ELSEVIER

Journal of Development Economics 72 (2003) 497–513

JOURNAL OF Development ECONOMICS

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The impact of trade liberalization on wage inequality: evidence from Argentina

Sebastian Galiani[a], Pablo Sanguinetti[b,*]

[a] *Universidad de San Andrés, Argentina*

[b] *Department of Economics, Universidad Torcuato Di Tella, Miñones 2159/77, Buenos Aires 1428, Argentina*

Abstract

Wage inequality in Argentina greatly increased during the nineties. During this period, a rapid and deep process of trade liberalization was implemented. In this paper we study whether trade liberalization played any role in shaping the Argentine wage structure during the nineties. Specifically, we test whether those sectors where import penetration deepened are also the sectors where, ceteris paribus, a higher increase in wage inequality is observed. Even though we find some evidence that supports this hypothesis, as has been found for some developed economies, trade deepening can only explain a relatively small proportion of the observed rise in wage inequality.

JEL classification: F14; J31

Keywords: Wage inequality; Trade liberalization; Argentina

1. Introduction

Argentina made slashing reforms towards liberalizing trade at the beginning of the 1990s, reducing average tariffs and the percentage of domestic output covered by import licenses. Trade liberalization may have stimulated economic growth, but it may also have adversely affected workers in industries that experienced an increase in competition from goods produced abroad. In particular, it may have sharpened wage inequality.

In this paper, we investigate the impact of trade liberalization on wage inequality in Argentina during the nineties. We attempt to answer the following question: has trade liberalization played any role in shaping the Argentine wage structure during the nineties?

Galiani (1999) shows that in Argentina, contrary to what has occurred in the OECD countries, it cannot be asserted that the returns to college graduates have increased during

* Corresponding author. Tel.: +54-11-4784-0080; fax: +54-11-4784-9807.

E-mail address: sanguine@utdt.edu (P. Sanguinetti).

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doi:10.1016/S0304-3878(03)00117-2

the eighties. It is only since the beginning of the nineties that there is clear evidence that the college wage premium increased. This evidence suggests that trade openness could have played a role in shaping relative wages in Argentina.

Several OECD countries have experienced an increasing dispersion of wages during the last two decades, with by far the biggest rise in wage dispersion taking place in the UK and the US (see Nickell and Layard, 2000). In particular, in these countries, a large increase in the wage differentials by educational level is observed (see Bound and Johnson, 1992; Katz and Murphy, 1992; Machin, 1996; Schmitt, 1995).

There is widespread agreement on the fact that in developed countries there has been a shift in demand away from unskilled labor in favor of skilled workers during the last two decades. Two competing explanations have been proposed to explain this shift in the relative demand for skilled labor: the impact of trade on low-wage (developing) countries, and skill-biased technological change (see Berman et al., 1994; Berman et al., 1998; Machin, 1995; Wood, 1995). A large amount of research has sought to evaluate both explanations, with the result that the latter is often thought to be more important in explaining the relative shift in labor demand (see Feenstra, 1998), although most of the current research arrives at this conclusion indirectly. The argument is that skill-biased technological change must be present because both the relative wages and the employment of skilled workers move in the same direction across industries.

The claim that trade is responsible for the increase in wage inequality stems largely from the Heckscher–Ohlin model. According to this model, countries specialize in the production of those goods that use intensively the factors of production with which they are abundantly endowed. Developed countries specialize in the production of goods that are intensive in skilled labor and developing countries in goods that are intensive in unskilled labor. International competition will lead to an increase in the relative wage of high-skilled labor in developed countries if, and only if, there is an increase in the relative price of the goods they specialize in (Stolper–Samuelson theorem). This simple prediction has been subject to strong empirical analysis in recent years. Wood (1994), Sachs and Shatz (1994), and Leamer (1994, 1998) provided some evidence in favor of it. Still, these results are not widely accepted. For example, Lawrence and Slaughter (1993) find that the relative prices of goods that use production labor relatively intensively have declined. From this evidence, they conclude that Stolper–Samuelson effects have not driven relative US wages.

In this paper we explore the relationship between trade liberalization and wage inequality. First, following Lawrence and Slaughter (1993), we explore the extent to which the Heckscher–Ohlin model can explain the increase in educational skill premium in Argentina during the nineties. The evidence in favor of Stolper–Samuelson effects is mixed and not very strong. All that we can conclude from this analysis is that the Stolper–Samuelson effects, if present, did not operate in isolation. The problem with this analysis is that it is very difficult to identify the link between the economy-wide increases in skill premium and trade.

Second, in an attempt to control for all other things that could have affected wages, we depart from the traditional trade literature; we do not take as our theoretical point of reference the general equilibrium framework of Heckscher–Ohlin. The Heckscher–Ohlin model assumes perfect intersectoral factor mobility, implying that the wages of workers

with the same endowment of human capital equalize across sectors. However, there is evidence of the existence of interindustry wage premiums (see, e.g., Dickens and Katz, 1986; Kruger and Summers, 1989). The existence of wage differentials across industries for workers with the same skills opens a window to an alternative empirical strategy for studying the impact of trade liberalization on wage inequality. In this paper we propose to exploit the variability within sectors and time in both the extent of trade liberalization and of skill premiums to explore the role played by the former on shaping the Argentine wage structure during the nineties. Specifically, we investigate whether those sectors where trade liberalization had larger effects, measured by import penetration at the sector level, are also the sectors where, ceteris paribus, we observe a higher increase in wage inequality.

We find that trade liberalization impacted greatly on trade flows, employment and relative prices. In particular, the manufacturing sector has faced strong competition from foreign markets, as reflected by the significant increase in the import penetration ratios. Additionally, we observe a negative correlation between the relative prices of the manufacturing goods and the level of import penetration of the respective manufacturing sector.

Given that the manufacturing sector in Argentina overwhelmingly employs unskilled labor, there is a strong presumption in favor of the hypothesis that a deep increase in foreign competition, like the one observed in Argentina during the nineties, would affect the wages of the unskilled workers more than the wages of the skilled workers. This assertion is confirmed by our statistical analysis. In particular, we find statistical evidence that shows that there is a positive and significant association between the rise in import penetration ratios and the rise in the college wage premium, a phenomenon that characterizes the evolution of wages in Argentina during the nineties. However, as has been found for some developed economies, trade deepening can only explain a relatively small proportion of the observed rise in wage inequality.

