Wage inequality and trade liberalization: Evidence from Argentina[1]

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1. Introduction

The study of the changes in the wage structure of a country is an important area of research in the field of labor economics. In developed countries, the changes in the wage structure have recently attracted a considerable amount of research. The 1980's witnessed rapid and dramatic changes in the structure of wages in the United States. In particular, we observe sharp changes in wage inequality, and dramatic increases in wage differentials by education and experience (see, e.g., Bound and Johnson, 1992 and Katz and Murphy, 1992). Overall, wage dispersion increased to levels greater than at any time since the 1940s (see Goldin and Margo, 1992). What is more, within group wage dispersion has also grown significantly (see, e.g., Buchinsky, 1994 and Juhn et al., 1993).

Great Britain also experienced important increases in wage inequality during the 1980s (see Schmitt, 1995). Nevertheless, these changes in the wage structure are not observed in other developed countries. Indeed, comparing the evolution of the wage differentials among the OECD countries, we find that only in United Kingdom and United States the distribution of wages is substantially wider now than in the 1970s (see Nickell and Layard, 1998).

The differences observed in the evolution of wages among OECD countries has taken place in spite of the fact that during the last two decades, the demand for unskilled workers has been falling at a rapid rate in all OECD countries. The two leading explanations for this shift in labor demand are skill-biased technical change and increasing trade, especially with developing countries.

There is considerably less evidence about the evolution of wages in developing countries. There is some evidence, for example, that during the 90s, the wage differential of college graduates has increased in Mexico (see Hanson and Harrison (1994)). For Argentina, Galiani (1999) shows that during the eighties, it cannot be asserted that the

returns to college graduates have increased. Only from the beginning of the nineties there is clear evidence that college premium have increased. This evidence found for Argentina already suggest that that trade openness could have played a key role in shaping relative wage behavior. This is because Argentina between 1988 and 1994 has taken swiping reforms at liberalizing trade with foreign markets.

This suggestive "timing" has motivated us to study, in this paper, the relationship between trade liberalization and relative wages in Argentina. Most of the empirical research in this area has been done using mainly aggregate data constructed at industry activity level. We do analyze this data for Argentina but at some point we combine it with micro-data coming from household surveys. This approach allows us to define skilled labor in terms of precise educational categories and more important we can control for a number of individual characteristics (sex, age, work experience, etc.) that also affect wages and which cannot taken into account when working with data at industry level. In terms of educational attainment, we work with three categories: unskilled (those individuals who at most have attend high school but have not finished it), semi-skilled (those that just finished high school) and skilled workers (those that finished a tertiary degree).

We find that trade flows, industrial employment and relatives prices have moved after trade liberalization according to what a simple version of the Heckscher-Ohlin (H-O) model would have predicted for an economy like Argentina. When performing the micro-data analysis we also find evidence that trade liberalization has increased the college wage premium. Still, similarly with what have been found for some developed economies, trade deepening can explain a relative small proportion of the observed rise in wage inequality.

The rest of the paper is organized as follows. Next section documents the trends in wage inequality in Argentina since the eighties. Then in section 3 we turn to discuss a simple H-O type model relating wages structure with trade liberalization. In section 4 we describe the main features of Argentina's trade liberalization process and investigate

using aggregate data, some implications of H-O theory. In section 5, we perform a micro-data test of the relationship between trade openness and relative wages.

2. Trends in wage inequality in Argentina

In this section we study the evolution of the wage structure in Argentina. Indeed, the empirical evidence available is from Greater Buenos Aires, the main urban agglomerate. Thus, the sample covers only 40 percent of the labor force. Galiani (1999) presents a detailed study of the wage structure for the period 1980-1998. He uses micro data to model the conditional distribution of wages on a set of variables measuring observable skills and demographic characteristics of the individuals in the sample and analyzes the changes through time of the estimated conditional distribution of wages. The study concentrates exclusively on describing the changes in the wage structure during the sample period. Therefore, self-employed, owner-managers and unpaid workers are excluded from the sample. The dependent variable is the logarithm of the hourly earnings of the sampled individuals in their main occupations. For employees, this variable is equivalent to the hourly wages. The wage per hour as a measure of earnings has the virtue that it abstracts from issues of labor-leisure choice and therefore comes closest to some transaction price for a defined quantity of labor (see Griliches, 1977).

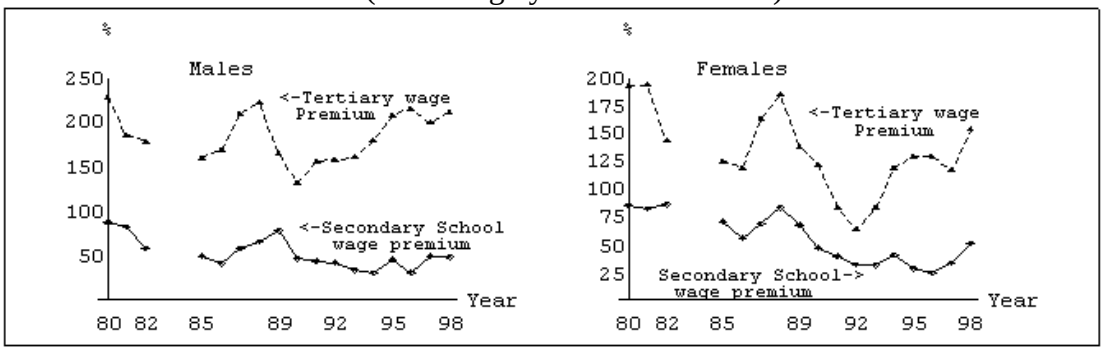
We interpret the parameters of the conditional distribution of wages as being derived parameters from a set of supply and demand parameters. Hence, the estimated parameters are not structural and consequently, their changes through time are not by themselves informative about the changes of the underlying supply and demand parameters. Even so, our interest is centered on studying the evolution of the educational wage premia.

The changes in the wage structure of a country and the comparison of these changes among several countries have always been an important area of research in economics. In developed countries, changing dispersion in wages, particularly, the changes by skill levels, have recently attracted a considerable amount of research.

Thoroughly, there is a difficulty to define the skill groups, and thus, in the empirical work it has to be decided on which wage differentials to focus the analysis. Most applied research assumes that different demographic groups, identified by sex, experience and educational attainment, constitute distinct labor inputs that interact in the production of goods. To the extent that different demographic groups are imperfect substitutes in production (their elasticity of complementarity is greater than zero), their wage differentials become the parameters of interest.

In this paper, we emphasize the wage differentials by educational attainment levels and define the ensuing three skill groups: unskilled (those individuals who at most have attended high school but have not finished it), semi-skilled (those that just have finished high school) and skilled workers (those that have finished a tertiary degree). The results of the estimation of the wage premia are shown in the following figure (taken from Galiani 1999).

Figure 1: Skilled and semi-skilled workers wage premia
(Base category: unskilled workers)



The figures report the evolution of the educational wage premia by gender. These statistics are derived from the coefficients of a wage equation 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 (see Galiani, 1999). The schooling group g wage premium in year t is given by $WP_{gt} = 100$ [Exponential(α_{gt}) – 1], where α_{gt} is the estimated coefficient associated to a dummy variable that indicates the educational group of the individual. Thus, the schooling group g wage premium in year t (WP_{gt}) is the expected percentage increase in the wage of a worker whose level of education is g with respect to the expected wage of an unskilled worker.

