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THE IMPACT OF INTERNATIONAL TRADE ON WAGE INEQUALITY RECENT EVIDENCE FROM ARGENTINA

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ABSTRACT

Wage inequality in Argentina has substantially changed in the last decade. During this period there were also significant changes in the macroeconomic and trade policy. This paper studies the impact of the international trade changes on the wage structure of Argentina between 1998 and 2006. Particularly, with microdata of household survey, we test the effect of import penetration and export intensity on the wage inequality on industrial sectors. The main outcome of the paper is that the effects were significant, generating a higher dispersion in the case of the imports and a higher equity in the case of the export.

RESUMEN

La desigualdad salarial en Argentina cambió profundamente durante la última década. Durante este periodo también hubo cambios significativos en la política macroeconómica y comercial. En este trabajo se investiga cuál fue el impacto de los cambios en el comercio exterior sobre la estructura salarial Argentina entre los años 1998 y 2006. En particular, se testea cuál fue el efecto de la penetración de importaciones y la intensidad de las exportaciones sobre la desigualdad salarial a nivel de subsectores industriales. Se encuentra evidencia que indica que los efectos fueron significativos, generando una mayor dispersión en el caso de las importaciones y una mayor equidad en el caso de las exportaciones.

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I. Introduction[1]

In the beginning of the 90s a deep and intensive program of liberalization of the trade and financial sectors took place in Argentina, which impacted rapidly on the trade and financial flows of the country. In the trade sector the liberalization measures were implemented unilaterally as well as through international agreements. In the first case the program included reductions in nominal protections and the quantitative restrictions. The average external tariff was reduced from 45 percent in 1988 to 12 percent in 1991 and all the importing and exporting quotas were eliminated[2]. These measures were complemented by the liberalization of regional trade through the subscription to the MERCOSUR treaty in 1991, which members (Argentina, Brazil, Paraguay and Uruguay) committed to establish free trade inside the region.

The impact of these measures on trade flows was reflected by an increase of the trade value of almost 400 percent between 1990 and 1998, while the participation of international trade in the GDP increased by 80 percent, from approximately 7 percent in 1990 to 12 percent in 1998. However, this increase in trade intensity was mainly based on imports and, according to Kosacoff and Ramos (2001) while the export coefficient (exports over the gross value of production) rose from 7.4 percent at the end of the 80s to 10.8 percent at the end of the 90s, the participation of imports in the gross value of production in the same period grew from 7.4 percent to 18.5 percent. This situation caused the country to move from a balanced industrial trade to a negative balance equal to 7.7 percent of industrial production. Accordingly, this growth in international trade came together with a significant expansion of the deficit in the current account, which doubled in only 2 years between 1992 and 1994[3].

1. We are thankful to Alfonso Herranz Loncan and Andrea Szok for their technical support which was very important for this paper, referee of REPBA and commentators of XLV annual meeting of AAEP for their thoughtful remarks.

2. Except the car industry in which the car importing quota was maintained.

3. According to the National Institute of Statistics and Census (INDEC).

In reference to this topic, Galiani and Sanguinetti (2003) have proved the significant increase of international competition that the domestic industry had to deal with. Disaggregating trade data by industry, they have pointed out that, since 1990, almost all industrial sectors suffered an increase in the import penetration index (calculated as imports over the gross added value per industry).

In short, in Argentina free trade meant basically free imports. The growing and sudden international competition had a significant impact on the employment structure. While the Argentinean economy grew steadily by 6 percent annually between 1990 and 1998, Galiani and Sanguinetti (2003) indicated that approximately a third of the country's industrial employment was destroyed between 1992 and 1996. Beker (2005) shows that one out of five employments in the industrial sector disappeared each year and only half of them were replaced. The same author states that during the 90s the rate of industrial employment destruction exceeded that of employment generation by a proportion that went from 36 to 65 percent.

Thus, during the 90s there was a clear change on the Argentinean productive and employment structure. The intense economic growth was biased towards non trading sectors, while the other sectors were losing importance within production and employment. The other face of employment loss in the industrial sector was the strong growth of employment in the service sector. Boosted in part by the financial liberalization and the great amount of international capital flow that entered the country between 1990 and 1998, employment in the "financial and business services" sector grew by 67 percent, while the "social and personal services" and "transport and communication" sectors grew by 23 and 43 percent respectively.

These changes in the employment structure had a considerable impact on the income distribution and particularly on the wage differentials by educational level (or skill wage premium). Gasparini, Marchioni and Sosa Ecudero (2001) stated that the Gini coefficient increased shar-

ply from 40.0 in 1991 to 47.4 in 1998. During the 90s Argentina lost its traditional characteristic of being one of the most egalitarian countries of Latin America, a region whose average Gini coefficient was 49.0 in 1998[4].

