent increase in relative wages, a two percent increase in the relative wage bill, and a half-percent increase in the employment share of tertiary equivalents. The second panel shows that increases in foreign R&D stock also have strong, positive effects. The magnitude of the coefficients is substantially larger than those in the first set of specifications: A one percent increase in the North R&D stock is associated with a 14 percent increase in relative wages, a five percent increase in the wage bill, and a one percent increase in the employment share. The relatively larger magnitude of the coefficients in this second panel suggests that the composition of imports is important, not just the volume. The third panel directly takes up this question. The results show that both the measure of trade volume and trade composition, but particularly the measure of trade composition, is an important determinant of skill upgrading in Chile, Colombia,

[15] We also considered regressions in first differences. In these regressions, 18 of the 20 coefficients reported in Table 13 are positive, as expected, although these are generally not significant.

[16] As is well known, this will be an adequate correction only if there is no serial correlation of the error terms. However, in the absence of credible instruments, there is no generally agreed-upon solution preferable to lagging the explanatory variables.

and Mexico. Put differently, it is not just the amount of trade but who you trade with that matters—so that imports from countries and industries which are intensive in R&D is a particularly strong impetus for skill upgrading. Earlier work by Machin and Van Reenen (1998) shows that there is a clear association between industry-level R&D intensity and the wage bill for skilled workers in a sample of OECD countries (including Denmark, France, Germany, Japan, Sweden, the United States, and the United Kingdom). The results in Table 13 are consistent with a pattern whereby foreign R&D, transmitted through trade, increased the relative wages, employment shares, and demand for tertiary workers in Latin America.

We consider, finally, two alternative explanations for the patterns we observe: Labor market reforms, including falling levels of unionization and an erosion of the real value of the minimum wage, and changes in the relative quality of schooling, in particular decreases in the quality of secondary school relative to university, which could lead to an increase in the relative demand for tertiary equivalents.

Labor market reform as an alternative explanation? The minimum wage could affect the relative earnings of tertiary to secondary equivalents in a number of ways. First, if it is binding, and if at least some secondary equivalents earn low enough wages, the minimum wage could compress the lower end of the distribution of relative earnings. Second, if wages higher up in the distribution are established, at least in part, as multiples of the minimum wage (a so-called numeraire effect), the minimum wage could have an effect on the relative earnings of secondary and tertiary equivalents even if the wages of these more skilled groups are substantially higher than the value of the minimum wage. Third, if the minimum wage serves as a reference point for fair remuneration, even if it is not strictly binding, it could have an effect on the distribution of relative earnings (a so-called lighthouse effect).[17]

In the spirit of DiNardo, Fortin, and Lemieux (1996), we consider the effect of the minimum wage with univariate kernel density plots of wages, both for the population as a whole, and for secondary and tertiary equivalents only.[18] These plots suggest that the minimum wage is clearly binding in some countries—Colombia and less obviously Brazil, both for the population as a whole and, to a lesser extent, for the more skilled workers—but not in others—Chile and Mexico (see Bell (1997) for a similar conclusion about differences between Colombia and Mexico based on firm-level data). Figure 6 shows that in Colombia there is substantial piling of mass at the level of the minimum wage, even for secondary and tertiary equivalents, and other

[17] For a discussion applied to the Latin American, see Maloney and Nuñez 2001.

[18] For Brazil information on the minimum wage is available annually for 1984-98; for Chile, for 1986-95; for Colombia, for 1982-92; for Mexico, for 1987-96. No information on the minimum wage for Argentina was available for this paper. We are grateful to Wendy Cunningham for providing us with these data.

spikes higher up in the distribution; some of these coincide with multiples of the minimum wage, suggesting a numeraire effect of the minimum wage. No such patterns are observable in Mexico. (Comparable graphs for Brazil and Chile are not included, but are available from the authors upon request.)

Can changes in the real value of the minimum wage help explain some of the observed changes in relative earnings? Figure 7 graphs the evolution of the minimum wage standardized by the mean wage (SMW) for the four countries for which data are available. These graphs show that the SMW fell in Mexico between 1987 and 1995 (coinciding with rising relative wages for skill), rose in Chile between 1986 and 1995 (coinciding with a time when the relative wage for skill stopped increasing), was very volatile in Colombia between 1982 and 1992, although the value of the minimum wage in 1992 was roughly comparable to that in 1982, and generally fell in Brazil between 1984 and 1998, except for a brief period in 1990-93, when it rose sharply (which coincides reasonably well with the evolution of relative wages, which generally rose over the period, but were flatter in 1990-93). These graphs suggest that changes in the real minimum wage could plausibly help explain the evolution of relative earnings in some of the countries in our sample.

We next turn to a discussion of unionization. Union membership in Latin America has generally fallen over the course of the last two decades: Pages and Shinkai (2002) estimate that the mean unionization rate in the region fell from 22 percent in the 1980's to 15 percent in the 1990's. Their analysis also suggests that unions generally tend to compress the distribution of earnings in the region except for Brazil, where unions *increase* dispersion (on Brazil, see also Arbache 1999).[19] Table 14 presents summary estimates of the union membership rates in the five countries in our analysis.[20] A comparison of the rates in Table 14 and the graphs for the evolution of relative wages in Figures 2 and 4 suggests that periods of falling unionization are generally associated with increases in the relative wages of the most skilled (for example, Colombia and Mexico in the 1990's), while increases in union membership coincide with a flattening of the relative earning schedule (for example, in Chile in the early 1990's). In Brazil the pattern is the reverse, so that periods of increasing (decreasing) union membership are associated with periods of increasing (decreasing) relative wages for the most skilled workers.

[19] The union effect on the distribution of wages decreases substantially (by 40 percent) when basic controls for education are included.

[20] We thank Martin Rama for making these data available to us.

Most analysts argue that the degree of labor market reform which took place in Latin America in the 1990's was modest.[21] The discussion above suggests, however, that changes in the minimum wage and in unionization could have compounded the effects of skill-biased technological change transmitted through trade in Latin America. An additional (and unanswered) question is the extent to which the changes in the minimum wage and unionization rates were themselves endogenous, and reflected the diminishing bargaining power of unskilled labor in the face of skill-biased technological change.[22]

Changes in the relative quality of education as an alternative explanation? A second alternative explanation for the observed changes in relative earnings in Latin America focuses on changes in the relative quality of secondary school and tertiary equivalents. Katz and Murphy (1992, p. 67) argue that within-cohort comparisons of relative earnings should hold schooling quality reasonably constant. Figure 8 presents 3-year moving averages of the log wage differential between tertiary and secondary equivalents for three different birth cohorts, by country, for Brazil, Colombia and Mexico (comparable graphs for Argentina and Chile are much more noisy, because of the smaller sample sizes). The figures show that the increase in relative wages for tertiary equivalents generally appears to have affected all birth cohorts. Similarly, when we compare the relative earnings of tertiary and secondary equivalents for workers with low (1-10) and high (25+) years of experience, we find no evidence that the increase in earnings associated with schooling is concentrated among younger or older workers—unlike the United States, where younger, highly educated workers appear to have benefited more than their older counterparts (see Card and Lemieux 2001; Heckman, Lochner, and Todd 1998). We therefore conclude that changes in the relative quality of schooling are unlikely to help explain much about the evolution of relative earnings in Latin America.

7. Conclusion

Workers with tertiary education have seen their wages rise steeply in Latin America. This paper shows that this increase in relative wages has been caused by sharp increases in the demand for these most skilled workers by firms. The bulk of the changes in the wage premium for skilled workers have taken place within detailed industries, and in the same industries in different countries. Both of these are suggestive of an important role for skill-biased

[21] See, for example Guasch 1999, and Gill et al. 2002. Behrman, Birdsall, and Szekely (2001) graph the evolution of various indices of reform in Latin America, including a composite measure of labor market reform, and argue that labor markets in the region were no more flexible in the mid-1990's than in the mid-1980's.