The rest of the paper examines these questions. Section 2 documents the trends in wage inequality in Argentina since the eighties. Section 3 describes the main features of Argentina's trade liberalization process. Section 4 explores the extent to which Stolper–Samuelson effects are identifiable in the data. In Section 5, we test whether trade openness had any impact on wage inequality in Argentina during the nineties. Finally, Section 6 summarizes our findings.

2. Trends in wage inequality

In this section, we study the recent evolution of relative wages in Argentina. Specifically, the empirical evidence available is from Greater Buenos Aires, the main urban agglomerate.[1] We analyze the evolution of skill premiums by educational attainment levels of workers and, for that, we define three skill groups: unskilled (those individuals who at most have attended high school but have not finished it), semi-skilled (those that have finished high school) and skilled workers (those that have finished a tertiary degree). We exclude self-employees, owner-managers and unpaid workers since we are only interested in the changes in the wage structure. Fig. 1 shows the evolution of the skill

[1] This market covers approximately half of the labor force of the country.

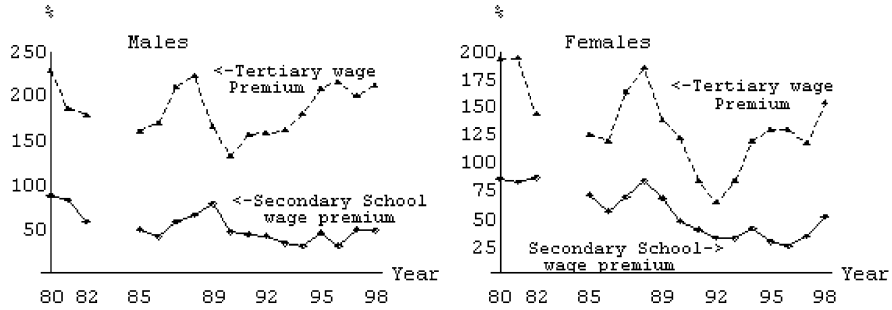

Fig. 1. Skill premiums (base category: unskilled workers). Note: The dependent variable is the logarithm of the hourly earnings of the sampled individuals in their main occupation. For employees, this variable is equivalent to the hourly wages. The yearly data are taken from the October wave of the Household survey for Greater Buenos Aires (GBA). There are no data tapes available for the years 1983 and 1984.

premiums for the period 1980–1998, with particular attention to the time evolution of the skill wage premiums by gender. These time series are derived from the coefficients of a set of wage equations where the dependent variable is the logarithm of the hourly wages and, among the covariates, there is a set of educational dummies and a quadratic function in potential experience. The equations are estimated separately by gender.

The main changes in the wage structure are the following: the skill premium of the semi-skilled group has deteriorated relative to the skill premium of the unskilled group. Additionally, the unskilled group has not seen its skill premium deteriorate relative to the skill premium of the skilled workers. Nevertheless, during the nineties we find a rather different picture. The skill premium of the semi-skilled group did not deteriorate relative to the skill premium of the unskilled group while both the unskilled and semi-skilled premiums deteriorated relative to the premium of the skilled group, mainly since 1992. Indeed, the skilled–unskilled premium increased substantially during the nineties. In order to quantify the magnitude of these changes, we estimate the change per year in the skill premium of the groups plotted in Fig. 1. Table 1 presents the results. It is worth noting that, even though for the whole period these time series do not show a monotonic behavior, they do so during the nineties, which is the period in which we are most interested. We estimate that the male college skill premium rose 10 percentage points per year during the nineties. A similar trend is found for the female college skill premium during this period. We do not find that the secondary school skill premium has changed during the nineties, even though it has declined

Table 1
Skill premiums fitted time trends (fitted variable: skill premiums by schooling group)

Time period	Semi-skilled group		Skilled group	
	Males	Females	Males	Females
1980–1998	−2.11*** (0.54)	−3.37*** (0.50)	0.23 (1.20)	−3.41*** (1.37)
1990–1998	0.25 (1.03)	−0.38 (1.21)	10.1*** (1.47)	6.7** (2.2)

The time trend takes the values $t = 1, 2, 3, 6, 7, \ldots, 19$. Standard errors are in parentheses.

** If the coefficient is statistically different from zero at the 5% significance level.

*** If the coefficient is statistically different from zero at the 1% significance level.

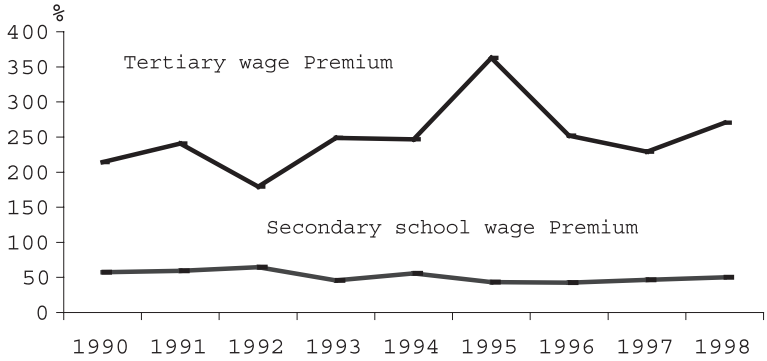

Fig. 2. Skill premiums in the manufacturing sector (base category: unskilled workers). Note: The dependent variable is the logarithm of the hourly earnings of the sampled individuals in their main occupation. The yearly data are taken from the October wave of the Household survey for Greater Buenos Aires (GBA).

when the whole period is considered. Lastly, it is worth noting that the trends depicted here, especially during the nineties, do not differ significantly by gender.