For the whole period, the main changes in the wage structure are the following: the semi-skilled group has become more like the unskilled group as time has passed, that is, they have seen their wages deteriorate relative to the unskilled group wages. Additionally, the unskilled group has not seen its wages deteriorate relative to the skilled workers wages. For example, the male skilled wage premium was 228 percent in 1980, 156 percent in 1991 and 211 percent in 1998 while the male semi-skilled wage premium was respectively, 87, 44 and 48 percent.

However, if the analysis is restricted to the evolution of wages during the 90s, the period where as we will see, trade liberalization was deepened, we see a somewhat different picture. The wages of the semi-skilled group did not deteriorate relative to the unskilled group wages while both groups' wages deteriorated relative to the skilled group wages. Indeed, the skilled-unskilled wage premium increased substantially during the 90s. In order to quantify the magnitude of these trends we fit a constant and a linear time trend to the estimated wage premium for those skill groups plotted in figure 1. The coefficients associated with the time trend measures the per year rate of decrease or increase in the respective time trend. Table 1 shows the results.

Table 1: Fitted time trends by schooling group
Fitted variable: wage premia by schooling group (base category: unskilled workers)

time period	Secondary school group		Tertiary degree group	
	Males	Females	Males	Females
80-98	-2.11 *	-3.37 *	0.23	-3.41 *
	(0.54)	(0.50)	(1.20)	(1.37)
90-98	0.25	-0.38	10.1 *	6.7 **
	(1.03)	(1.21)	(1.47)	(2.2)

Notes: The time trend takes the values t = 1,2,3,6,7,…,19. * if the coefficient is statistically different from zero at the one percent significance level. ** if the coefficient is statistically different from zero at the five percent significance level. We report the statistical significance of the fitted trends only as informative measures.

Then as we see, though for the whole period there is no significant tendency for the male college premium, since the beginning of 1990 we do find a positive and

significant trend. In particular the estimated coefficient implies the male college wage premium raised 10% per year. For females the behavior of the college wage premium was significantly negative for the whole period (at 5% level) and changed to significant when we consider only the 1990-1998 period. Still the estimated yearly rate of change for latter period is lower compared to that of males. For the secondary school group we find, consistently with what we see in figure 1, that the wage premium with respect to incomplete secondary has no statistically significant time trend during the nineties, though is has been declining when evaluating the whole 1980-1998 period.

3. Wages and trade: theory

Most studies that tried to relate trends in wage inequality with trade liberalization have used some version of the well-known Heckscher-Ohlin (HO) theory. In particular, they consider a simple formulation with two countries (developed and developing), two factors (skill and unskilled labor), two traded manufactured goods (skill intensive machinery and labor intensive apparel).

Assuming that the developed country is relative abundant in skilled labor, and the developing country is relative abundant in unskilled, the HO model predicts that trade liberalization will expand output and exports of the skilled labor intensive good in the developed country (while output of the less skilled good declines as imports of this good rises). At the same time, in the developing country we should observe an expansion in production and exports of the unskilled traded good (with a fall in production of the skilled intensive traded good which is substituted from imports from the developed economy). Associated with this changes in the flow of trade and domestic production in each country, the H-O model predicts (the so called Stolper-Samuelson theorem) that wages of the skilled labor will raise relative to unskilled in the developed economy and the same wage ratio will decrease in the developing country2.

2 As it is well known this result will prevail while both economies continue to produce both goods (they are inside the cone of diversification).

This very simple framework has been applied to understand the recent trends in some developed countries in which coincidentally with a rapid increase in imports of low skill products from the developing world, there has been a strong rise in wage differential in favor of skilled workers (see Wood 1994, Sachs and Shatz, 1994, Leamer 1994, 1995). Though the simple version of the model seems to be consistent with the stylized facts in developed countries, it does not fit entirely the evidence coming from developing economies. As indicated, for these countries we would expect that the relative wage of unskilled to skilled labor should rise as they integrate with the world economy and shift their production mix toward the less intensive labor skilled products.

As noted by Wood (1997), there is some evidence that this has happened in the case of East Asian countries since the sixties and seventies (when these economies liberalized their trade policies). On the other hand, the rather scatter evidence available for Latin American countries point to the other direction, toward an increase in the relative wage of skilled workers, specially since the mid eighties when most of these economies started to open up their economies. In the case of Argentina, as we saw in the previous section, this trend is observed since the beginning of the nineties, coincidentally with the consolidation of the reforms that liberalized foreign trade (more on this below).

How this apparent contradiction between theory and evidence has tried to be explained? Wood (1997) has emphasized that one key difference between Latin America and East Asia is that the former region is comparatively rich in natural resources3. Thus, the basic HO model has to be extended to include this additional factor of production. Other possible extension is the introduction of one or various non-traded sector, with varying degrees of intensity in terms of skilled and unskilled labor (see Richarson (1995) and Sachs and Shatz (1994)).

3 He suggests that this pattern of comparative advantage has been enhanced since the eighties when the integration to the world economy of China and other low income countries made the medium income, Latin American countries no more abundant in low skilled labor relative to the former nations.

With these additional features the model can in principle be adjusted to describe the observed increase in wage premium in Latin America. This will be case if skilled and natural resources are complementary inputs so that the expansion in the production of natural resources intensive goods can also bring an increase in the demand for skilled labor and then a rise in its relative earnings. The presence of a large non-traded sector will not affect this result if this sector is on average less skilled intensive than the natural resource sector and at the same time more labor skilled intensive than manufacturing. The expansion in the natural resources related activities, as a consequence of trade liberalization, will take resources from the non-traded good production (as well as manufacturing), but to maintain full employment the wages of low skilled workers should fall relative to skilled. Moreover even an expansion in the former sector (due to reasons beyond trade liberalization) will no be enough to accommodate at the current wage the unskilled labor that is going out of manufactures; for this to happen the wages of the unskilled workers should fall relative to skilled.

Independently of where this "augmented" H-O model can be applied to the Latin American region as a whole, we think it is particularly appealing for the Argentinian case. When evaluating the factor endowment of this country relative to the world, as the source of comparative advantage, we are impressed by the importance of natural resources both in terms of land as well as oil and mining. The estimations coming from Leamer 1997 (see also Cristini (1999)) show that while Argentina has an approximately 1% share in world GDP, it has a participation of more than 4% in arable land; more than 2% in mining and pretroleum, but less than 0.3% in unskilled labor, and about the same participation as GDP in skilled labor. These calculations also suggest that Argentina has no comparative advantage in unskilled labor and it has an endowment close to the world average in term of skilled labor. Moreover, from the household survey data (see Table 2) we learn that industry in Argentina at the beginning of the nineties was intensive in unskilled labor (up to secondary school) while primary production and services as a whole are relatively more skilled intensive compared to industry.

Table 2
Factor intensity skill/unskill - Agreggate economic sectors

	1993	1994	1995	Average 1993-95
		Share Unskilled (in %)		
Total Economy	78.4	78.0	75.4	77.3
Total (excluding industry)	76.1	76.2	73.4	75.2
Industry	86.2	84.9	83.1	84.7
Services	69.7	68.9	66.1	68.2
Primary products	60.0	66.7	47.1	57.9
		Share Skilled (in %)		
Total Economy	21.6	22.0	24.6	22.7
Total (excluding industry)	23.9	23.8	26.6	24.8
Industry	13.8	15.1	16.9	15.3
Services	30.3	31.1	33.9	31.8
Primary products	40.0	33.3	52.9	42.1

Source: authors calculations based on EPH, GBA, October waves

Thus for this "extended H-O" model to be a plausible explanation for the observed widening of the wage differential in Argentina we should find that trade liberalization brings about the following facts: (1) The domestic price of manufactured goods (both low skilled and high skilled intensive) should fall relative to natural resources related products (primary and manufactured) as well as non-traded goods; (2) An expansion of employment, output and exports of natural resources intensive products both primary and manufactured; (3) The contraction in employment of low skilled intensive manufactured goods (for Argentina this covers most of the industry) as well as high skilled intensive manufactured goods, both substituted by imports (the first coming from developed nations and the later from low income, labor abundant countries).