[22] See Katz and Autor 1999, especially pp. 1540-47, for a discussion.

technological change. In addition, the relative demand for tertiary equivalents increased in sectors and at times of increasing penetration of R&D intensive imports. The patterns we find are consistent with the transmission of skill-biased technologies from the North to Latin American countries. Labor market reforms may have further compounded these effects.

References

The word processed describes informally reproduced works that may not be commonly available through library systems.

Acemoglu, Daron. 2003. Patterns of Skill Premia. *Review of Economic Studies* (forthcoming).

Acemoglu, Daron, and Fabrizio Zilibotti. 2001. Productivity Differences.*Quarterly Journal of Economics* 116 (2), 563-606.

Arbache, Jorge Saba. 1999. Do Unions Always Increase Wage Dispersion? The Case of Brazilian Manufacturing.*Journal of Labor Research* 20, 425-36.

Attanasio, Orazio, Pinelopi K. Goldberg and Nina Pavcnik. 2002. Trade Reforms and Income Inequality in Colombia. Paper prepared for the 2002 IMF Conference on Macroeconomic Policies and Poverty Reduction, March 14-15, Washington, D.C.

Autor, David H., Lawrence F. Katz, and Alan B. Krueger. 1998. Computing Inequality: Have Computers Changed the Labor Market? *Quarterly Journal of Economics* 113 (4), 1169-1214.

Barro, Robert, and Jong-Wha Lee. 2000. International Data on Educational Attainment: Updates and Implications. Harvard University. Processed.

Behrman, Jere, Nancy Birdsall and Miguel Szekely. 2001. Economic Policy and Wage Differentials in Latin America. Penn Institute for Economic Research Working Paper 01-048.

Bell, Linda. 1997. The Impact of Minimum Wages in Mexico and Colombia.*Journal of Labor Economics* 15 (3), S102-S135.

Berman, Eli, John Bound, and Zvi Griliches. 1994. Changes in the Demand for Skilled Labor within U.S. Manufacturing: Evidence from the Annual Survey of Manufactures. *Quarterly Journal of Economics* 109 (2), 367-97.

Berman, Eli, John Bound, and Stephen Machin. 1998. Implications of Skill-Biased Technological Change: International Evidence. *Quarterly Journal of Economics* 113 (4), 1245-1280.

Berman, Eli and Stephen Machin. 2000a. Skill-Biased Technology Transfer Around the World. *Oxford Review of Economic Policy* 16(3): 12-22.

---------- 2000b. Skill-Biased Technology Transfer: Evidence of Factor Biased Technological Change in Developing Countries. Boston University and London School of Economics. Processed.

Card, David, and John DiNardo. 2002. Skill-Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles. NBER Working Paper 8769. Cambridge, Mass.

Card, David, and Thomas Lemieux. 2001. Can Falling Supply Explain the Rising Return to College for Younger Men? A Cohort-Based Analysis. *Quarterly Journal of Economics* 116 (2), 705-46.

Coe, David, Elhanan Helpman, and Alexander Hoffmeister. 1997. North-South R&D Spillovers.*The Economic Journal* 107 (440), 134-149.

DiNardo, John, Nicole M. Fortín, and Thomas Lemieux. 1996. Labor Market Institutions and the Distribution of Wages, 1973-1992: A Semiparametric Approach. *Econometrica* 64 (5), 1001-44.

Feenstra, Robert C., and Gordon H. Hanson. 1996. Globalization, Outsourcing, and Wage Inequality.*American Economic Review* 86 (2), 240-45.

Gill, Indermit S., Claudio E. Montenegro and Dorte Domeland. 2002. *Crafting Labor Policy: Techniques and Lessons from Latin America.* New York: Oxford University Press for the World Bank.

Glewwe, Paul, and Gillette Hall. 1998. Are Some Groups More Vulnerable to Macroeconomic Shocks Than Others? Hypothesis Tests Based on Panel Data for Peru. *Journal of Development Economics* 56 (1), 181-206.

Guasch, Jose Luis. 1999. *Labor Market Reform and Job Creation: The Unfinished Agenda in Latin American and Caribbean Countries* Washington, D.C.: World Bank.

Hanson, Gordon H. and Ann Harrison. 1999. Trade Liberalization and Wage Inequality in Mexico.*Industrial and Labor Relations Review* 52 (2), 271-88.

Heckman, James, Lance Lochner and Petra Todd. 1998. Fifty Years of Mincer Regressions. University of Chicago. Processed.

Inter-American Development Bank. 2002. *Beyond Borders: The New Regionalism in Latin America.* Washington, D.C.: The Johns Hopkins University Press for the Inter-American Development Bank.

Juhn, Chinhui, Kevin M. Murphy and Brooks Pierce. 1993. Wage Inequality and the Rise in the Returns to Skill. *Journal of Political Economy* 101 (3), 410-42.

Katz, Lawrence F. and David Autor. 1999. Changes in the Wage Structure and Earnings Inequality. In Orley Ashenfelter and David Card, eds. *Handbook of Labor Economics*, Vol. 3A New York and Oxford: Elsevier.

Katz, Lawrence F., and Kevin M. Murphy. 1992. Changes in Relative Demand, 1963-1987: Supply and Demand Factors. *Quarterly Journal of Economics* 107 (1), 35-78.

Keller, Wolfgang. 2002. Trade and the Transmission of Technology. *Journal of Economic Growth* 7 (1), 5-24.

Kugler, Maurice. 2002. Market Reform, Technology Adoption, and Skill Formation: Evidence from Colombia. The World Bank. Processed.

Machin, Stephen, and John van Reenen. 1998. Technology and Changes in Skill Structure: Evidence from Seven OECD Countries. *Quarterly Journal of Economics* 113 (4), 1215-45.

Mincer, Jacob. 1974. *Schooling, Experience, and Earnings.* New York: Columbia University Press.

Pages, Carmen, and Naoko Shinkai. 2002. Union Membership and Wage Distribution, unpublished manuscript, The Inter-American Development Bank.

Pavcnik, Nina. 2002. Trade Liberalization, Exit, and Productivity Improvement: Evidence from Chilean Plants. *Review of Economic Studies* 69 (1), 245-76.

Pavcnik, Nina, Andreas Blom, Pinelopi Goldberg, and Norbert R. Schady. 2002 Trade Liberalization and Wage Inequality in Brazil. The World Bank. Processed.

Rama, Martin, and Raquel Artecona. 2002. A Database of Labor Market Indicators across Countries. The World Bank. Processed.

Schiff, Maurice, Yanling Wang, and Marcelo Olarreaga. 2002. Trade-Related Technology Diffusion and the Dynamics of North-South Integration. World Bank Policy Research Working Paper 2861. World Bank, Washington, D.C.

Schultz, Theodore W. 1975. The Value of Ability to Deal with Disequilibria. *Journal of Economic Literature* 13 (3), 827-46.

Wood, Adrian. 1994. *North-South Trade, Employment, and Inequality: Changing Fortunes in a Skill-Driven World.* IDS Development Studies Series. Oxford and New York:Oxford University Press).

World Bank. 2001. *World Development Report 2000/2001: Attacking Poverty.* New York: Oxford University Press for the World Bank.