Finally, we study the evolution of the wage premiums for the manufacturing sector during the nineties. Due to sample size considerations, we only present the average wage premium by skill group. Fig. 2 shows that the trends we observe in the manufacturing sector during the nineties are very similar to those we observe for the whole economy. The figure reports the evolution of the educational skill premiums in the manufacturing sector. These statistics are derived from the coefficients of a set of wage equations where the dependent variable is the logarithm of the hourly wages and among the covariates there is a set of educational dummies, a quadratic in potential experience and a gender dummy. We find a positive and statistically significant trend in the college skill premium. On average, it has increased approximately 7 percentage points per year during the nineties while we do not find any statistically significant trend for the secondary school skill premium.[2] Thus, overall, we conclude that during the nineties the trends in relative wages in the manufacturing sector are similar to those found for the whole economy.

3. Trade liberalization, trade flows and employment in Argentina during the nineties

During the early nineties Argentina undertook a broad program of trade liberalization through policies applied unilaterally, regionally and within the multilateral negotiations of the General Agreement on Tariffs and Trade (GATT). Trade liberalization started gradually as a unilateral policy in 1988 but made a strong impact only after 1990. The program included both a reduction in nominal protection and a significant reduction of tariff positions that were subject to quantitative restrictions. By the end of 1991, nominal

[2] Indeed, as happened in the entire economy, the rise in the skilled workers wage premium started in 1992. It is also worth noting that the estimated value for this statistic in 1995 is extremely high. Nevertheless, it may be just the result of sampling variability.

tariffs had been lowered to an average level of 12% and all import licenses had been eliminated.

Unilateral tariff liberalization was complemented by regional trade liberalization through the establishment of the Mercosur treaty in 1991, which aimed at the institution of a Custom Union among the southern cone countries (Argentina, Brazil, Paraguay and Uruguay). The treaty established free trade within the region while extra-region common tariffs were set between 0% and 20%. However, Argentina already had an average level of external tariffs that was close to the average tariff agreed in the Mercosur treaty. Thus, Mercosur mainly enhanced free trade within the region.

Trade liberalization significantly impacted trade flows. Total trade almost quadrupled between 1990 and 1998, nearly doubling its share in GDP from approximately 10% to 18%. Trade data disaggregated by industry show that, since 1990, most manufacturing sectors faced a significant rise in competition from abroad. Table 2 shows import penetration indicators computed as the ratio of imports to gross value added by industry. Import penetration rose from 5.7% in 1990 to 19% in 1999 for the whole manufacturing sector. Additionally, there is ample variability across sectors. For example, in those sectors where Argentina possesses comparative advantages, such as Food and Beverages, Petroleum Distillery, and Nonmetal Mineral products, the foreign supply in 1999 was still a small proportion of domestic production (below 4% of value added). Contrarily, in those sectors where Argentina does not have comparative advantages, in unskilled labor-intensive

Table 2
Import penetration ratios: imports to gross value added by industry (%)

Manufacturing sector	1990	1991	1993	1995	1999
Food and beverages	0.4	1.5	2.9	3.1	3.5
Tobacco	0.1	0.1	0.1	0.1	0.2
Textile products	1.6	6.7	13.6	12.2	19.8
Apparel	0.3	3.9	11.9	9.1	11.3
Leather, footwear	0.6	2.9	7.7	8.2	11.9
Wood production (non-furniture)	3.3	5.5	11.8	16.6	21.4
Paper production and paper products	3.4	11.6	20.9	28.8	32.6
Printing and publishing	0.4	1.4	4.4	8.0	9.7
Petroleum distillery	0.3	2.0	2.9	6.1	3.9
Chemical products	14.7	21.9	25.3	36.8	44.3
Rubber and plastic products	2.4	7.1	18.1	26.7	29.1
Nonmetal mineral products	2.2	4.0	7.3	9.7	11.1
Basic metals	4.3	10.3	15.0	19.5	24.0
Metal products (non-machinery and equipment)	2.7	5.5	11.5	20.4	26.0
Machinery and equipment	11.8	28.6	60.5	67.3	92.0
Computer, accounting and office machinery	70.7	124.4	308.5	368.3	357.8
Engines and electric equipment	10.9	17.1	44.2	62.8	68.4
Audio, video, TV, and communication equipment	12.7	53.9	83.7	83.8	107.1
Medical, ophthalmic, watches and clocks, etc.	27.8	52.3	100.4	133.9	159.1
Motor vehicles and equipment	3.5	12.6	28.0	36.6	46.8
Other transportation equipment	16.7	32.8	99.4	77.2	220.3
Furniture and manufacturing industries	4.4	18.0	29.0	30.9	39.5

Data are classified according to the Standard International Trade ISIC Classification, revision 3.
Source: Author's calculation based on data provided by CEPAL.