In the next section, after describing the main features of Argentina trade liberalization policies, we show evidence consistent with the above facts. Afterwards, in section 5, we turn to a more formal, micro-data test of the effect of trade openness on relative wages.

4. Trade liberalization, trade flows and industrial employment in Argentina in the nineties.

Argentina trade liberalization process has been accomplished by policies applied unilaterally, regionally and also within the multilateral negotiations at the GATT/WTO. The process of trade liberalization started as a unilateral policy in 1988 with the so called "Canitrot Reform" (see Cristini (1991)). On the tariff side there was a reduction in nominal protection so that the average import tax was reduced from a level of 45% in 1987 to 29% at the end of 1988. Regarding non-tariff measures, there was a significant reduction of tariff positions that were subject to quantitative restrictions. In particular, import licenses (authorizations) for approximately 3000 tariff items were eliminated.

The new administration, that took office in 1989, continued with this trade liberalization process. Between August 1989 and January 1991, nominal tariffs were lowered even more reaching a level of 18% at the latter date, and the remaining import licenses were eliminated. With the assumption of Cavallo at the Economic Ministry, trade liberalization was pushed even further; the average tariff fell to an unprecedented level of 9.7%. This impulse toward liberalization was partially reverse when, in October of 1992, the government established an extraordinary and temporary non tariff duty of 10% to almost all tariff items (the so called "tasa de estadistica"). At the end of 1994 this extraordinary levy was reduced to 3% (see Berlinsky 1998). Overall and as a consequence of this unilateral process of liberalization the average tariff in Argentina was reduced from a level of 45% in 1987 to around 12% in 1994.

Trade liberalization was enhanced and, more important, made more credible and perdurable with the establishment of the Mercosur treaty (between Argentina, Brasil, Paraguay and Uruguay) which was signed in 1991. The objective of the treaty was to reach free trade within the region while imports from the rest of the world pay a common external tariff (CET) that varies from 0 to a maximum of 20%. The 100% preference for intraregional trade was obtained through a mechanism of automatic tariff cuts (applied at 6-months intervals) starting in March 1991 and ending in December 1994. Also, the CET, negotiated in the second semester of 1994, was put into operation, as scheduled, at the beginning of 1995. Though some exceptions to the CET and to the zero tariff for intraregional trade was established, their importance was of second order (they amount to 300

items out of the 8000 tariff positions that were negotiated). In any case these exceptions were scheduled to disappear in a period of five to six years.

An overall assessment, as of 1996, of the result of the internal and external liberalization process within Mercosur can be seen in Table 3 taken from Olarreaga and Soloaga (1998). The table contains data on average 8-digit HS tariff lines, external and internal, for the four Mercosur countries. We see that in spite of the commented exceptions, in 1996 on average countries were pretty close to the liberalization objectives. One interesting thing is that while the external tariff in Argentina and Brazil converge from above to the CET, those of Paraguay and Uruguay do it from below, reflecting the relative lower level of protection that those countries had compared to the big patterns in Mercosur. Still, these small countries were allowed to have higher exceptions for internal liberalization as showed by the average level of the tariff corresponding to exempt items.

Table 3
Average tariffs in Mercosur Countries, 1996

Country	Average tariff		Average tariff weighted by Imports		Tariff on excepted goods	
	External	Internal	External	Internal	External	Internal
Argentina	11.78	0.36	13.37	0.86	14.33	11.69
Brasil	13.14	0.02	15.44	0.02	21.39	10.20
Paraguay	8.79	0.80	5.18	0.37	6.83	24.91
Uruguay	10.78	0.88	11.01	1.77	5.92	19.73
Mercosur	11.15	0.00	11.09	0.00	n.a.	n.a.

Fuente: Olorreaga and Soloaga (1998)

But the evaluation of tariff liberalization within Mercosur has also to be done comparing the initial or pre-CET tariffs with those resulting from the CET negotiations. Did the external tariff in Mercosur countries fall or increase as a consequences of the establishment of Mercosur?. Table 4, taken from Kishore et al (1999), presents some indicators corresponding to the tariff structure of Argentina and Brasil in 1992 and 1994 and their differences with the CET established in 1995. All indicators are calculated using the 6-digit tariff lines of the HS system. First we see that for this level of aggregation the average level of the CET is closed to 13% (instead of the 11% obtained at 8-digit level). For the case of Argentina and for this level of aggregation the establishment of the CET did not imply any further reduction in protection. Thus tariffs in Argentina were already low

in 1992 and this level of protection was on average the one that latter got embodied in the negotiated CET.

Table 4

Descriptive Statistics. Tariffs by 6-digit HS system

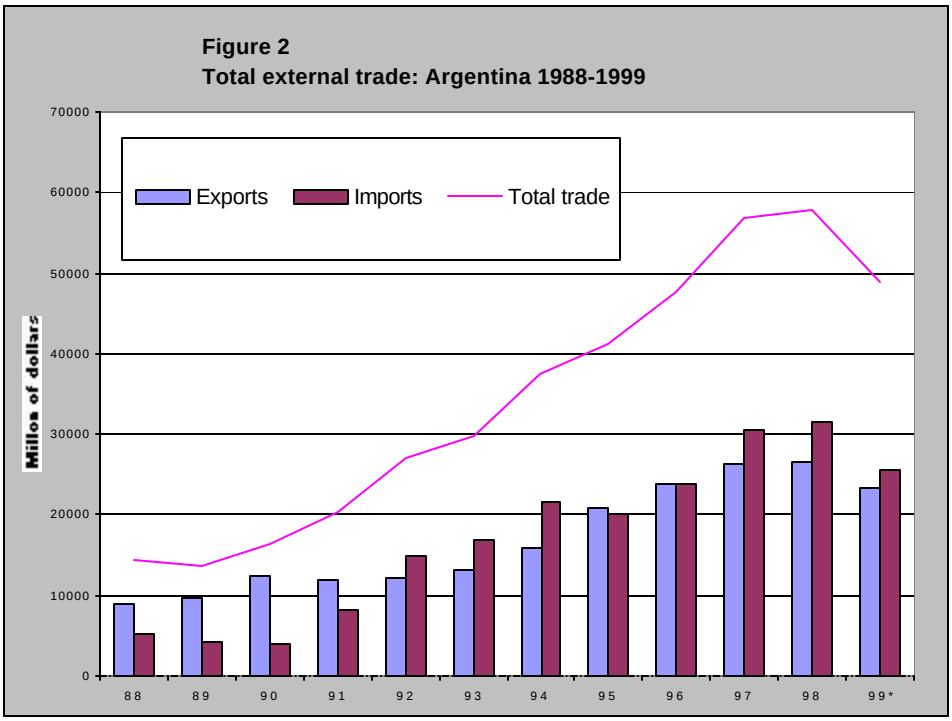
Variable	obs	mean	stand. Dev.	Min	Max
targ92	4500	13.43	6.76	0	35
tbra92	4499	22.79	13.09	0	65
targ94	4501	11.91	4.76	0	20
tbra94	4502	13.64	7.28	0	40
CET	4267	13.25	5.4	0	20

Source: Own calculations.