Table 1. Data Sources

	Survey	Frequency	Period covered
Argentina	Survey of Greater Buenos Aires	Yearly	1986-2000
Brazil	Pesquisa Mensal de Emprego (PME)	Monthly	1982-1999
Chile	Encuesta de la Universidad de Chile	Yearly	1966-1999
Colombia	Encuesta de Ingresos de los Hogares	Quarterly	1982-2000
Mexico	Encuesta Nacional de Empleo Urbano (ENEU)	Quarterly	1987-1999

Table 2. Summary Statistics - Sample Size

	Period	Average	Minimum	Maximum
Argentina	1986-2000	2,331	1,900	3,027
Brazil	1982-1999	154,228	130,685	194,697
Chile	1966-1999	1,914	1,544	2,240
Colombia	1982-2000	9,473	6,439	13,152
Mexico	1987-1999	49,630	24,383	83,994

Note: Samples include all salaried workers aged 25-60 with at least 1 year of education

Table 3. Summary Statistics – Unemployment Rate and Incidence of Salaried Employment

			Unemployment Rate	
	Period	Primary	Secondary	Tertiary
Argentina	86-00	9.7	7.7	4.6
Brazil	82-99	3.4	2.7	1.4
Chile	66-99	9.7	7.6	3.4
Colombia	82-00	8.4	9.4	6.6
Mexico	87-99	0.9	1.1	1.2
			Salaried employment	
	Period	Primary	Secondary	Tertiary
Argentina	86-00	67.6	69.4	70.4
Brazil	82-99	69.2	74.7	74.3
Chile	66-99	61.0	70.0	80.0
Colombia	82-00	47.8	63.7	73.2
Mexico	87-99	62.2	75.2	76.3

Note: Samples include all salaried workers aged 25-60 with at least 1 year of education.

Table 4. Education Levels and Years of Schooling

	Primary	Secondary	Postsecondary
Argentina [A]	7 years	5 years	3-5 years
Brazil	8 years	3 years	3-5 years
Chile [B]	8 years	4 years	3-5 years
Colombia	5 years	6 years	3-5 years
Mexico	6 years	6 years	4-5 years

[A] The Argentinean system changed in 1997/98 to primary (6 years), lower secondary (3 years), and upper secondary (3 years). This change does not affect the analysis since we focus exclusively on individuals aged 25 and above.
[B] Individuals born prior to 1950 were educated under a different system in Chile (primary, 6 years; secondary, 6 years; postsecondary, 3-5 years). This change was taken into account when assigning individuals to different education groups based on their years of schooling.

Table 5. Summary Statistics – Educational Attainment of Salaried Workers, Ages 25-60

		1970	1975	1980	1985	1990	1995	2000
Argentina	Primary				51.6	49.0	45.3	39.3
	Secondary				29.2	29.4	29.6	31.7
	Tertiary				19.1	21.6	25.0	29.0
Brazil	Primary			61.6	59.5	55.0	55.5	50.6
	Secondary			21.5	23.4	26.7	27.7	31.4
	Tertiary			16.8	17.1	18.2	16.8	17.9
Chile	Primary	55.2	50.5	46.6	38.9	30.6	29.0	26.9
	Secondary	33.7	38.1	38.9	43.8	47.3	49.9	46.5
	Tertiary	11.0	11.2	14.4	17.2	21.9	20.9	26.5
Colombia	Primary			54.9	51.3	44.9	40.5	37.1
	Secondary			31.5	33.9	38.2	41.6	42.7
	Tertiary			13.6	14.7	16.5	17.3	19.7
Mexico	Primary				53.7	49.5	41.5	40.3
	Secondary				30.0	32.2	32.3	33.9
	Tertiary				16.3	18.3	26.2	25.7

Note: Samples include all salaried workers aged 25-60 with at least 1 year of education

Table 6. Barro and Lee estimates of educational attainment, various years

		1970	1975	1980	1985	1990	1995	2000
Argentina								
	No schooling	8.3	9.1	7.1	7.0	5.7	6.3	5.8
	Some primary	72.4	70.6	66.4	63.2	56.9	52.7	49.6
	Some secondary	15.3	14.8	20.4	21.6	25.3	24.9	24.9
	Some tertiary	4.0	5.5	6.1	8.2	12.0	16.2	19.7
	Years of education	5.88	5.85	6.62	6.74	7.77	8.12	8.49
Brazil								
	No schooling	42.6	32.7	32.9	32.2	22.4	22.1	21.2
	Some primary	46.1	57.3	55.3	55.3	61.3	58.8	56.8
	Some secondary	9.6	5.7	6.9	6.1	9.1	11.2	13.5
	Some tertiary	2.0	4.3	5.0	6.4	7.2	7.9	8.4
	Years of education	2.92	2.78	2.98	3.22	3.76	4.17	4.56
Chile								
	No schooling	12.4	10.6	9.4	8.3	5.8	5.2	5.3
	Some primary	57.2	59.1	56.6	56.0	48.0	45.8	42.9
	Some secondary	26.6	25.5	26.9	27.3	33.9	35.4	36.0
	Some tertiary	3.8	4.8	7.2	8.3	12.3	13.7	15.8
	Years of education	5.48	5.55	5.96	6.04	7.14	7.53	7.89
Colombia								
	No schooling	39.2	22.4	24.5	24.5	24.5	23.1	19.8
	Some primary	49.1	55.9	54.2	52.0	49.6	48.0	48.9
	Some secondary	9.7	18.4	17.0	17.8	19.1	20.4	21.4
	Some tertiary	2.0	3.3	4.3	5.7	6.9	8.5	9.9
	Years of education	2.73	3.98	3.94	4.15	4.37	4.68	5.01
Mexico								
	No schooling	35.0	34.4	34.2	29.5	18.8	15.0	12.4
	Some primary	54.7	54.0	48.6	49.9	48.5	47.9	47.3
	Some secondary	7.8	8.3	11.8	13.3	23.4	26.7	29.0
	Some tertiary	2.6	3.3	5.4	7.3	9.2	10.3	11.3
	Years of education	3.31	3.49	4.01	4.49	5.87	6.37	6.73

Source: Barro and Lee (2000)

Table 7. Wage Inequality – Gini Coefficient of Monthly Wages (5-year averages)

	Argentina	Brazil	Chile	Colombia	Mexico
1965-70			0.447		
1970-75			0.419		
1975-80			0.453		
1980-85		0.545	0.484	0.392	
1985-90	0.396	0.559	0.504	0.371	0.352
1990-95	0.377	0.557	0.469	0.402	0.403
1995-99	0.388	0.548	0.461	0.416	0.430

Table 8. Average Annual Changes in the Relative Demand for Tertiary Equivalents

	Argentina		Brazil		Chile		Colombia		Mexico	
	σ = 1	σ = 2	σ = 1	σ = 2	σ = 1	σ = 2	σ = 1	σ = 2	σ = 1	σ = 2
1965-70					5.1	4.1				
1970-75					-2.4	-5.3				
1975-80					4.1	5.9				
1980-85			-2.6	-2.1	4.3	6.7	2.9	3.2		
1985-90	1.1	1.1	1.0	3.8	5.4	7.7	2.7	3.7	4.4	7.3
1990-95	4.2	4.9	-1.9	-0.5	-0.5	-1.0	5.3	11.2	8.7	11.8
1995-99	3.5	5.6	-1.5	-1.2	5.2	1.8	5.5	6.8	2.5	3.6

Note: Values are 100 times the annual log changes

Table 9. Average Annual Changes in the Relative Demand for Tertiary Equivalents in the United States

	σ = 1	σ = 1.4	σ = 2
1940-50	0.50	-0.25	-1.36
1950-60	3.75	4.08	4.58
1960-70	3.25	3.52	3.94
1970-80	4.25	3.95	3.50
1980-90	4.05	4.65	5.56
1990-96	1.98	2.14	2.38

Source: Autor, Katz, and Krueger 1998

Note: Values are 100 times the annual log changes

Table 10. Within and Between Changes in the Wage Bill of Tertiary and Secondary Equivalents

	Period	Number of Sectors	Initial S_t	Change in S_t (annualized – % points)	Change due to Within-Industry Changes (annualized – % points)	Change due to Between-Industry Changes (annualized – % points)
Argentina	1986-89 and 1997-99	25	53.0	1.8	1.3	0.5
Brazil	1982-83 and 1987-89	48	60.9	-0.1	-0.1	0.0
	1987-89 and 1997-99	48	60.6	-0.2	-0.2	0.0
Chile	1977-79 and 1987-89	39	51.0	1.2	1.1	0.1
	1987-89 and 1997-99	39	60.8	0.1	0.2	-0.1
Colombia	1982-83 and 1988-89	34	48.6	-0.1	0.0	-0.1
	1988-89 and 1998-99	34	48.2	1.1	0.9	0.2
Mexico	1987-89 and 1997-99	75	36.6	2.1	2.0	0.1

Note: The wage bill for tertiary equivalents, S_t, is the wage bill of tertiary equivalents as a fraction of the wage bill for secondary and tertiary equivalents.