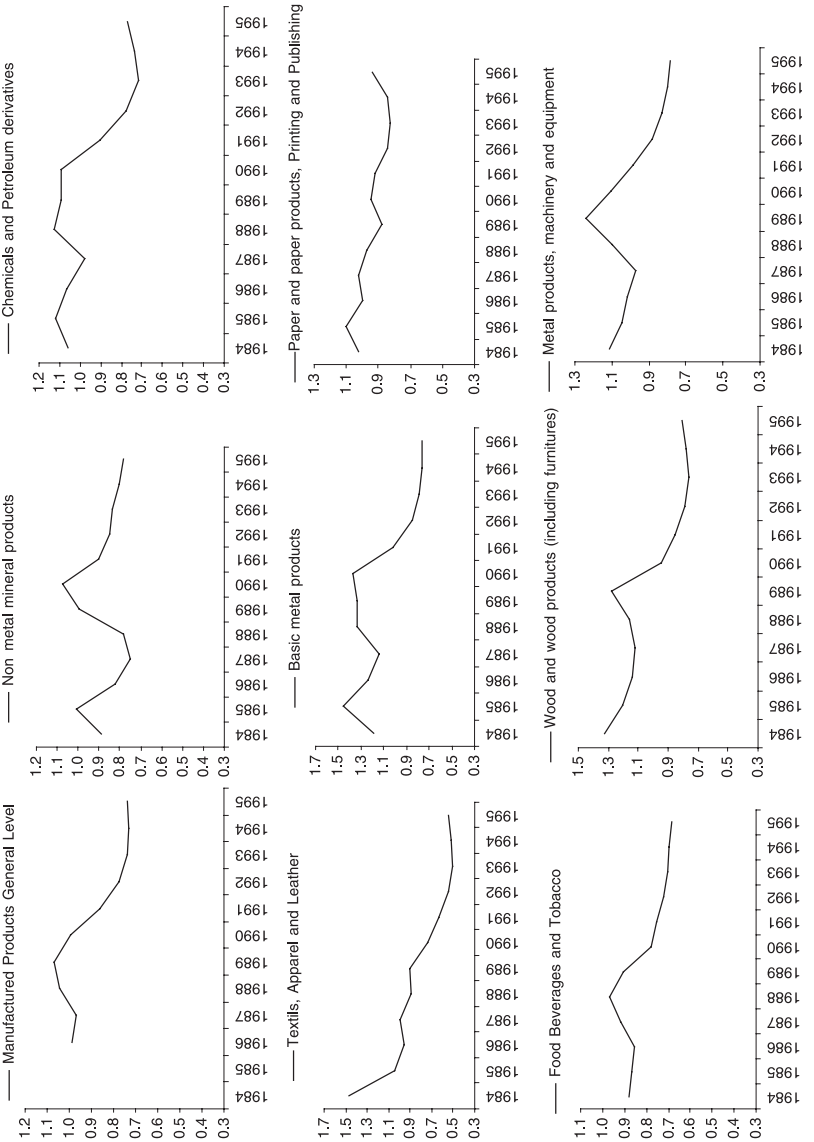

Fig. 3. Manufacturing prices relative to GDP deflator.

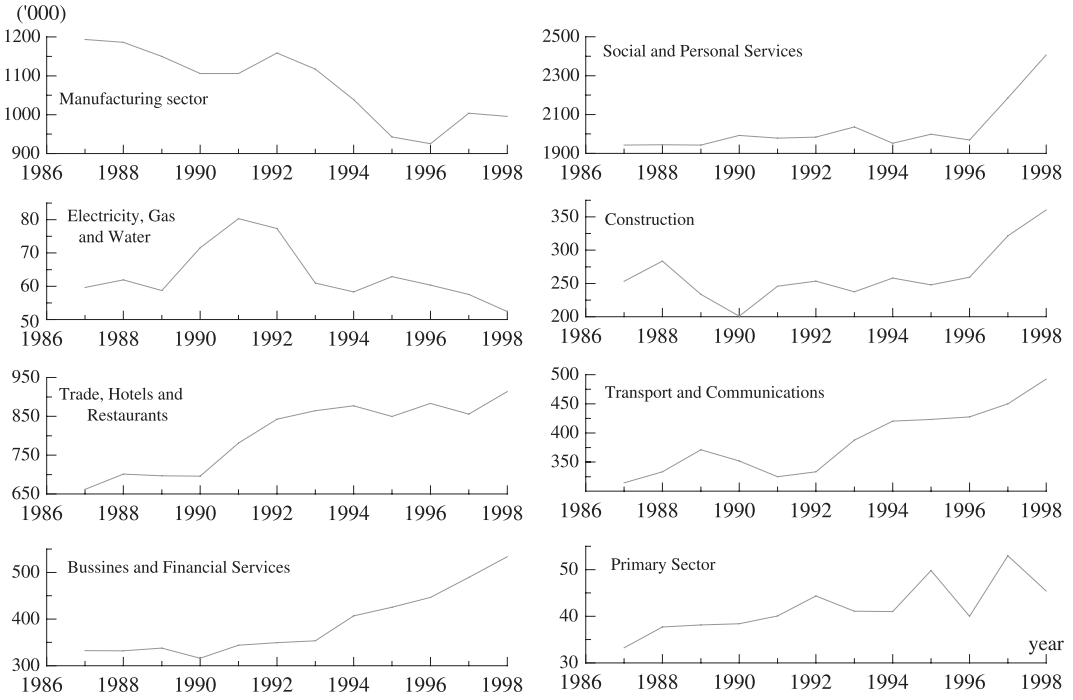

Fig. 4. Employment by Sector: Employees Annual averages (thousands). Source: Household survey, all urban agglomerates.

Table 3
Employment index by industry (base 1993 = 100)

Manufacturing sector	1993	1994	1996	1998	Variation 1993–1998 (%)
Manufacturing sector	100	97.1	88.0	88.3	−11.7
Food and beverages	100	100.0	91.1	88.0	−12.0
Tobacco	100	89.9	72.5	67.2	−32.8
Textile products	100	90.0	83.0	81.2	−18.8
Apparel	100	92.1	77.9	78.9	−21.1
Leather, footwear	100	97.0	85.2	85.2	−14.9
Wood production (non-furniture)	100	98.8	86.9	92.9	−7.1
Paper production and paper products	100	100.5	93.6	83.3	−16.7
Printing and publishing	100	100.3	94.1	91.2	−8.8
Petroleum distillery	100	73.3	69.1	66.8	−33.2
Chemical products	100	97.4	94.6	93.4	−6.6
Rubber and plastic products	100	96.0	97.9	102.5	2.5
Nonmetal mineral products	100	95.0	84.0	83.9	−16.1
Basic metals	100	96.3	93.0	93.0	−7.0
Metal products (non machinery and equipment)	100	97.0	86.4	98.8	−1.2
Machinery and equipment	100	95.9	89.2	90.8	−9.2
Computer, accounting and office machinery	100	97.0	92.0	76.3	−23.7
Engines and electric equipment	100	94.9	82.2	84.6	−15.4
Audio, video, tv, and communication equipment	100	89.1	64.8	66.2	−33.8
Medical, ophthalmic, watches and clocks, etc.	100	94.6	89.0	85.3	−14.8
Motor vehicles and equipment	100	103.5	85.8	91.0	−9.0
Other transportation equipment	100	87.0	73.0	83.3	−16.7
Furniture and manufacturing industries	100	93.9	80.4	87.0	−13.0

Source: INDEC.

activities or capital-intensive sectors (where natural resources are not complementary), we observe significant rises in import penetration ratios.