Finally we want to say a word regarding trade liberalization within the multilateral framework. In this regard Argentina negotiated a consolidated, most-favored-nation tariff level of 35% in the Uruguay round which ended in 1994. It is interesting to note that this level was substantially higher that the average CET of around 11% negotiated in Mercosur. Thus, Mercosur even though it didn't brought further reductions in the overall protection, it has helped to "freeze" nominal protection at a level even lower that what was compromised on an multilateral basis4.

It is not surprising that such a profound and rapid process of liberalization have had a tremendous impact on trade flows. In particular, total trade rose almost four times between 1985/7 to 1996/8 (see figure 2), almost doubling its participation in GDP (it was approximately 10% in 1985/7 and rose to almost 18% in 1996-98).

4 The rigidity that implied the fact that tariffs levels cannot be changed unilaterally any more after Mercosur, have given origin to a new "protectionism" (developed-country style) : the extensive use of the antidumping regulations (see Salustro and Sanguinetti (2000)).



Regarding the composition of exports and imports, we observe that exports of primary and oil and mining-related products raised considerably (see table 5 and 6). Oil and mining participated only with a 3% share of total exports in 1984-88 while in 1993-97 their participation was around 12% (in value these exports rose 10 times). This change in the pattern of exports is, on general terms, consistent with the H-O predictions mentioned in the previous section[5]. Regarding the composition of imports, we observe a sharp increase both in imported consumption goods and capital goods. This change in composition of total imports also seems to correspond with the pattern predicted by theory, especially if we assume that these products are, respectively and on average, more intensive in low skilled and high skilled labor compared to primary products.

5 Nevertheless we cannot be too precise at this level of commodity aggregation. One feature that has preoccupied some people (see Yeats (1997) is the raised in manufacturing exports, fact that it is also shown in table 5, and which is in apparent contradiction with H-O theory. In this regard, first we should mention that within those products we have food and other products that used intensively natural resources as inputs where Argentina has truly comparative advantage. On the other hand, within those categories we also have cars that are trade mainly within Mercosur. Though these trade flows may reflect some natural advantages given by low transport costs within the region, it is also true that this sector has not been entirely liberalize and that its exchange its subject to quotas and other type of administrative regulations within Mercosur.

Table 5
Argentine Exports by main aggregates
(in millons of dollars)

Clasification	Averag, 84-88		Averag 93-97		1998		1999		Change	Chang
	Valor	Part.	Valor	Part.	Valor	Part.	Valor	Part.	99/84-88	99/93-9
Primary Products Agriculture	2828	36.4%	3529	18.9%	6603.3	25.5%	5241	22.5%	85.3%	48.5%
Manufactured goods	2984	38.4%	7105	38.0%	8762	33.7%	8210	35.2%	175.1%	15.5%
Non agriculture manufactured goods	1692	21.8%	5807	31.0%	8624.3	32.8%	6907	29.6%	308.2%	18.9%
Pretroleum and energy products	257	3.3%	2276	12.2%	2451.4	8.0%	2959	12.7%	1051.4%	30.0%
Total	**7761**	**100%**	**18718.0**	**100%**	**26441**	**100%**	**23318**	**100%**	**200.5%**	**24.6%**

Source: CNCE (2000).

Table 6
Imports by main categories
(in millons of dolars)

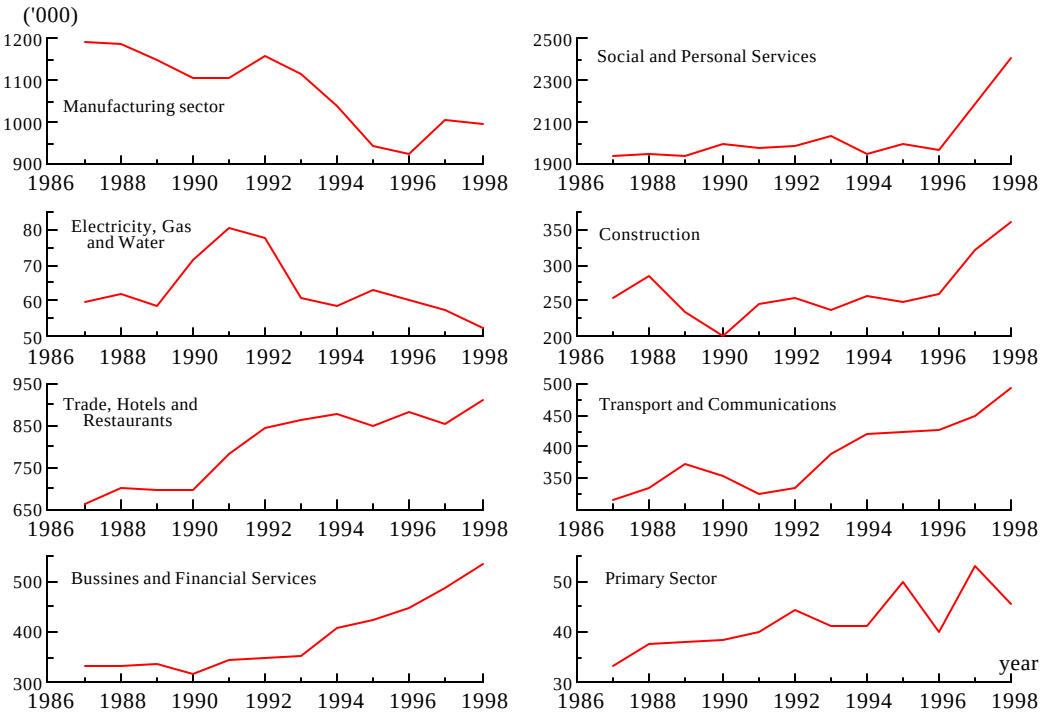
Clasificación	Prom. 84-88		Prom. 93-97		1998		1999		Variación	Variaci
	Valor	Part.	Valor	Part.	Valor	Part.	Valor	Part.	99/84-88	99/93-
Consumption goods	297	6.1%	3743	16.6%	4859.1	14.9%	4510	17.7%	1418.5%	20
Intermediate inputs	2300	47.4%	7395	32.8%	10016.4	33.1%	8369	32.8%	263.9%	13
Capital goods	800	16.5%	5635	25.0%	8499.8	25.3%	7017	27.5%	777.1%	24
Parts and accessories (of capital goods)	944	19.4%	3843	17.1%	5521.3	18.0%	3932	15.4%	316.5%	2
Petroleum and gas oil	495	10.2%	722	3.2%	852.8	3.2%	730	2.9%	47.5%	1
Vehicules	8	0.2%	1157	5.1%	1627.8	5.1%	958	3.8%	11875.0%	-17
Rest	8	0.2%	26	0.1%	26.3	0.1%	21	0.1%	162.5%	-18
TOTAL	**4582**	**100.0%**	**22522**	**100.0%**	**31403.5**	**99.7%**	**25537**	**100.0%**	**457.3%**	**13**

We can sharpen our analysis of the consequences of trade liberalization and whether H-O theory is a useful point of departure to look at the data, if we concentrate our analysis on the performance of

the industry. As indicated in the previous section, in Argentina industry as a whole it is more intensive in low skilled labor than primary production and services. Thus, given the apparent lack of comparative advantage that Argentina has on this factor we would expect, following H-O, that this sector will be hit very seriously after the open up of the economy. We already show that beyond some few exceptions (possibly the most important being the car industry) tariff and protection for manufacturing was significantly reduced between 1988 to 1993/94.