Table 11. Correlation in Changes in Wage Bill Shares of Tertiary and Secondary Equivalents

	Argentina	Brazil	Chile	Colombia
Brazil	-0.430			
Chile	0.766°	0.126		
Colombia	0.390	0.041	0.440	
Mexico	0.583°	-0.106	0.460	0.839°

Note: ° Significant at 10% level. These are cross-country correlations of within-industry changes in the wage bill of tertiary equivalents as a percentage of the wage bill of tertiary and secondary equivalents. Changes for Argentina, Brazil, Colombia and Mexico are measured between 1988/89 and 1998/99. Changes for Chile are measured between 1978/79 and 1988/89. Observations are weighted by industry employment shares averaged over time and across all countries. The number of sectors in each country is 11.

Table 12. Changes in Import Penetration and R&D Stock by Country and Industry

A. Chile, 1981-1998

	% Change in Import Penetration	% Change in R&D Stock
Food products, beverages and tobacco	0.4	255.0
Textiles, wearing apparel, footwear and leather products	130.2	235.2
Wood products and furniture	128.9	259.5
Paper, printing and publishing	198.7	259.4
Chemicals, petroleum products, plastic and rubber	103.4	252.7
Non-metallic products	55.9	257.9
Iron and other metals	135.7	252.0
Metal products, machinery and transport equipment	46.1	208.4

B. Colombia, 1982-1998

	% Change in Import Penetration	% Change in R&D Stock
Food products, beverages and tobacco	37.0	326.4
Textiles, wearing apparel, footwear and leather products	406.1	330.7
Wood products and furniture	159.7	299.6
Paper, printing and publishing	-3.0	340.4
Chemicals, petroleum products, plastic and rubber	30.9	312.8
Non-metallic products	139.5	339.6
Iron and other metals	1.14	188.8
Metal products, machinery and transport equipment	37.8	283.7

C. Mexico, 1987-1998

	% Change in Import Penetration	% Change in R&D Stock
Food products, beverages and tobacco	173.6	422.2
Textiles, wearing apparel, footwear and leather products	2626.2	707.2
Wood products and furniture	751.9	716.2
Paper, printing and publishing	230.9	532.4
Chemicals	145.9	239.5
Petroleum products	120.6	160.7
Plastic and rubber	1936.7	239.5
Non-metallic products	574.4	445.3
Iron and steel	220.7	346.3
Non-ferrous metals	499.5	475.5
Fabricated metal products	366.2	493.4
Machinery, except electrical	60.2	584.8
Electrical machinery	940.1	804.5
Transport equipment	34.5	454.4
Professional and scientific equipment	60.7	804.5
Other manufactured products	765.8	311.8

Source: Authors' calculations using World Bank datasets and data from Schiff, Wang and Olarreaga (2002)

Table 13. Imports, R&D, and skill upgrading in Chile, Colombia, and Mexico

	Relative wages	Relative demand	Wage bill	Employment share (hours)	Employment share (workers)
			Specification 1		
Import penetration	0.049***	0.087***	0.018***	0.006***	0.005**
	(0.011)	(0.023)	(0.006)	(0.002)	(0.003)
			Specification 2		
NRD stock	0.138***	0.282***	0.051***	0.011***	0.009***
	(0.012)	(0.027)	(0.007)	(0.003)	(0.003)
			Specification 3		
Import penetration	0.041***	0.065***	0.016***	0.002	0.001
	(0.011)	(0.023)	(0.006)	(0.002)	(0.002)
NRD composition	0.044***	0.119***	0.015***	0.019***	0.021***
	(0.012)	(0.028)	(0.007)	(0.003)	(0.003)

Note: *** Significant at 1%. ** Significant at 5%. * Significant at 10%
GLS regressions with AR(1) in error term, with observations weighted by employment in a country-industry-year cell. All series are detrended using country-industry specific trends and all regressions include country-sector specific dummies. The sample size for each of the fifteen regressions is 375. Chi-squared tests for joint significance of the coefficients are significant at the 5 percent level or better in all specifications.

Table 14. Union membership rates

	Argentina	Brazil	Chile	Colombia	Mexico
1980-84	28.2	34.8	9.1	17.7	27.3
1985-89	26.5	38.1	9.5	12.1	35.3
1990-94	21.5	24.8	13.1		22.4
1995-99	24.6			7.0	

Source: Rama and Artecona (2002)

Figure 1. Relative Unemployment and Salaried Employment Rates
Tertiary and Secondary Equivalents