Import penetration ratios (or import shares) are an intuitively appealing way to categorize industries facing significant competition from abroad. For this purpose, a complementary piece of evidence is given by prices. Fig. 3 plots the time series of the relative prices of the manufacturing sector to the GDP deflator (eight industry aggregates and the general level of prices of the manufacturing sector) for the period 1985–1995. A significant decline in the relative prices of all manufacturing sectors is observed after 1990. Additionally, as is the case with the import penetration ratios, we also find substantial variability across industries. Interestingly enough, we find a negative and significant correlation between (relative) prices and import penetration ratios.

During the nineties there was a significant change in the employment structure in Argentina. As shown in Fig. 4, employment in the manufacturing sector was severely affected.[3] Approximately 30% of the net employment in the manufacturing sector was destroyed between 1992 and 1996. It may seem natural to associate this phenomenon, at

[3] It is worth noting that unemployment tripled during the nineties (see Galiani and Hopenhayn, 2003). Thus, we cannot infer from Fig. 4 that labor is highly mobile across sectors even though there were sectors contracting and expanding, since both unemployment and labor supply also increased substantially during the same period.

Table 4
Factor intensity

	Share of skilled workers (%)			Average 1993–1995
	1993	1994	1995	
Total economy	21.6	22.0	24.6	22.7
Total economy but the manufacturing sector	23.9	23.8	26.6	24.8
Manufacturing sector	13.8	15.1	16.9	15.3
Services sector	30.3	31.1	33.9	31.8

Source: household survey, Greater Buenos Aires (GBA).

least in part, with trade openness.[4] As shown in Table 3, the fall in employment has taken place in most manufacturing sectors.

Finally, Table 4 shows that, compared to the other sectors of the economy, the industry is relatively intensive in unskilled labor. Thus, since the industries that experienced larger reductions in protection levels employ a greater proportion of low-skilled workers, trade liberalization may have had the effect of reducing the wages of the less skilled workers relative to the wages of the high-skilled workers. We explore this question next.

4. Trade and relative wages: preliminary evidence from industry level data

In this section we explore whether the aggregate data available are consistent with the main implications of the Heckscher–Ohlin model as formulated in the Stolper–Samuelson theorem. All other things being equal, a rising relative wage of skilled workers, as took place in Argentina during the 90s, should manifest in: (a) an increase in the international price of skilled-labor-intensive products relative to those of unskilled-labor-intensive products, and (b) a fall in the ratio of skilled to unskilled labor employed across industries. Following the approach adopted by Lawrence and Slaughter (1993), we now investigate these two relationships. Thus, the analysis is pursued for the manufacturing sector using industry data disaggregated at the two-digit SIC level. Also, following the literature, in this section we group workers in two skill groups: unskilled (U) and skilled (S).[5]

Fig. 5 explores whether the international price of skilled-labor-intensive products increased relative to those of unskilled-labor-intensive products. The change in prices is the change in nominal industry prices between 1993 and 2000 while the ratio of skilled to unskilled workers (S/U) is measured at the beginning of this period. If the increase in wage inequality observed in Argentina during the nineties is the result of Stolper–Samuelson effects, the prices of the industries that are relatively intensive in the use of skilled labor should have risen relative to the prices of production of the industries that are relatively intensive in the use of unskilled labor. Fig. 5 indicates that this is the case. There is a positive correlation between product prices and the skilled/unskilled employment ratio.

[4] The other sector that suffered a significant reduction in employment is electricity, gas and water; a sector that was heavily affected by layoffs because of privatization during the nineties.

[5] The unskilled group includes the unskilled and semi-skilled workers as defined in Section 2.

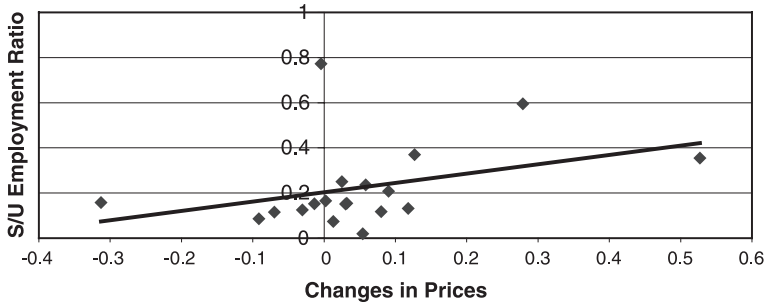

Fig. 5. Skilled–unskilled employment ratio and changes in prices.

However, the relationship is weak (the correlation coefficient is equal to 0.36). In addition, the evidence in Fig. 6 suggests that, contrary to what is predicted by standard trade theory, employment in the industries that are intensive in the use of unskilled labor did not decline relative to the employment in the industries that are intensive in the use of skilled labor.

Finally, Fig. 7 explores whether there is a fall in the ratio of skilled to unskilled labor employed across industries as a result of the fact that the skill premium increased. As can be seen, the evidence is mixed: there are only 7 sectors where the share of unskilled labor increased between 1991 and 1999, while there are 13 sectors where the opposite occurred.

Thus the evidence in favor of Stolper–Samuelson effects is mixed and not very strong. All that we can conclude from this analysis is that the Stolper–Samuelson effects, if present, did not operate in isolation, which is a hypothesis of the empirical strategy adopted in this section. The problem with this empirical strategy is that it is very difficult to identify the link between the economy-wide increases in skill premium and trade.

The Heckscher–Ohlin model assumes perfect intersectoral factor mobility, implying that the wages of workers with the same endowment of human capital equalize across sectors. However, there is evidence of the existence of interindustry wage premiums (see, e.g., Dickens and Katz, 1986; Kruger and Summers, 1989). Interindustry wage premiums may be attributable to compensating differentials, specific human capital; they may reflect the existence of trade union premiums or, more generally, it may be that industry affiliation

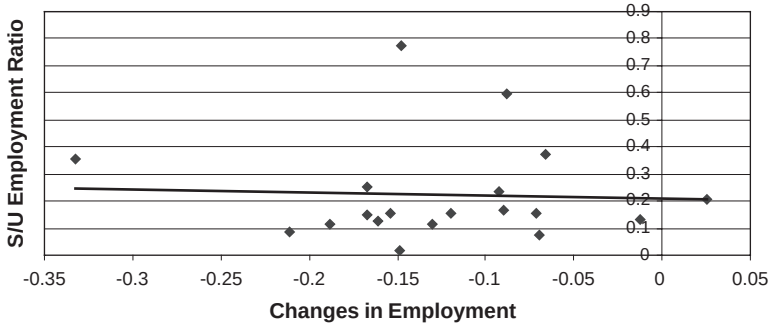

Fig. 6. Skilled–unskilled employment ratio and changes in employment.