More to the point, Gasparini (1999, p. 125) states that: "*the change in the demand of work towards more skilled workers has been faster than the change in the supply, which results in a relative increase in the wages of the groups with higher incomes. A higher wage inequality means a higher income inequality*". Related to this, Galiani and Sanguinetti (2003) illustrate the effects that free trade had over wage inequality. The authors test whether those sectors where the import penetration index increased most were also the sectors where the inequality increase was higher, and they found a positive and significant association between the import penetration index and the skill wage premium during the nineties[5].

Since January 2002 there was a change in the economic model and trade policy of the country. After four years of economic depression and being unable to deal with the international financial commitments, Argentina decided to cease payments to external creditors and devaluated the national currency, derogating the exchange convertibility law that for the last 11 years had established a parity Argentinean peso-dollar, causing an important exchange slowdown and negatively influencing international competitiveness of the domestic industry.

In order to moderate the effect of the new exchange rate regime on relative prices and to strengthen the fiscal balance some measures were taken. Firstly, export taxes, which had been eliminated at the beginning of the nineties, were reestablished. In addition, the trading policy took a more "defensive" focus, in order to encourage "reindustrialization", employment creation and growth. Due to the restrictions to operate on

4. See Londoño-Székely (1998).

5. The relation between overall wage inequality and skill wage premiums has not been studied for Argentina. However, for the United States, Lemieux (2006) finds that 60 percent of the increase in overall wage inequality from 1973 to 2003 is accounted for by the expansion in educational wage differentials, and especially by the rise in the premium to post-secondary schooling.

the tariff side, due to multilateral and preferential commitments, the government appealed to a more aggressive legislation of trade defense and to the establishment ad hoc protection measures.

These changes had important consequences on trade characteristics. The openness coefficient, estimated to be the sum of exports plus imports over the GDP, rose from 11 percent in the triennial 1996-1998 to 22 percent in 2006[6]. However, in this case, the trade expansion did not have an importing bias but it was due to the performance of exports, which doubled their value in dollars between 1996 (highest peak before 2002) and 2007.

The modification of the macroeconomic regime at the beginning of 2002 started a period of steady and accelerated growth, where the dynamics of the external sector, through exports, were an important factor of the boost of the depressed industrial production. Imports, following the economic cycle, also grew considerably. In 2006 they were over the highest value reached in 1998. Nevertheless, the exporting boost determined that the cycle initiated in 2002 was dominated by a constant surplus in the balance of trade.

The purpose of this work is to determine how these recent changes in trading policies have affected wage inequality in the industrial sector and, more exactly, the wage differentials by education level (or skill wage premium). We are trying to answer the following questions: Which has the relationship between trade flow (import and export) and wage inequality in the industrial sector been since the end of nineties to the present? And, has the change in the trading model after 2002 meant a change on the wage structure of the Argentinean industry?

In order to do this, firstly, we have studied the evolution of the skill wage premium in the industrial sector for the period between 1998 and 2006 and, secondly, we have analyzed the relationship between the international trade indicators (exports and imports intensity) and the skill wage premium. By categorizing workers in three different levels accor-

6. See Kosacoff and Ramos (2001)

ding to their education level, the model and the econometric technique used allows determining the relation between trade flows and wage differences among groups.

The paper is organized as follows. In the next section we will document the evolution of wage inequality in Argentina throughout the period studied (1998-2006). Section 3 describes the changes that took place after 2002 in the employment and trading structures. Section 4 identifies the theoretical framework in which the empiric analysis takes place, which is introduced on section 5, where the impact that the trading flow has had on wage inequality in the period under analysis is assessed. Finally, section 6 summarizes the main conclusions.

II. The Recent Evolution of Argentinean Wage Inequality

Most of the developed economies have experienced an increase on the wage dispersion during the last decades. Goldin and Katz (2007) show how the educational wage differentials sharply increased in the United States from the beginning of the eighties to 2005. In the same way, Autor, Katz and Kearney (2005) show that college-high school wage premium in the United States sharply rose in the eighties, and went on increasing at a more moderate rate in the nineties. Acemoglu (2003) also illustrates the increase of educational wage premium during the 80s and 90s in the United States and the United Kingdom, and indicates that the same trend is present, even though with less intensity in the continental European economies. In the case of Latin America, Goldberg and Pavcnik (2007) have highlighted the increasing educational wage differentials that dominated the 80s and the 90s in a series of referential countries of the region (Mexico, Argentina, Brazil, Colombia and Chile), highlighting that in Colombia and Argentina the trend started in the 90s, together with the trading reforms. Behrman, Birdsall and Székely (2007) have conducted a panel study of 18 countries of Latin America for the period between 1977 and 1998, underlining also the growth of the educational wage premium.