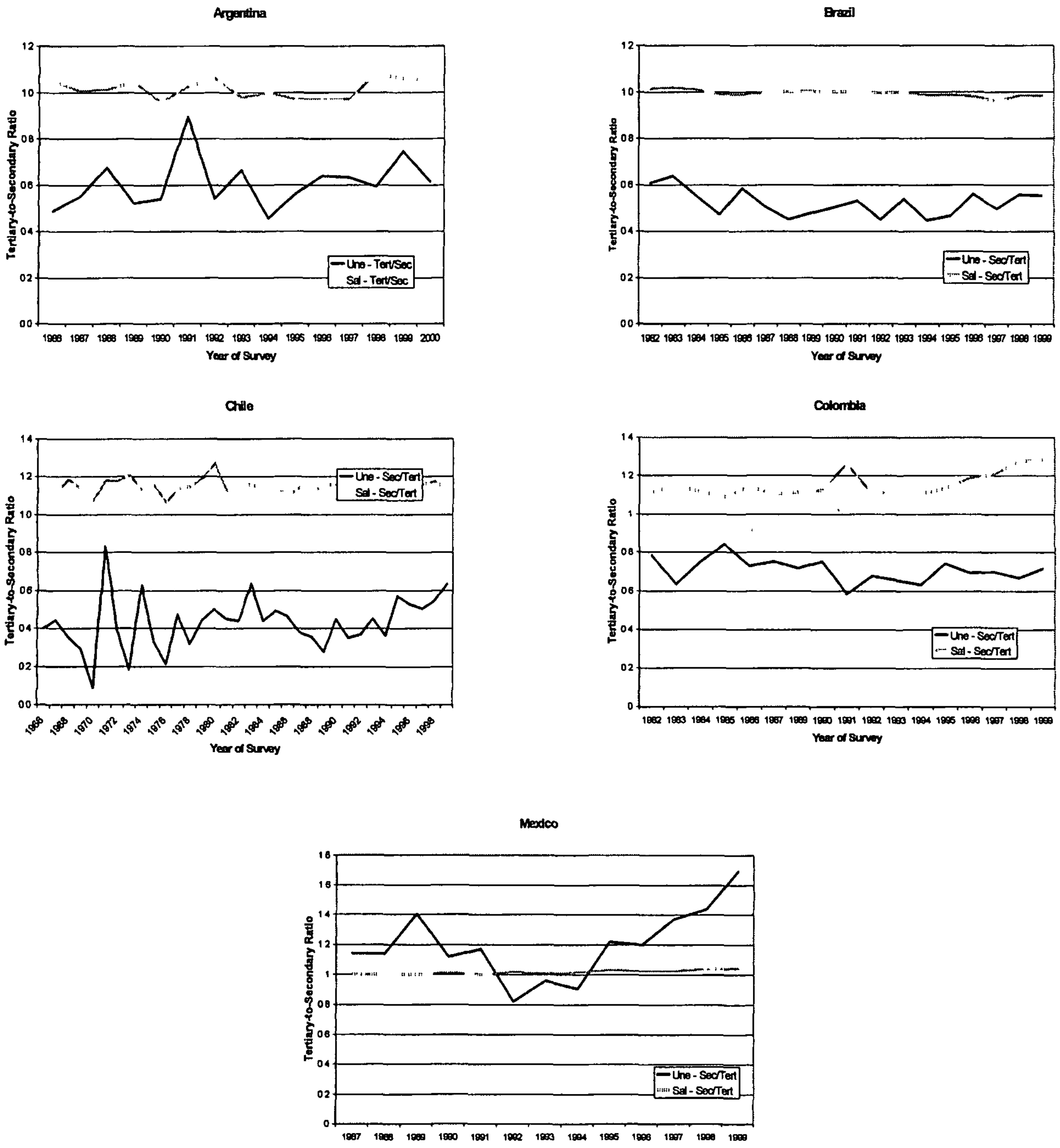
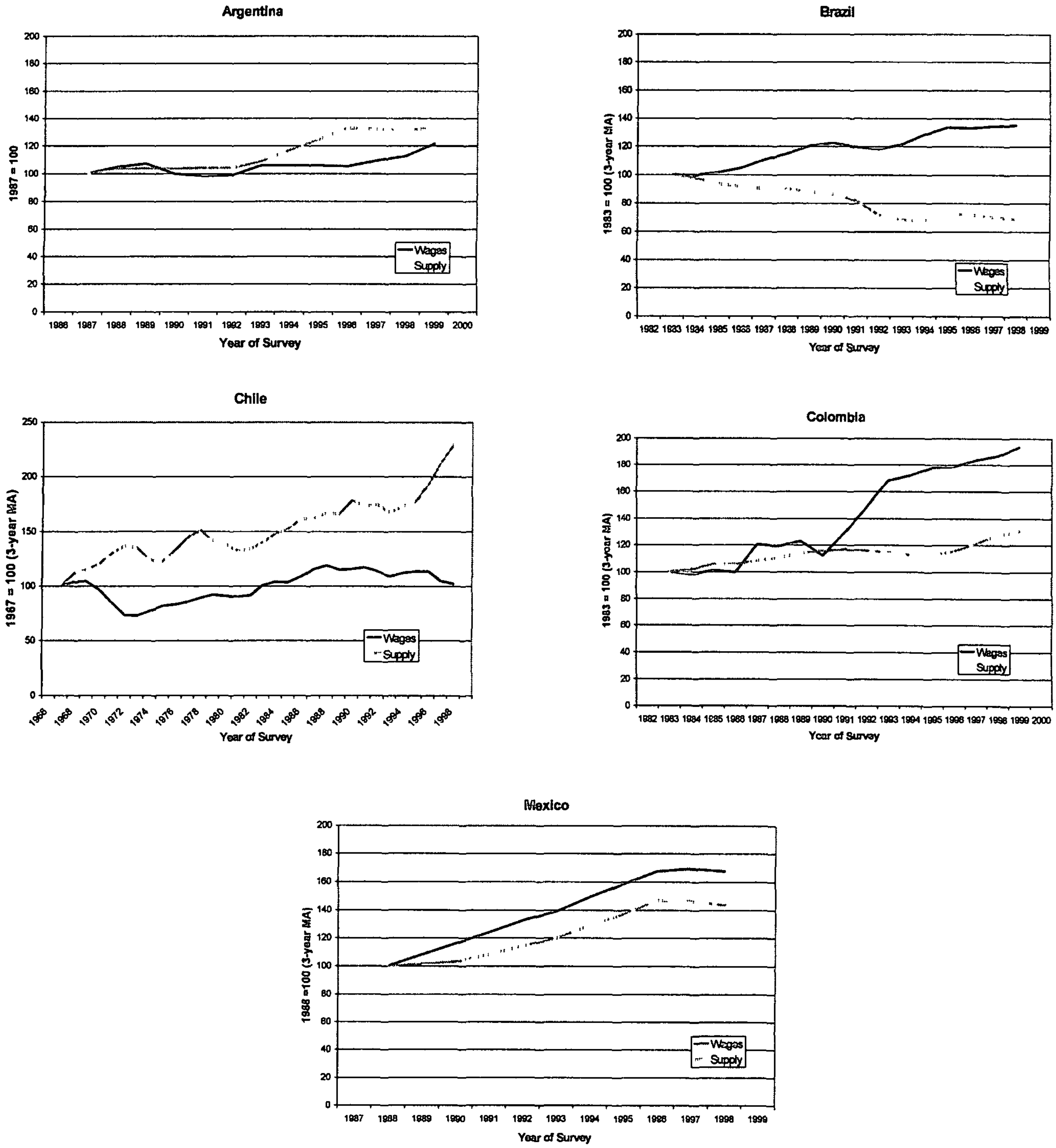
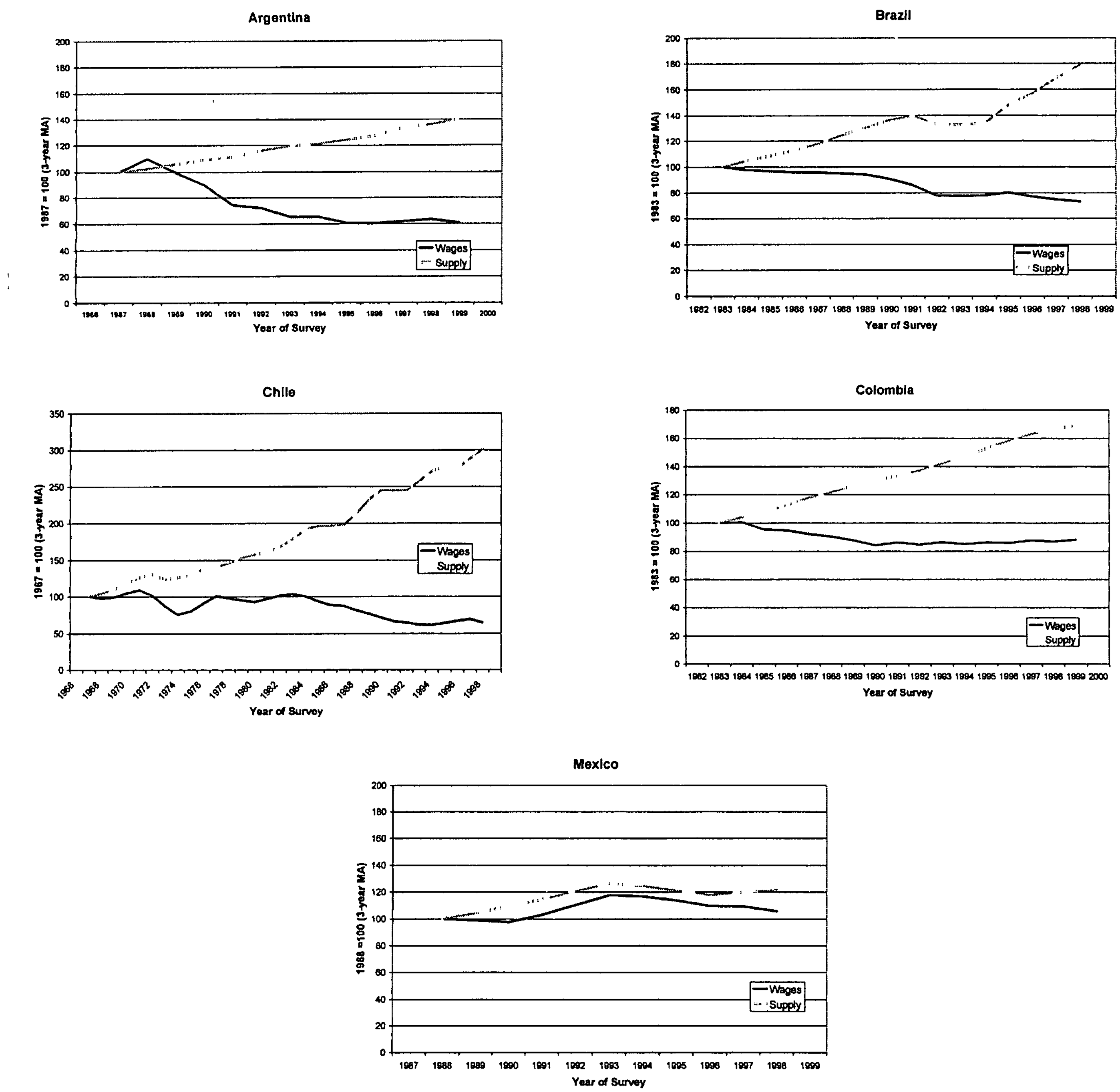