Figure 3 shows that comparatively to other sector of the economy industry was almost the only one who suffered a significant reduction in employment since the beginning of the nineties. It is difficult not to relate at least part of this fall to trade openness given that this sector, together with primary goods, was the only one to face foreign competition. Moreover, consistent with H-O theory employment of primary goods expanded after liberalization. This was also the case for most non traded sectors (only electricity, gas and water suffered a fall in employment as a consequence of the process of privatization**).**

Figure 3: Employment by sector: Employees
Annual averages (miles)



Note: see notes to figure 1, panel b. Source: Household survey, all urban agglomerates.

This fall in employment is replicated in most sectors of the industry (see Table 7) though the evaluation of the fall in employment by sector as a consequence of trade liberalization is dampened by the lack of comparable data before 1993. Table 8 shows that during this period of rapid fall in employment many sectors in the industry faced strong competition from foreign markets. In particular, there was a significant rise in import penetration. For the whole industry import penetration (measure as the ratio of import to imports plus industry production minus exports) rose from 13% in 1993 to 19% in 19986.

6 Again the lack of comparable data at two digit industry level for the period before 1993 impedes us from looking at his trends froam a broader perspective.

Table 7
Workers ocuppied Index - Manufacturing Industry
Base 1993=100, by sector. Argentina. Years 1993/1998.

Manufacturing industry sector (1)	1993	1994	1995	1996	1997	1998	Porcentual variation 1993-98
General Level	100	97.1	91.3	88.0	89.3	88.3	-11.7%
Food and Beverages	100	100.0	95.2	91.1	91.6	88.0	-12.0%
Tobacco	100	89.9	82.3	72.5	79.4	67.2	-32.8%
Textil products	100	90.0	83.6	83.0	85.6	81.2	-18.8%
Apparel	100	92.1	83.5	77.9	77.3	78.9	-21.1%
Leather, footwear	100	97.0	86.6	85.2	85.8	85.2	-14.9%
Wood production (non furnitures)	100	98.8	89.8	86.9	91.3	92.9	-7.1%
Paper production and paper products	100	100.5	94.1	93.6	88.2	83.3	-16.7%
Printing and publishing	100	100.3	96.7	94.1	89.2	91.2	-8.8%
Petroleum destilery	100	73.3	71.0	69.1	66.9	66.8	-33.2%
Chemical products	100	97.4	95.8	94.6	94.6	93.4	-6.6%
Rubber and Plastic products	100	96.0	98.7	97.9	103.0	102.5	2.5%
Non metal mineral products	100	95.0	87.1	84.0	86.7	83.9	-16.1%
Basic metals	100	96.3	93.3	93.0	92.6	93.0	-7.0%
Metal products (Non machinery and equipment)	100	97.0	90.4	86.4	95.7	98.8	-1.2%
Machinery and equipment	100	95.9	91.9	89.2	89.0	90.8	-9.2%
Computer , Accounting and Office Machinery	100	97.0	97.2	92.0	83.6	76.3	-23.7%
Engines and Electric equipment	100	94.9	87.9	82.2	85.2	84.6	-15.4%
Audio, video, TV, and communication equipment	100	89.1	71.6	64.8	66.8	66.2	-33.8%
Medical, Ophtalmic, watches, clocks,etc.	100	94.6	91.3	89.0	90.3	85.3	-14.8%
Motor vehicles and equipment	100	103.5	94.8	85.8	87.6	91.0	-9.0%
Other Transportation equipment	100	87.0	70.2	73.0	81.0	83.3	-16.7%
Furnitures and manufacturing industries	100	93.9	83.0	80.4	84.1	87.0	-13.0%

Table 8
Import Penetration in manufacturing industry*
Base 1993=100, by sector. Argentina. Years 1993/1998.

Manufacturing industry sector (1)	1993	1994	1995	1996	1997	1998	Porcentual variation 1993-98
Food and Beverages	3.3%	3.7%	3.4%	3.6%	4.0%	4.2%	28.4%
Tobacco	0.1%	0.1%	0.1%	0.2%	0.1%	0.2%	227.3%
Textil products	12.2%	13.3%	12.2%	15.4%	17.8%	21.2%	73.6%
Apparel	10.0%	9.7%	8.5%	7.7%	8.5%	10.2%	2.0%
Leather, footwear	9.6%	9.4%	10.2%	8.1%	10.3%	11.7%	22.0%
Wood production (non furnitures)	10.8%	13.1%	18.9%	22.4%	17.9%	17.2%	59.4%
Paper production and paper products	16.2%	17.1%	18.8%	19.7%	23.9%	26.1%	60.9%
Printing and publishing	3.5%	4.2%	5.5%	5.2%	6.5%	7.8%	119.2%
Petroleum destilery	3.1%	4.6%	5.9%	5.5%	3.7%	3.2%	3.1%
Chemical products	20.2%	22.9%	24.8%	27.6%	29.0%	29.8%	47.8%
Rubber and Plastic products	14.6%	15.0%	17.2%	17.2%	19.6%	20.6%	40.9%
Non metal mineral products	6.2%	7.6%	8.0%	9.7%	11.0%	12.2%	96.2%
Basic metals	13.2%	15.2%	15.2%	15.5%	20.0%	18.2%	38.1%
Metal products (Non machinery and equi	9.6%	12.5%	14.0%	15.1%	19.3%	20.9%	117.7%
Machinery and equipment	38.2%	45.0%	41.8%	43.9%	46.9%	47.2%	23.6%
Computer , Accounting and Office Machi	78.0%	90.0%	94.4%	87.2%	89.8%	91.7%	17.5%
Engines and Electric equipment	30.6%	41.6%	41.2%	43.8%	48.5%	52.2%	70.6%
Audio, video, TV, and communication equ	44.6%	55.7%	58.6%	48.5%	55.9%	54.5%	22.1%
Medical, Ophtalmic, watches, clocks,etc.	51.2%	64.1%	87.3%	68.8%	67.0%	68.9%	34.5%
Motor vehicles and equipment	22.2%	27.5%	27.2%	32.5%	36.2%	37.8%	70.6%
Other Transportation equipment	57.3%	58.0%	57.5%	68.3%	69.5%	54.8%	-4.3%
Furnitures and manufacturing industries	20.9%	27.2%	24.5%	24.2%	22.7%	22.2%	6.4%

(1) ISIC, Rev 3 classification
Source: authors calculations based on INDEC, foreign trade and national account statistics
*Import penetration is defined as=Import/(Imports + domestic production - exports).

Nevertheless, the relationship between import deepening and fall in employment is not found in every sector of the economy. For example we do find that the important fall in employment in textiles (-18.8% between 1993 and 1998) coincides with a significant increase in import penetration in that sector (from 12% to 19%). Similarly, for electric machinery manufacturing where employment fall almost 16%, import penetration rose from 29% to 49%. Still, at two digit level, one of the sector that shows the strongest fall in employment is petroleum refinery (-33%), but this

sector maintained during the period a constant and very low level of foreign competition (3%). For the twenty-one two-digit sectors we find no significant correlation between imports deepening and employment7.

The lack of a strong evidence relating import competition and employment suggest that other factors beyond trade were playing a significant role in shaping employment and wage behavior in the industry. This is not surprising and a key candidate is labor augmenting technological progress. Though direct evidence on this factor is hard to find, there are reasons to believe that this factor has been present during this period. In this regard, there was the privatization of most of the industrial activities at the hands of the estate. The ones with the most significant impact on industry were the privatization of the state run Petroleum Company YPF and the steel mill Somisa. The change in hands of these and other companies implied a strong change in the input mix of these firms in favor of new technology and capital. This was, in turn, favored by a government policy that keeps taxes and import duties very low for newly investment goods.