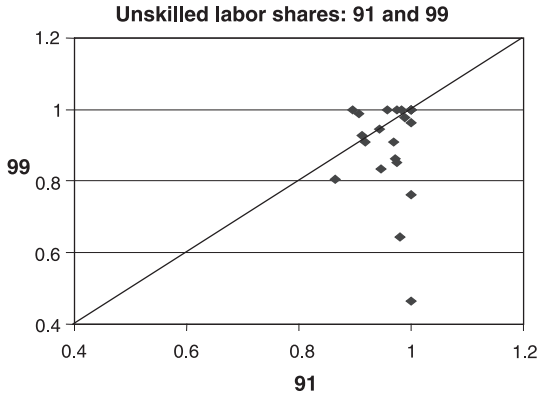

Fig. 7. Unskilled labor shares: 1991 and 1999.

is systematically correlated with unobserved worker attributes (see, among others, Lovely and Richardson, 2000).

In any event, the existence of wage differentials across industries for workers with the same skills opens a window to an alternative empirical strategy for studying the impact of trade liberalization on wage inequality. In this paper we propose to exploit the variability within sectors and time in both the extent of trade liberalization and skill premiums to explore the role played by the former in shaping the Argentine wage structure during the nineties. Specifically, in the next section, we investigate whether those sectors where trade liberalization had larger effects, as measured by import penetration at the sector level, are also the sectors where, ceteris paribus, a higher increase in wage inequality is observed.

Thus, trade liberalization induces an exogenous change in labor demand by industry. In the next section, we exploit this variability across industries and time to identify the impact of import penetration ratios on wage premiums. However, other more standard channels through which import penetration may affect wage premiums would not be identified. Since the manufacturing sector is more intensive in low-skilled labor, the aggregate demand of these workers is more affected by trade liberalization than the aggregate demand of skilled labor. Thus, in a world with perfect factor mobility, the wages of the unskilled workers decline the same in all sectors of the economy and, hence, the correlation between the degree of import penetration and wage differentials by sector vanishes. Therefore, our empirical analysis may not estimate the whole effect of import penetration on wage inequality, that is, it is not an estimate of its general equilibrium effect, which, unfortunately, may not be identifiable.

5. An empirical test of the impact of trade on wage inequality using micro data

In this section we study whether trade liberalization had any identifiable impact on the distribution of wages in the manufacturing sector in Argentina during the nineties. Specifically, we test, using micro data, whether those sectors where import penetration deepened are also the sectors where, ceteris paribus, a higher increase in wage inequality is

observed. Thus we investigate whether—after we control for other factors including worker's individual characteristics—relative wages widened comparatively more in those sectors that faced strongest competition from foreign markets. In order to test this hypothesis, we estimate the following regression function:[6]

$$\mathrm{Log}(w_{ijt}) = \sum_{g\_1} \mathrm{ds}_{ijgt}\alpha_{gt} + \sum_{g} \mathrm{ds}_{ijgt} m_{jt}\alpha_{gm} + \sum_{c\_1} \mathrm{dt}_{ijct}\phi_{ct} + f_t(\mathrm{age}_{ijt}) + \mathrm{dsex}_{ijt}\varphi_t + c_t + \mu_j + u_{ijt} \quad (1)$$

where w_{ijt} is the wage of individual i working in industry j at time t; ds_{ijgt} is a dummy variable that indicates schooling group g in period t, and α_{gt} is a schooling effect in period t; m_{jt} is the logarithm of the ratio of imports to gross value added in the manufacturing sector j in period t. dt_{ijct} is a dummy variable that indicates tenure group and ϕ_{ct} is the tenure effect in period t. The tenure groups are: (0,1), (1,5), (5,10), (10,20) and (20,20+). $f_t(\mathrm{age}_{it})$ is a linear time-varying function of age and age squared; dsex_{ijt} is a dummy variable indicating the gender of individual i and φ_t is the gender impact on wages in period t; c_t is the intercept in period t (the period effect); μ_j is the sector fixed-effect, and u_{ijt} is the error term for individual i working in sector j during period t. The dependent variable is the logarithm of the hourly earnings of the sampled individuals in their main occupations. The schooling groups are the unskilled group, the semi-skilled group and the skilled group defined in Section 2. Finally, it is worth noting that, as is common in the literature, we are interested in the effect of import penetration on the skill premiums and, hence, we are interested in the $(\alpha_{gm} - \alpha_{bm})$ parameters, where α_{bm} is the estimated coefficient in the regression function (Eq. (1)) for the educational base category.[7]

We estimate Eq. (1) by sampling workers in the manufacturing sector only. This is the only group of workers for which the measure of import penetration adopted here presents variability. Thus, it is worth reemphasizing that our objective is to test whether there is an identifiable impact of import penetration on wage inequality, even though this is not necessarily an estimate of the general equilibrium effect of trade liberalization on wage inequality.[8] The micro data used in this section are gathered from the household survey for the period 1992–1999. The survey is conducted twice per year. Thus, the period effect refers to the wave-year effect. Finally, the data on imports, exports, value added and prices by sector at the two digit levels are taken from the Argentine International Trade Commission.

Thus, under the specification adopted in Eq. (1), the schooling group g wage premium in sector j in year t is given by $\mathrm{WP}jgt = 100[\mathrm{Exponential}(\alpha_{gt}+(\alpha_{gm} - \alpha_{bm})m_{jt}) - 1]$, where α_{bm} is the estimated coefficient in the regression function (Eq. (1)) for the educational base category. Given our hypothesis, that is, that the relative wages widened comparatively more in those activities that faced strongest competition from foreign markets and the

[6] We also test the validity of this specification by augmenting it with other trade variables at the industry level.