Figure 2. Relative Wages and Supply by Education Level--
Tertiary and Secondary Equivalents



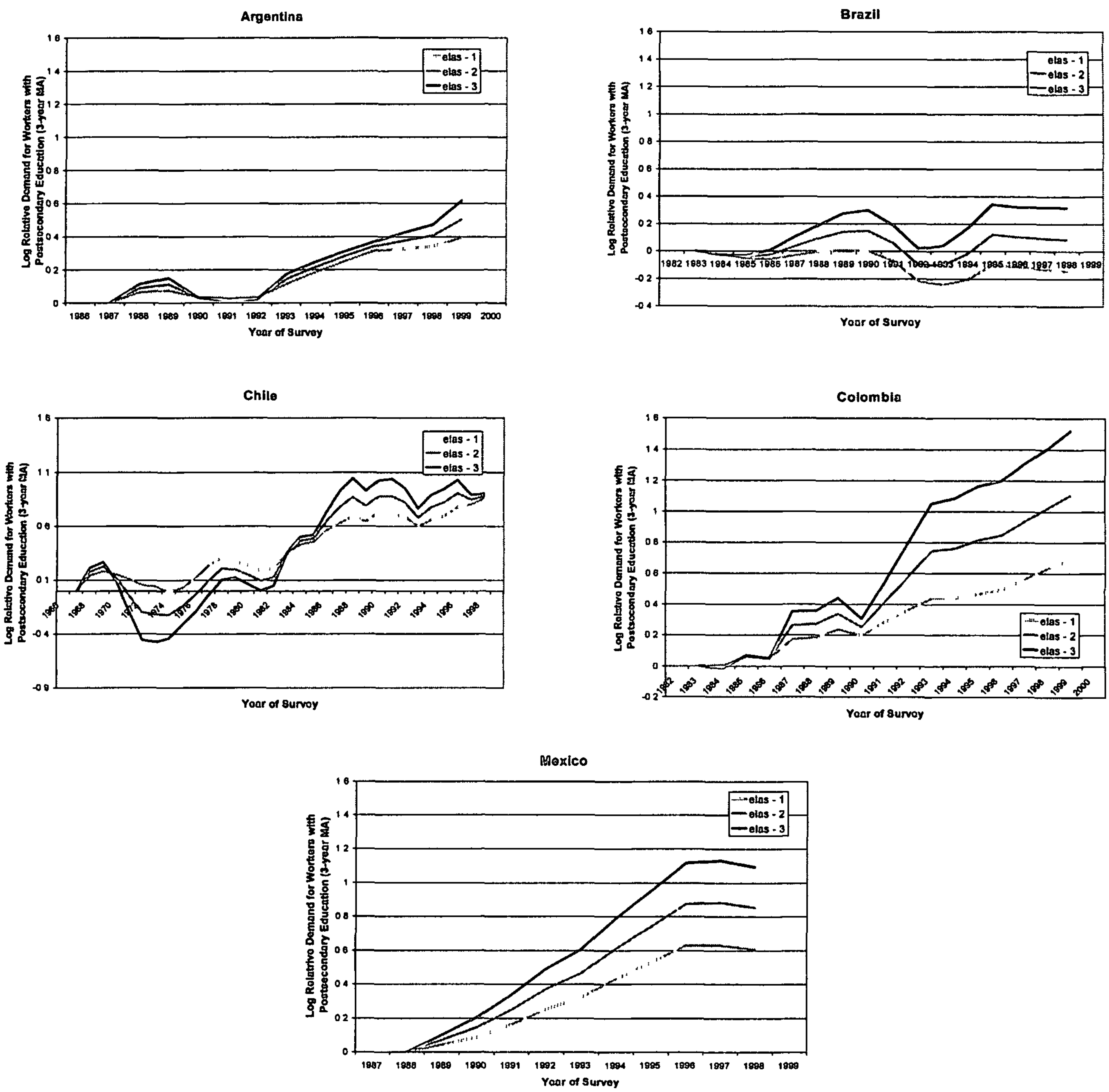
Note: Relative wages and supply series are 3-year moving averages.

Figure 3. Relative Wages and Supply by Education Level--
Secondary and Primary Equivalents



Note: Relative wages and supply series are 3-year moving averages

Figure 4. Alternative Implied Relative Demand Time Series— Tertiary and Secondary Education Equivalents



Note: Relative demand series are 3-year moving averages.

Figure 5. Imports and R&D Stock, 1980s and 1990s

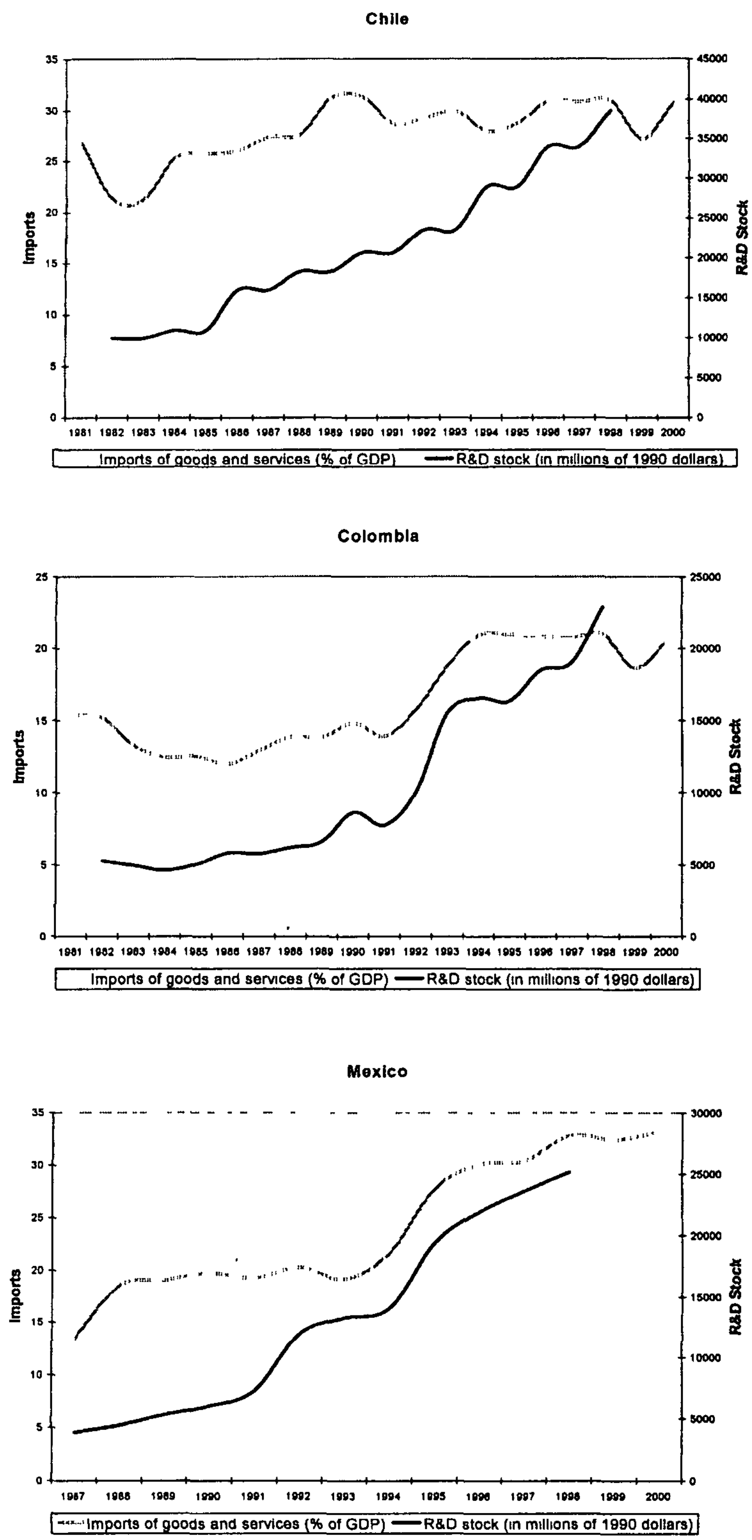
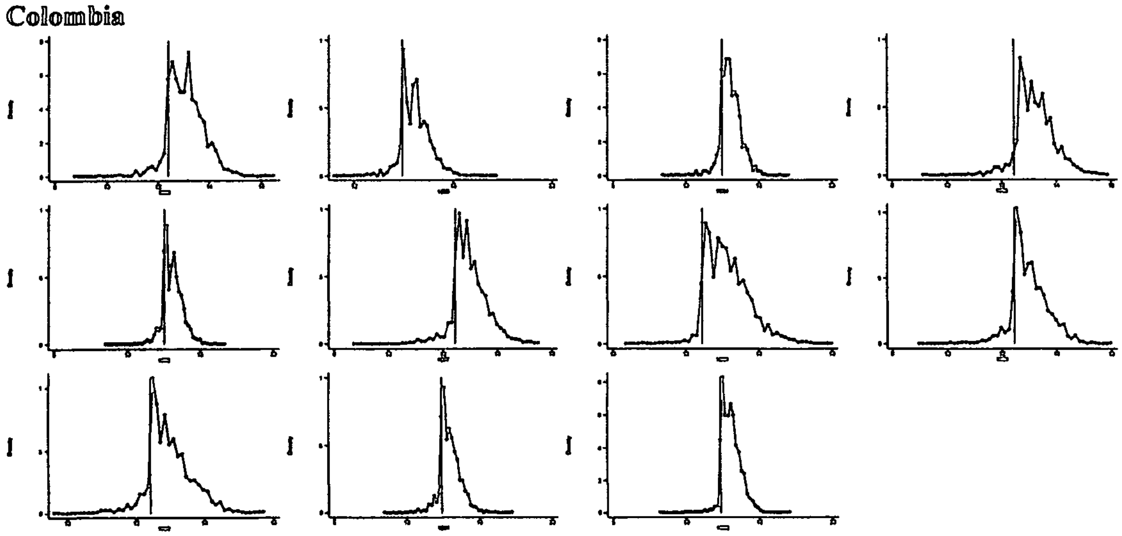