But, beyond what other forces that may have affected employment and wages in the industry, if we still want to keep trade liberalization as part of the explanation we have to look at other complementary piece of data. That is, to be faithful with H-O predictions we also have to find evidence that both the increase in imports and the decline in employment and production in industry are associated with changes in relative prices, in terms, induced by the trade liberalization measures. Moreover, as pointed out by Richarson (1995) there are many reasons why trade flows may increase and job in industry to fall. Still the fall in industry relative price is the only way we can related trade openness with the observed increase in the wage premium of skilled labor.

Now when facing the challenge of the "price test" is when most studies done for developed countries ended up concluding that openness is not, after all, a significant force behind the observed deterioration in unskilled wages (see Lawrence (1994), Lawrence and Slaugter (1993), Sachs and Shatz (1994)). In performing this analysis researchers have had problems for gathering the right price data, as well as there has been some disagreement of what prices to include and how to measure relative prices. We encounter similar problems when analyzing the argentine data. On one

7 We have done the same analysis using net exports obtaining similar results.

hand there is not a unique data set of industrial prices that covers the whole 1988/1999 period. We have one data set starting in 1980 (the ISIC version two) that ends in 1995 and another that starts in 1993 (the ISIC version three). Both have different commodity definition at two-digit level.

Using the first data set we computed the aggregate industry prices relative to primary goods. Figure 4 shows the evolution of this relative price indicator. Clearly, for the aggregate of the industry we don't find a clear pattern of behavior though we do observe a clear deterioration for textiles. When we evaluate industry relative prices with respect to non-traded goods (we use as a proxy the consumer price index) we find a clear trend of reduction in prices from 1988 onwards, period that coincided with the open up of the economy (see Figure 5). Still, some authors (i.e Hanson and Harrison 1994) have claimed that the right relative prices to look at are national industry price relative to imported prices. Figure 6 shows those prices for a set of industrial activities since 1984 to 1995 (as indicated the series are discontinued after 1995). We observe a clear pattern in which domestic product prices increase relative to their import counterpart. This clearly suggest that trade liberalization makes imported good cheaper relative to domestic products and in part explains the rise in imports and the decline in domestic employment.

Figure 4 . Manufacturing sectors prices 1984-1995
(relative to agricultural goods) 1981=1

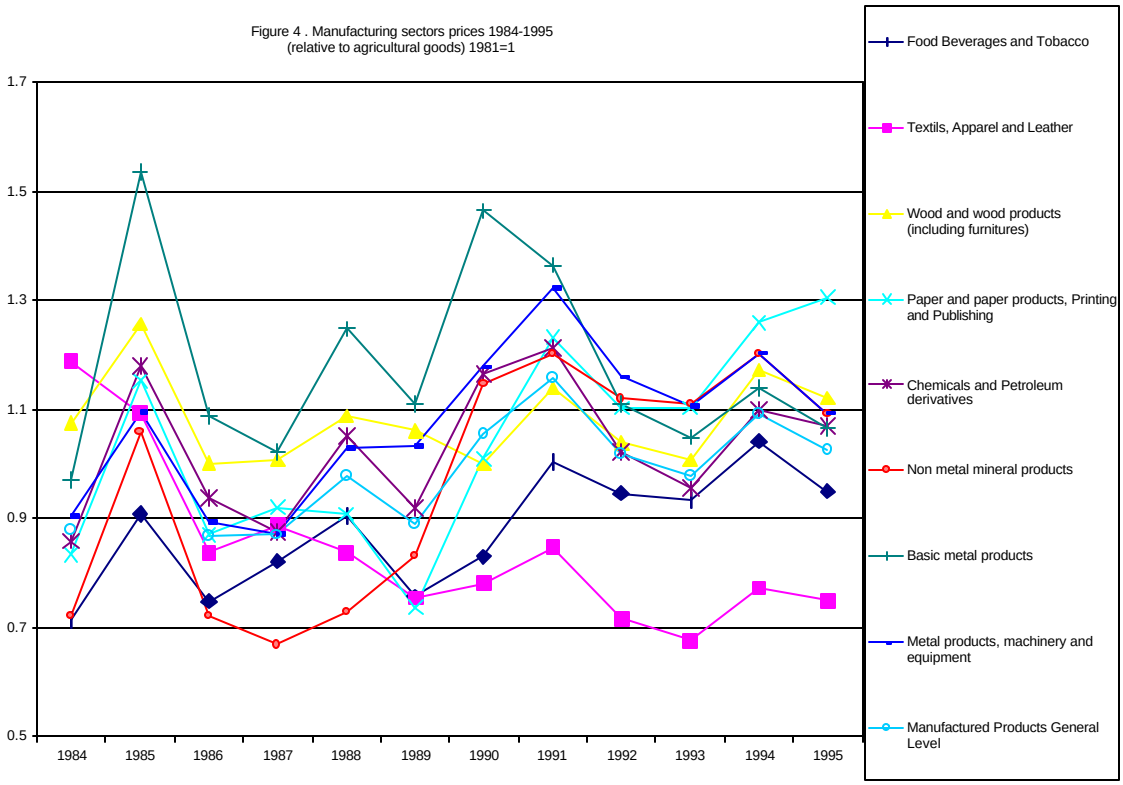


Figure 5. Manufacturing sectors prices (relative to consumer price index) 1984-1995