In the particular case of Argentina, Galiani (2000), Gasparini (1999) and Galiani and Sanguinetti (2003) show that, contrary to what happened in many developed countries and most Latin American countries, the wage differentials by educational level did not increase in the 80s. The trend towards an increasing wage inequality started in the 90s. These studies agree that, during the 80s, the wages of semi-skilled workers deteriorated in relation to unskilled workers and that the latter did not lose positions in relation to skilled workers. In the 90s the situation was different, since the semi-skilled workers wage did not deteriorate in relation to the unskilled ones, but the semi-skilled and the unskilled wages lost ground compared to skilled workers' wages. More specifically, the wage premium for skilled workers increased annually on an average of 10 percent during the 90s.

In this section we study the most recent evolution of the skill wage premium among workers of all urban agglomerates around the Argentinean territory. For this purpose, we define three educational groups: unskilled (workers that have not finished secondary school), semi-skilled (workers that have finished secondary school) and skilled (workers that have a university or college degree). Self-employed, owners and unpaid workers are excluded from the study, limiting the work to paid employed workers.

The estimation of the skill wage premium has been carried out through the wage equation developed by Mincer (1974) with the log hourly wage of each worker explained by individual worker characteristics. The main variables of interest are two binary variables that indicates whether the worker is skilled, semi-skilled or unskilled

$$\ln(w_i) = \exp_i \delta + f(\exp_i) + dsex_i \varepsilon + ds_i^1 \alpha^1 + ds_i^2 \alpha^2 + \varepsilon_i \qquad (1)$$

Subscript i denotes individuals, the dependent variable is the logarithm of the hourly wage and, as explanatory variables, we include two binary variables (ds^1 for the semi-skilled and ds^2 for the skilled), the ex-

perience, a quadratic function of experience and gender. The wage data has been collected from the second wave (October of each year) of the household survey (HS) for all urban agglomerates of Argentina carried out by the Instituto Nacional de Estadisticas y Censos (INDEC). The study was carried out from 1998 until 2006, the last year in which the HS was published.

The hourly wage is calculated by dividing the monthly payment of the main occupation of the surveyed individual at the moment of the interview by the weekly work hours multiplied by 4.33. The experience is conventionally defined as age minus education years minus six. A cross-section estimation has been done for each of the 9 years between 1998 and 2006. The coefficient signs for all variables in all years are consistent with the theory of human capital. The experience has a positive coefficient, the square experience has a negative one and the wages grow with the level of education. In addition, being a woman implies a wage of approximately 15 percent less than a man. Table A.1 and A.2 in the annex presents the results of the estimations of equation (1) for 7 years under consideration.

Regarding the coefficient of the educational dummy variables (α^1 and α^2) in each of the annual estimations of equation (1), the following table summarizes the evolution (in percentages) of skill wage premium for the period 1998-2006 for all sectors of the economy.

Table 1. Skill wage premium in all sectors, in percentages (base: unskilled workers wages)

Educational Level	1998	1999	2000	2001	2002	2003	2004	2005	2006
Semi skilled	67,88	64,9	70,69	68,5	63,73	61,53	58,5	64,84	63,8
Skilled	217,29	197,72	215,28	217,46	201,58	199,19	194,44	206,64	203,18

Source: elaborated by the authors from data of INDEC, HS

The table allows us to observe that the increasing wage inequality that caracterized the 90s was interrupted during the last years of the

century. In addition, after 2001, coinciding with the macroeconomic and trade policy change, the wages of both skilled and semi-skilled workers significantly deteriorated compared to the unskilled ones. In the case of semi-skilled workers, whereas in 2000 and 2001 the difference was of 71 and 69 percent respectively, in 2002 this difference decreased to 64 percent and in 2004 it reached a low peak of 59 percent. Later on, there was a recovery, even though the gap continued to be lower than before 2002. For skilled workers, the trend is similar, with a decline in relation to the unskilled workers from 2002. In 2000 and 2001 the wage difference between these two groups was 215 and 217 percent respectively, in 2003 it reached a low peak of 194 percent and then stayed below the levels previous to 2002.

Table 2 provides the same data for the industrial sector, which will be the objective of analysis in the next sections of the paper.