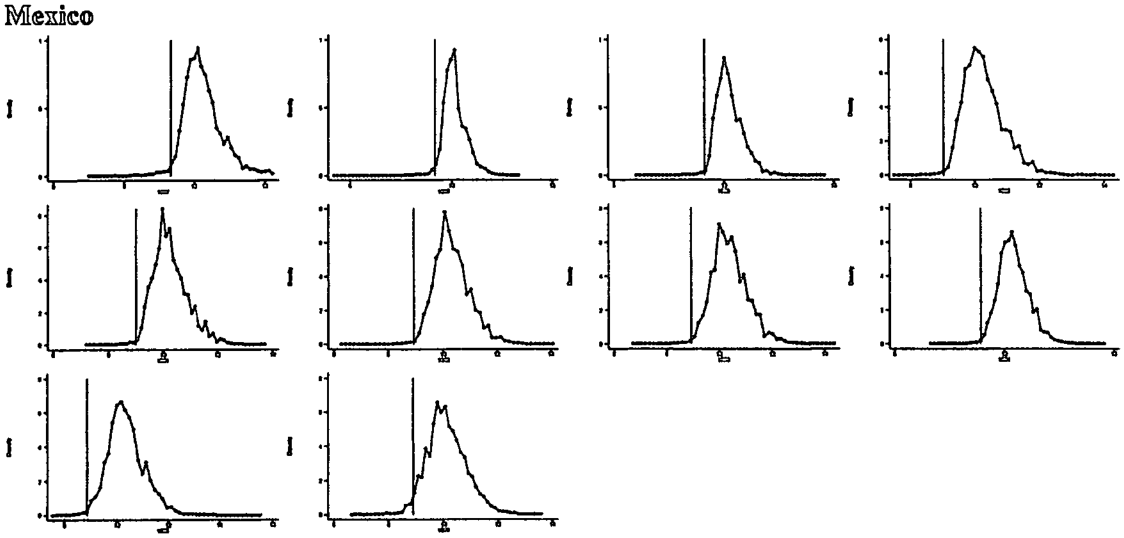
Figure 6. Kernel density estimates of the distribution of wages of secondary and tertiary equivalemts, Colombia and Chile, various years

Colombia



Minimum Wages in Colombia, 1982-1992

Mexico



Minimum Wages in Mexico, 1987-1996

Figure 7. The evolution of the minimum wage standardized by the mean wage (SMW)