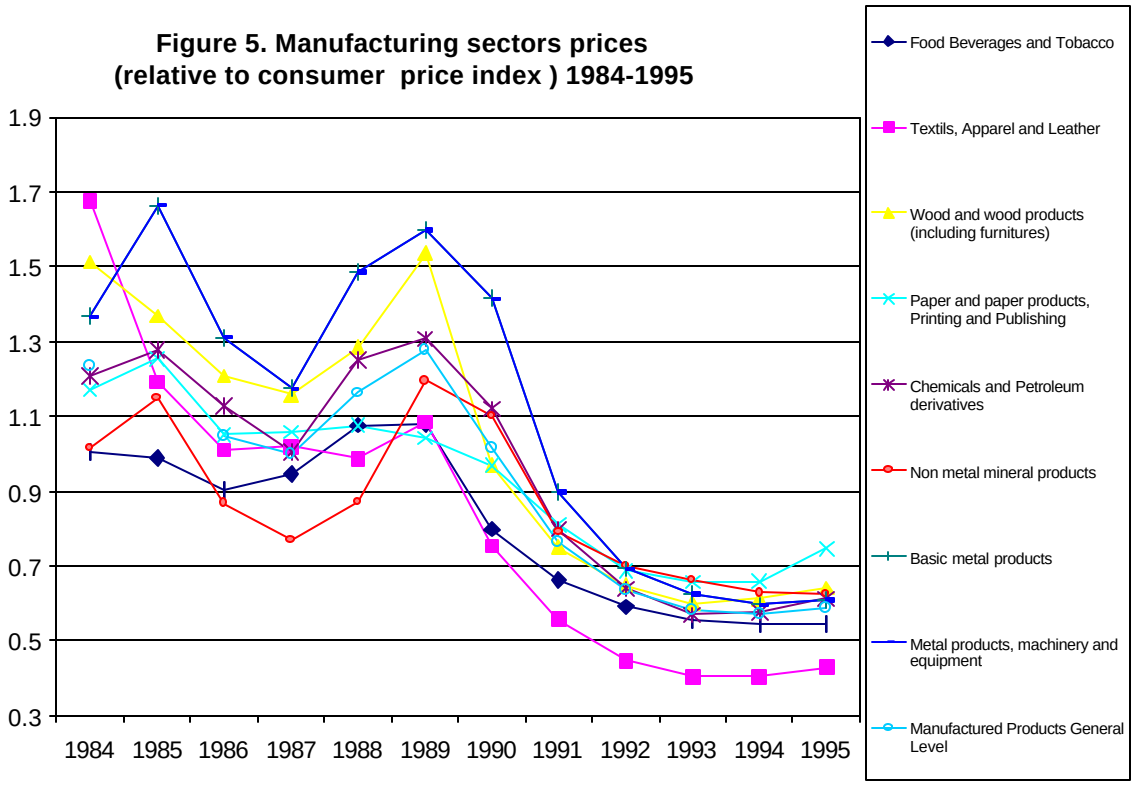
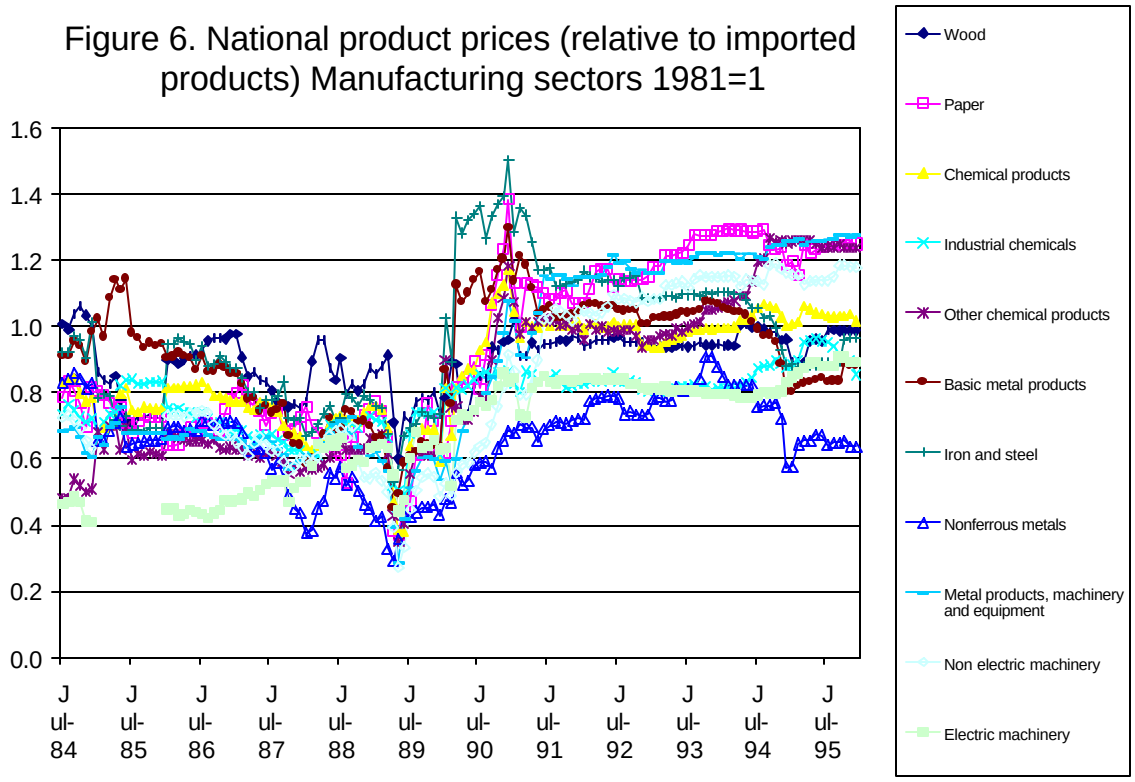


Figure 6. National product prices (relative to imported products) Manufacturing sectors 1981=1



But how much this decline in industrial prices could have affected relative wages? Well as predicted by HO this will depend on whether the declining prices were the strongest in those sectors that were more intensive in less skilled labor. Table 9 shows an estimation of unskilled labor intensity by sector using the household survey. We observe that apparel, textiles, leader products, furniture are among the sectors more intensive in unskilled sectors. We already showed that some of these sectors suffered significant declines in prices and in employment together with a significant increase in import supply. More formally, we can test a key implication of H-O theory by performing a range correlation between prices change and unskilled labor intensity. A significant and negative correlation (meaning prices decline for the most unskilled intensive sectors) would give us room to be confident about the role that trade openness played in the rise of wage inequality. The result of that estimation is, nevertheless, not too strong. The Spearman correlation coefficient is negative, but significant only at 10% level.

Table 9

Factor intensity skill/unskill - 2-digit economic sectors

	Average93-95	
	unskilled	skilled
Medical, Ophtalmic, watches, clocks,etc.	56.4	43.6
Printing and publishing	62.7	37.3
Audio, video, TV, and communication equipment	71.0	29.0
Chemical products	73.0	27.0
Petroleum destilery	73.8	26.2
Paper production and paper products	80.0	20.0
Machinery and equipment	80.9	19.1
Rubber and Plastic products	82.8	17.2
Total Manufacturing	84.7	15.3
Motor vehicles and equipment	85.8	14.2
Engines and Electric equipment	86.4	13.6
Food and Beverages	86.6	13.4
Wood production (non furnitures)	86.8	13.2
Other Transportation equipment	86.9	13.1
Metal products (Non machinery and equipment)	88.4	11.6
Non metal mineral products	88.9	11.1
Furnitures and manufacturing industries	89.6	10.5
Textil products	89.7	10.3
Apparel	92.1	7.9
Basic metals	93.1	6.9
Leather, footwear	98.1	1.9

Nota: Tobacco and Computer, accounting and office equipment are excluded because of lack of significance due to fery few observations

We conclude this section with a note of caution. On general terms, and at a high level of aggregation, we find that after trade liberalization, trade flows, industrial employment and relatives prices move according to what a H-O model would predict for an economy like Argentina. Still, so far we find rather weak evidence that trade liberalization would have played a central role in explaining the observed increase in wage inequality since the beginning of the nineties. In other to tackle this question more rigorously, in the next section, we perform an econometric analysis based on micro data.

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

In this section we study whether the deepened of trade liberalization has impacted on the distribution of wages. In particular, we test, using micro data, whether or not those manufacturing sectors where import penetration relative to the sector value added deepened are, *ceteris paribus*, the sectors where a higher increase in wage inequality by skill group occurred. As shown in the previous section import penetration has largely increased in most manufacturing sectors during the 90s. Still the pattern was not uniform across sectors. We want to investigate whether, after we control for several individual characteristics, it is the case that the relative wages widened comparatively more in those activities that faced strongest competition from foreign markets.

Hence, in order to test the hypothesis that trade competition shapes wage inequality we estimate the coefficients of the following regression function:

$$Log(w_{ijt}) = \sum_{g\_1} ds_{ig} a_{gt} + \sum_{g} ds_{ijg}\ m_{jt}\ a_{gm} + \sum_{c\_1} dt_{ic} f_{ct} + f_t(age_{it}) + dsex_i\ j_t + c_t + m_j + u_{ijt} \quad (1)$$

where ds_{ig} is a dummy variable that indicates schooling group g, and α_{gt} is a schooling effect in period t; m_{jt} measures the logarithm of the ratio of imports to value added in the manufacturing sector j in period t. dt_{ic} a is dummy variable that indicates tenure group and f_{ct} is the tenure effect in period t. The tenure groups are: (0,1), [1,5), [5,10), [10,20) and [20,20+). $f_t(age_{it})$ is a non-linear function of the age of individual i in period t, which is linear in the coefficients to be estimated. $dsex_i$ is a dummy variable indicating whether or not individual i is male 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 of individual i that works in sector j during period t.