[7] Actually, α_{bm} captures a common time-varying industry effect, which is hard to interpret.

[8] As we discussed in Section 4, an increase in import penetration may widen income inequality relative to the rest of the economy in the sectors affected. Our test evaluates the existence of these differential effects in the manufacturing industries.

evidence gathered in Section 2, we expect the difference among the coefficients for the skilled group and the other two skill groups to be positive. Additionally, given the factor content of the manufacturing sector, we may also expect these two estimated differences to be statistically similar.

It is worth noting that Eq. (1) controls both for period-fixed effect and sector-fixed effect. Thus, our model does not provide information about the level of wages by industry because we are conditioning our estimates on the sample means by sector. Also, this means that we are controlling for any aggregate shock that affects wages homogeneously. Thus, for example, if inflation affects all wages homogeneously, its effect on wages is controlled by the period effects in our specification (for instance, the same would be true for technological change). Instead, if inflation, or any other aggregate variable, affects wages differently by skill group, its effect on wages is captured by the time-varying wage premiums. This is an important feature of the specification adopted since it does justice to the alternative hypothesis in our test (i.e. other things widened relative wages). Thus, the set of parameters $(\alpha_{gm} - \alpha_{bm})$ only captures the impact on wages of the sector import penetration.

Table 5 presents a pair of typical estimated coefficients for the variables that control for individual characteristics in the regression function (Eq. (1)). The estimated coefficients are as expected. Wages increase with education, age and tenure. Both age and tenure profiles look familiar and to some extent they appear to be stable during the period studied. There is also a male wage premium that has risen considerably during the period studied. The skilled wage premium also increased on average during the period studied.

Table 6 presents the estimates of the parameters of interest. Additionally, it presents the results of successively enlarging the model by adding the interaction of the school dummy variables with the logarithm of the ratio of exports to gross value added by industry, and the logarithm of the relative prices, that is, the logarithm of the ratio of the price of each industry to the aggregate price level. The standard errors reported are consistent even though the errors in the regression function (Eq. (1)) are not independent within industries.

Table 5
Individual control variables: estimates for selected years

Variable	1992		1997	
	Coefficient	Robust standard error	Coefficient	Robust standard error
Semi-skilled dummy	0.39***	0.05	0.29***	0.06
Skilled dummy	1.00***	0.15	1.46***	0.14
Age	0.04***	0.01	0.06***	0.01
Age^2	−0.0004***	0.0001	−0.0005***	0.0001
Tenure (1,5)	0.08	0.06	0.09	0.08
Tenure (5,10)	0.16***	0.06	0.20**	0.10
Tenure (0,20)	0.21***	0.06	0.19**	0.08
Tenure (20,20+)	0.36***	0.08	0.16	0.12
Gender	0.13***	0.05	0.26***	0.05

The coefficients correspond to the October wave of the survey for each year.

** If the coefficient is statistically different from zero at the 5% significance level.

*** If the coefficient is statistically different from zero at the 1% significance level.

Table 6
The impact of trade variables on wages by skill group

Variable	Coefficient	Robust standard error	Coefficient	Robust standard error	Coefficient	Robust standard error
Unskilled dummy × import penetration	0.067	0.035**	0.067	0.035**	0.068	0.037*
Semi-skilled dummy × import penetration	0.060	0.035*	0.062	0.035*	0.061	0.038*
Skilled dummy × import penetration	0.125	0.048***	0.121	0.047***	0.139	0.050***
Unskilled dummy × export ratio			0.000	0.026	− 0.019	0.024
Semi-skilled dummy × export ratio			0.007	0.026	− 0.004	0.027
Skilled dummy × export ratio			0.071	0.047	0.035	0.051
Unskilled dummy × relative prices					0.000	0.001
Semi-skilled dummy × relative prices					0.000	0.002
Skilled dummy × relative prices					0.003	0.002

Relative prices are not available for 1992 and 1999.
* If the coefficient is statistically different from zero at the 10% significance level.
** If the coefficient is statistically different from zero at the 5% significance level.
*** If the coefficient is statistically different from zero at the 1% significance level.

That is, the standard errors reported are robust to the problem of random group or cluster effects in the data (cf. e.g. Huber, 1967; Moulton, 1986).

We find that import penetration affects wage premiums. This result holds unaltered when we also control for the impact on wage premiums of both export penetration ratios and relative prices.[9] Most important, the estimated impact of import penetration on the wages of the skilled workers is positive and statistically larger than the coefficient of this variable on the other two skill groups, which themselves are not statistically different (see Table 7).[10] Thus, our evidence shows that the wage premiums of the skilled workers increase with the level of import penetration faced by that industry where they work. During the 1990s, in those industries where the import penetration increased the most, wage inequality also widened relatively more in favor of the most skilled workers.

Consequently, we find that, at least partially, the aggregate trends on wage differentials we presented in Section 2 may be explained by the impact of trade liberalization on wages. However, the identified effect of trade liberalization on wage inequality does not explain a large portion of the rise of the skilled wage premium during the nineties, even though the

[9] If the interactions of the skill dummies with relative prices are entered alone in the model, none of the estimated coefficients associated to these interactions are statistically different from zero.

[10] Literally, our estimated model suggests that wages have increased with the level of import penetration. However, this effect is only significant at the 10% level of significance.

Table 7
F test for equality of coefficients

Unskilled dummy × import penetration = Skilled dummy × import penetration		
$F(1, 174) = 3.33$ Prob>$F = 0.0698$	$F(1, 174) = 3.03$ Prob>$F = 0.0834$	$F(1, 146) = 4.80$ Prob>$F = 0.0300$
Semi-skilled dummy × import penetration = Skilled dummy × import penetration		
$F(1, 174) = 4.15$ Prob>$F = 0.0431$	$F(1, 174) = 3.56$ Prob>$F = 0.0609$	$F(1, 146) = 6.07$ Prob>$F = 0.0149$
Unskilled dummy × import penetration = Semi-skilled dummy × import penetration		
$F(1, 174) = 0.28$ Prob>$F = 0.5969$	$F(1, 174) = 0.18$ Prob>$F = 0.6720$	$F(1, 146) = 0.21$ Prob>$F = 0.6506$

average (weighted by employment) import penetration ratio increased approximately 80% during the same period. Hence, for example, the average identifiable increase in the skilled wage premium due to trade liberalization in the manufacturing sector is 8 percentage points between 1992 and 1999, which is only 15% of the increase in the skilled wage premium during the same period.[11]

6. Concluding remarks

Argentina made major reforms in liberalizing trade at the beginning of the 1990s. The evidence presented in Section 2 shows that during the nineties the college wage premium increased substantially. Contrarily, during the eighties it decreased. This evidence suggests that trade openness could have played a role in shaping relative wages in Argentina. In this paper, we investigate whether this was the case. Specifically, we test whether those sectors where import penetration deepened are, ceteris paribus, the sectors where a higher increase in wage inequality has taken place.