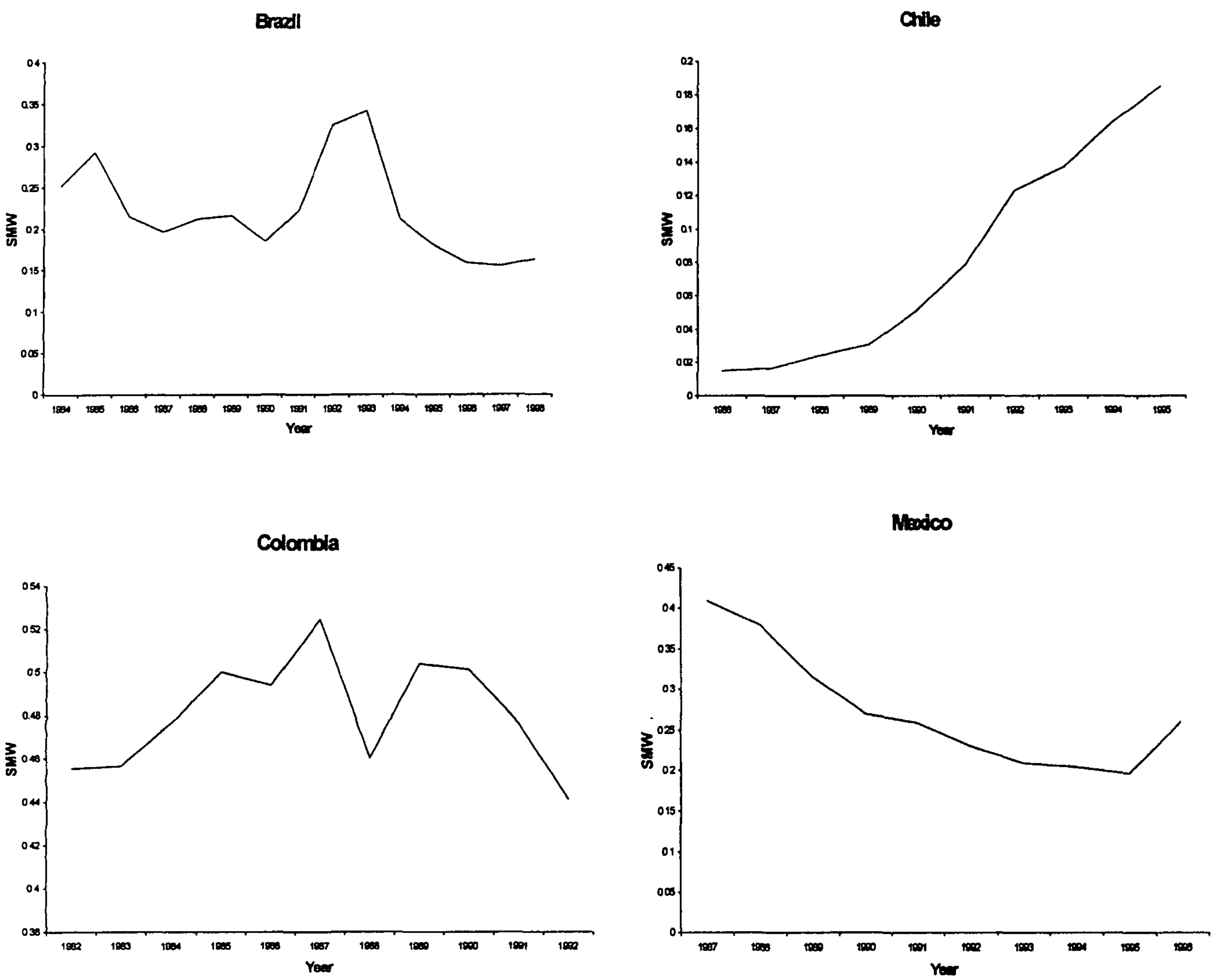
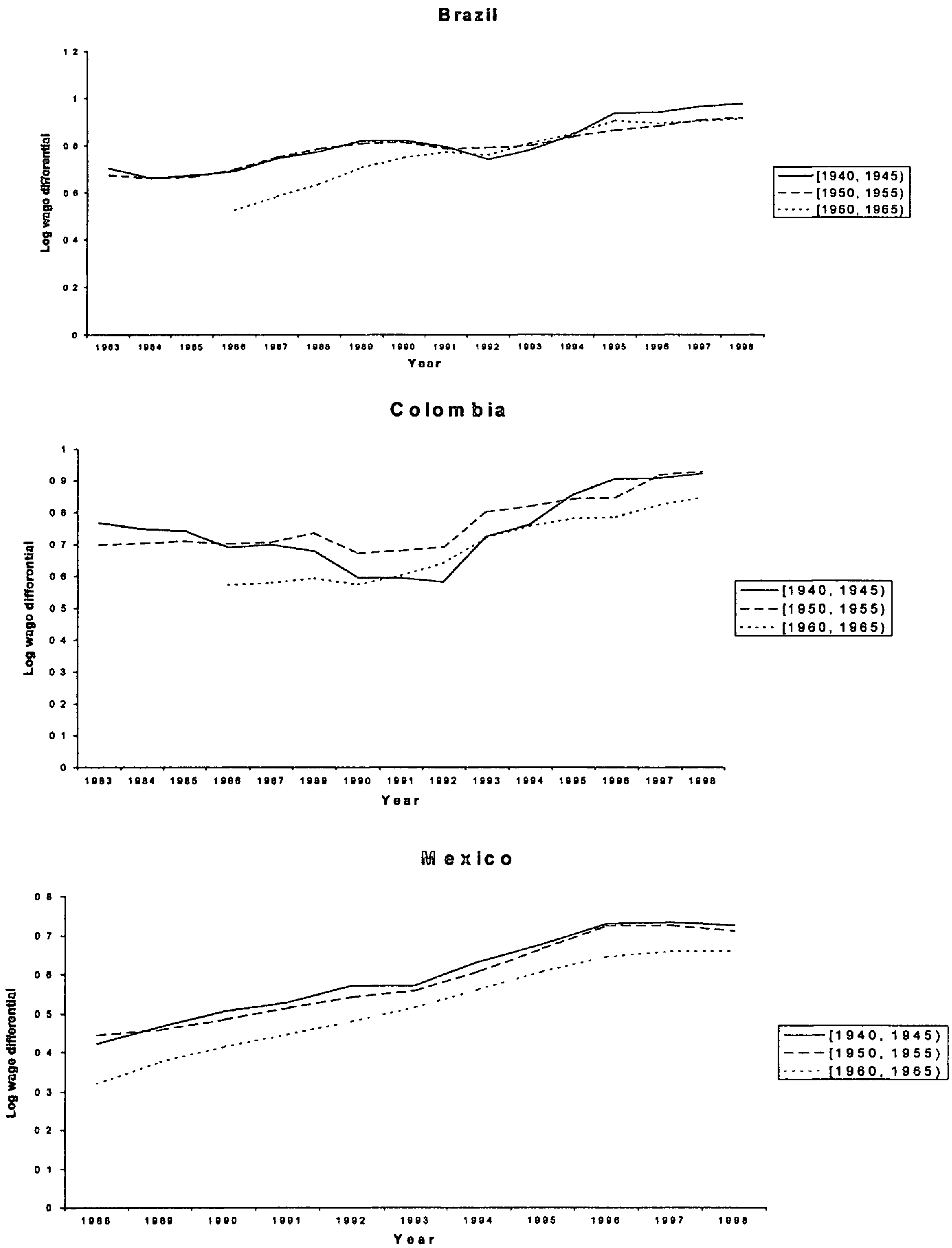


Figure 8. Tertiary-secondary equivalent log wage differential, by birth cohort



Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS2996	Bank Competition, Financing Obstacles, and Access to Credit	Thorsten Beck Aslı Demirgüç-Kunt Vojislav Maksimovic	March 2003	K Labrie 31001
WPS2997	Financial and Legal Institutions and Firm Size	Thorsten Beck Aslı Demirguç-Kunt Vojislav Maksimovic	March 2003	K Labrie 31001
WPS2998	Does Micro-Credit Empower Women? Evidence from Bangladesh	Mark M. Pitt Shahidur R. Khandker Jennifer Cartwright	March 2003	P Kokila 31001
WPS2999	Explaining Liberalization Commitments in Financial Services Trade	Philipp Harms Aaditya Mattoo Ludger Schuknecht	March 2003	P Flewitt 32724
WPS3000	International Climate Regime beyond 2012: Are Quota Allocations Rules Robust to Uncertainty?	Franck Lecocq Renaud Crassous	March 2003	V Soukhanov 35721
WPS3001	An Introduction to Financial and Economic Modeling for Utility Regulators	Antonio Estache Martín Rodríguez Pardina José María Rodríguez Germán Sember	March 2003	G. Chenet-Smith 36370
WPS3002	Information-Based Instruments for Improved Urban Management	Uwe Deichmann Somik V. Lall Ajay Suri Pragya Rajoria	March 2003	Y D'Souza 31449
WPS3003	The Investment Climate and the Firm: Firm-Level Evidence from China	Mary Hallward-Driemeier Scott Wallsten Lixin Colin Xu	March 2003	P Sintim-Aboagye 37644
WPS3004	Institutions, Trade, and Growth. Revisiting the Evidence	David Dollar Aart Kraay	March 2003	A Bonfield 31248
WPS3005	Vouchers for Basic Education in Developing Countries: A Principal-Agent Perspective	Varun Gauri Ayesha Vawda	March 2003	H. Sladovich 37698
WPS3006	Social Rights and Economics Claims to Health Care and Education in Developing Countries	Varun Gauri	March 2003	H Sladovich 37698
WPS3007	The Impact of Urban Spatial Structure on Travel Demand in the United States	Antonio M Bento Maureen L Cropper Ahmed Mushfiq Mobarak Katja Vinha	March 2003	V. Soukhanov 35721
WPS3008	Technology, Computers, and Wages: Evidence from a Developing Economy	Chris N Sakellariou Harry A Patrinos	March 2003	N Vergara 30432
WPS3009	Agriculture in the Doha Agenda	Patrick Messerlin	April 2003	P Flewitt 32724
WPS3010	Vulnerability in Consumption, Education, and health: Evidence from Moldova during the Russian Crisis	Edmundo Murrugarra José Signoret	April 2003	E. Murrugarra 34452

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS3011	Renegotiation of Concession Contracts in Latin America	J Luis Guasch Jean-Jacques Laffont Stéphane Straub	April 2003	J. Troncoso 37826
WPS3012	Just-in-Case Inventories A Cross-Country Analysis	J Luis Guasch Joseph Kogan	April 2003	J. Troncoso 37826
WPS3013	Land Sales and Rental Markets in Transition: Evidence from Rural Vietnam	Klaus Deininger Songqing Jin	April 2003	M. Fernandez 33766
WPS3014	Evaluation of Financial Liberalization A General Equilibrium Model with Constrained Occupation Choice	Xavier Giné Robert M Townsend	April 2003	K Labrie 31001