Thus, 100 times α_{gm} measures the percentage increase in the wage premium of skill group g as a response to a one percentage point increase in m_j. Consequently, α_{gm} are the parameters of interest. Given our hypothesis, that is, relative wages widened

comparatively more in those activities that faced strongest competition from foreign markets and the evidence gathered in section 2, we expect the difference of the coefficients of the skilled group and any other group to be positive. Additionally, given the evidence presented in section 2, we may also expect these differences to be statistically similar.

Note that our estimates of the impact of import penetration on wage inequality are not necessarily an estimate of the whole effect (the general equilibrium effect). For example, if the deepening of trade shift the labor demand against the unskilled in some sectors it should affect the relative wages of the group in the whole economy. Still, there are several mechanisms through which an increase in import penetration may widen income inequality in the sectors affected in relation to the rest of the economy. Our test evaluates exactly this differential effect in the manufacturing sectors. If we do not find any effect, still (theoretically) import penetration may be shaping wage inequality. Instead, if we do find a direct effect of import penetration on wage inequality, this would consequently be a lower bound to the general equilibrium effect (direct and indirect effects).

Note the similitude of our regression model and the wage curve model of Blanchflower and Oswald (1994). We control both for period fixed-effect and sector-fixed effect. Thus, our model does not provide information about the level of wages by sector because we are conditioning our estimates on the sample means by sector. In our model the curve is drawn in the plane of wage premium and sector import penetration instead. The mapping of our model to the suggested picture is straightforward whenever the wage premium of the unskilled group does not vary by sector.

As we already mentioned in section 2, we concentrate exclusively on describing the changes in the industry wage structure during the sample period. Therefore, we exclude from the sample self-employed, owner-managers and unpaid workers. Employee students are also excluded from the sample. Finally, we exclude from the sample those observations with missing data. 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.

The micro-data (individual data) used comes from the household survey for the period 1993-1998 for both waves of the year. Thus, the period effect refers to the wave-year effect. The data of imports and value added by sector at the two digit levels is taken from Argentine International Trade Comision.

Table 10 presents the results of the estimation of equation (1). Following the results presented in section 2, we estimate the regression function (1) both for the whole sample and for the male workers. The estimated coefficients are as expected. Wages increase with the education level, age and tenure of the individual. The age and tenure profiles do not present irregularities (although there seems that the wage differential in the first year of tenure is not statistically significant) and appears to some extent stable during the period studied. A male always earns more than a female and the male wage differential has increased in the period studied from around 12 percent to slightly above 20 percent. Interestingly enough, the year effects are not significant although average wages in the economy decreased since 1994.8

The main result of our paper are the following: we find evidence that shows that in those manufacturing sectors where the import penetration increased the most, wage inequality also widened relatively more in favor of the most skilled workers. The coefficient of the skilled group is positive and higher than the coefficient of the other two skill groups. Indeed, the other two coefficients are not statistically different from zero at conventional levels of significance. Thus, the impact of import penetration on wages is statistically significant (see test I and II in table 10). Therefore, we have shown that the difference of the coefficients of the skilled group and any other group is positive and statistically significant. Additionally, it is straightforward to see that the differences between the coefficients of the skilled and the semi-skilled group and the skilled and the

8 The manufacturing sector is the unionized sector and hence, this result confirms that wages are less responsive to shocks in the unionized sector than in the non-unionized sector.

unskilled group are similar. Finally, it is worth reporting that the coefficients of the semi-skilled and skilled groups maintaining constant the level of imports to value added do not present any trend during the period studied.

Table 10: Wage inequality and trade liberalization: An empirical test

Skill Group	Whole Sample		Males	
	Coefficients	Standard errors	Coefficients	Standard errors
$\alpha_{unskilledm}$ (1)	0.065	0.049	0.049	0.054
$\alpha_{semi\text{-}skilledm}$ (2)	0.054	0.049	0.044	0.056
$\alpha_{skilledm}$ (3)	0.115 *	0.05	0.122 *	0.062
Test I: (1) = (3)	F(1,6849) = 3.8 P-value = 0.05		F(1,5200) = 5.3 P-value = 0.02	
Test II: (2) = (3)	F(1,6849) = 4.9 P-value = 0.03		F(1,5200) = 4.3 P-value = 0.02	
Sample size	6933		5322	

* Statistically different from zero at the 0.05 level of significance.

Consequently, we find that there is scope for trade liberalization to explain the increase of the skilled group wage premium during the 90s. As we reported, we do not find any trend in the wage premium of the skilled group for a worker that does not face any import penetration at all. Thus, at least partially, the aggregate trends on wage differentials we presented in section 2 may be explained by the impact on trade liberalization on wages. However, the identified effect of trade liberalization on wage inequality does not explain much. Average (weighted by employment) imports to sector value added increased approximately 45 percent during the period studied. Hence, for example, the direct increase in the male skilled wage premium due to trade liberalization in the manufacturing sector is approximately 5 percentage points which is

only 10 percent of the increase in the male skilled wage premium during the same period (for the whole economy).

Thus, we conclude that we have found evidence that the increase in import penetration in the manufacturing sector has contributed to increase wage inequality in Argentina, hurting the less skilled (unskilled and semi-skilled) workers. Nevertheless the identified effect does not seem to be main cause of growing wage inequality during the 90s.

VI. Concluding remarks.

In this paper we investigated the relationship between trade openness and wage inequality. There are a priori ground to think this relationship has been present in Argentina given the fact that, as we showed, the wage of skilled labor (college graduates) has been rising since the beginning of the nineties, coincidentally with the implementation of the trade liberalization policies..

To study this relationship we combined aggregate data compiled at the industry level with micro-data coming from household surveys. This approach allows us to define skilled labor in terms of precise educational categories and more important we can control for a number of individual characteristics (sex, age, work experience, etc.) that also affect wages and which cannot taken into account when working with data at industry level. In terms of educational attainment, we work with three categories: unskilled (those individuals who at most have attend high school but have not finished it), semi-skilled (those that just finished high school) and skilled workers (those that finished a tertiary degree).

We find that trade flows, industrial employment and relatives prices have moved after trade liberalization according to what a simple version of the Heckscher-Ohlin (H-O) model would have predicted for an economy like Argentina. When performing the micro-data analysis we also find evidence that trade liberalization has increased the college wage premium. Still, similarly with what have been found for some developed economies, trade deepening can

explain a relative small proportion of the observed rise in wage inequality. In particular , the direct increase in the male skilled wage premium due to trade liberalization in the manufacturing sector is approximately 5 percentage points which is only 10 percent of the increase in the male skilled wage premium during the same period (for the whole economy).

More work needs to be done in order to evaluate the robustness of our results. On one hand we plan to add more regions to our micro-data set. That is at this stage we have use only the data corresponding to the area of Buenos Aires. We plan to add to the sample the data corresponding to Cordoba, Mendoza and Santa Fe, provinces that are also very strong in industrial activities. Equally important, and to be more consistent with trade theory, we plan to add two-digit industry prices as indicators of trade openness.

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