We find evidence in favor of the hypothesis that trade liberalization has contributed to raise the college-wage premium. In particular, once we control by individual and industry specific characteristics, we find a positive and significant correlation between import penetration and the college wage premium. Still, as has been found for some developed economies, trade deepening can explain a relatively small proportion of the observed rise in wage inequality. In particular, the direct increase in the skilled wage premium due to trade liberalization in the manufacturing sector is approximately 8 percentage points, which is only 15% of the increase in the skilled wage premium during the same period.

Thus, we conclude that there is evidence that supports the view that trade liberalization increased wage inequality. Nevertheless, the identified effect does not seem to be among the main causes of the growth in wage inequality in Argentina during the nineties.

[11] The increase, measured in percentage points, in the skilled wage premium due to trade liberalization in the manufacturing sector is computed as: $100\{\text{Exponential}\ (\alpha_{g92}+(\alpha_{gm}-\alpha_{bm})m_{99}) - \text{Exponential}\ (\alpha_{g92}+(\alpha_{gm}-\alpha_{bm})m_{92})\}$, where $\alpha_{\text{skilled92}} = 1$ (see Table 5).

Acknowledgements

We appreciate the comments of J. Aizenman, O. Ashenfelter, A. Cox-Edwards, L. Gasparini, F. Ferreira, G. Fields, M. Ureta, A. Varella Mollick, an anonymous referee and seminar participants at the Interamerican Seminar on Economics, NBER; Latin American Meeting of the Econometric Society; IZA/WDI Conference on Labor Markets in Emerging Market Economies, CEMA; UCLA; UdeSA and UTDT. We also thank J. Pantano for skilfull research assistance. All remaining errors are our own responsibility.

References

Berman, E., Bound, J., Griliches, Z., 1994. Changes in the demand for skilled labor within U.S. manufacturing industries: evidence from the Annual Survey of Manufacturers. Quarterly Journal of Economics 109, 367–397.

Berman, E., Bound, J., Machin, S., 1998. Implications of skilled-biased technological change: international evidence. Quarterly Journal of Economics 113, 1245–1280.

Bound, J., Johnson, G., 1992. Changes in the structure of wages in the 1980s: an evaluation of alternative explanations. American Economic Review 82, 371–392.

Dickens, W., Katz, L., 1986. Inter-industry wage differences and industry characteristics. In: Lang, K., Leonard, J. (Eds.), Unemployment and the Structure of Labor Markets. Basil Blackwell, Oxford, UK.

Feenstra, R., 1998. Integration of trade and disintegration of production in the global economy. Journal of Economic Perspectives 12, 31–50.

Galiani, S., 1999. The differential evolution of wages, job stability and unemployment. UTDT, mimeo.

Galiani, S., Hopenhayn, H., 2003. Duration and risk of unemployment in Argentina. Journal of Development Economics 71, 199–212.

Huber, P., 1967. The behavior of maximum likelihood estimates under non-standard conditions. Proceedings of the Fifth Berkeley Symposium in Mathematical Statistics and Probability. University of California Press, California, US.

Katz, L., Murphy, M., 1992. Changes in relative wages, 1963–1987: supply and demand factors. Quarterly Journal of Economics 107, 35–78.

Kruger, A., Summers, L., 1989. Efficiency wages and the inter-industry wage structure. Econometrica 56, 259–293.

Lawrence, R., Slaughter, M., 1993. Trade and US wages: giant sucking sound or small hiccup? Brookings Papers on Economic Activity, 161–226.

Leamer, E., 1994. Trade, wages and revolving door ideas. National Bureau of Economic Research, WP No. 4716. Cambridge, US.

Leamer, E., 1998. In search of Stolper–Samuelson linkages between international trade and lower wages. In: Collins, S. (Ed.), Imports, Exports, and the American Worker. Brookings Institution, Washington DC, US.

Lovely, M., Richardson, D., 2000. Trade flows and wage premiums: does who or what matter? In: Feenstra, R. (Ed.), The Impact of International Trade on Wages. University of Chicago Press, Chicago, US.

Machin, S., 1995. Changes in the relative demand for skills. In: Booth, A., Snower, D. (Eds.), Acquiring Skills: Markets Failures, Their Symptoms and Policy Responses. Cambridge Univ. Press.

Machin, S., 1996. Wage inequality in the UK. Oxford Review of Economic Policy 12, 47–64.

Moulton, B., 1986. Random group effects and the precision of regression estimates. Journal of Econometrics 32, 385–397.

Nickell, S., Layard, R., 2000. Labor markets institutions and economic performance. In: Ashenfelter, O., Card, D. (Eds.), Handbook of Labor Economics, vol. 3C. North-Holland, Amsterdam, The Netherlands.

Schmitt, J., 1995. The changing structure of male earnings in Britain, 1974–1988. In: Freeman, R., Katz, L. (Eds.), Differences and Changes in Wage Structures. University of Chicago Press, Chicago, US.

Sachs, J., Shatz, H., 1994. Trade and jobs in U.S. manufacturing. Brooking Papers on Economic Activity, 1–84.

Wood, A., 1994. North–South Trade, Employment and Inequality: Changing Fortunes in a Skill-Driven World Oxford Univ. Press.

Wood, A., 1995. How trade hurt unskilled workers. Journal of Economic Perspectives 9, 57–80 (Oxford, UK).