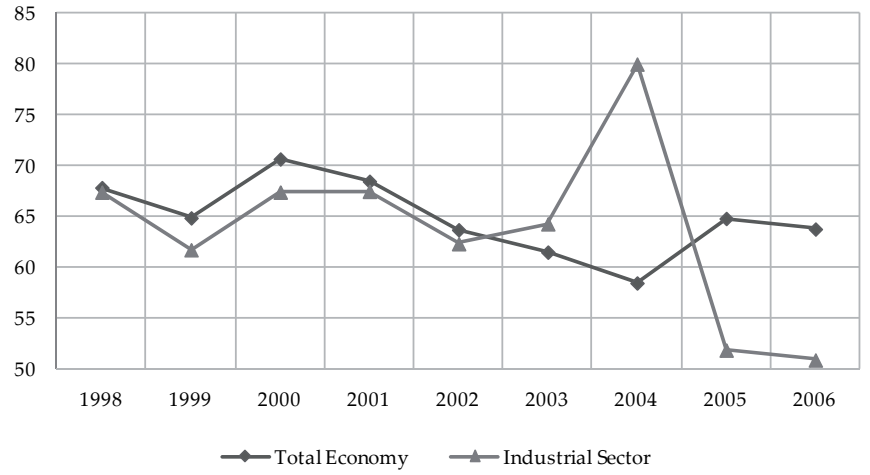
Table 2. Skill wage premium in the industrial sector, in percentages (base: unskilled workers wages)

Educational Level	1998	1999	2000	2001	2002	2003	2004	2005	2006
Semi skilled	67,43	61,76	67,43	67,51	62,36	64,31	80,02	51,9	50,92
Skilled	259,84	194,69	260,87	239,12	209,29	225,2	293,21	176,77	162,87

Source: elaborated by the authors from data of INDEC, HS

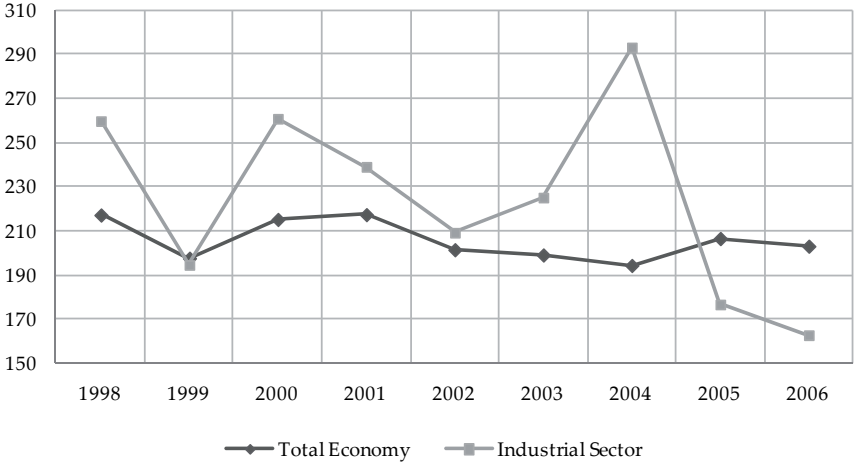
In the industrial sector the trends are similar to those of the whole economy but more intensively. Although the evolution is not monotonic, after 2001 skilled workers' wages significantly deteriorated compared to the unskilled workers. In 2001 the wage difference between these two groups was 239 percent, while in the year 2006 it had fallen to 163 percent. Semi skilled workers' wages also deteriorated compared to the unskilled workers' ones, but with less intensity. The spotted difference in 2001 was 68 percent and, by 2006, it had dropped to 51 percent. Figures 1 and 2 summarize the information of Tables 1 and 2.

Figure 1. Wage difference between semi-skilled and unskilled workers (percentages) (semi-skill premium)



Source: elaborated by the authors from data of INDEC, HS

Figure 2. Wage differences between skilled and unskilled workers (percentage) (skill premium)



Source: elaborated by the authors from data of INDEC, HS

To sum up, from the previous analysis we can observe that the trend towards an increasing wage inequality that was present during the nineties and well documented in the previously mentioned studies, was reversed after the changes in economic policy in 2002. Between this year and 2006, in the economy as a whole as well as in the industrial sector, wage differences among the three educational groups were considerably reduced.

The literature suggests two main potential reasons, related to labor demand, to explain the changes in the educational wage differentials or the skill premium. The first one is technological change. Many papers, such as Acemoglu (2003), Autor, Levy and Murnane (2003) and Goldin and Katz (2007) state that the skill-biased technological change which took place in particular sectors of the economy from the 80s is responsible for a relatively faster increase in the demand for skilled labor, which caused an increase in the price of this factor due to the deficient reaction from the supply. As Goldin and Katz put it: *"The race had been lost to technology"*.

The second explanation, which is the one that inspired this paper, focuses on the role of international trade as responsible for changes in the relative wages. This explanation is more used in developing countries, where the technological change is slower, than in developed countries, and can be understood on the basis of the Heckscher-Ohlin model, according to which each country specializes on the production of those goods that use intensively production factors with which it is abundantly endowed. International trade allows this specialization, since each country will obtain through trading those goods that use intensively production factors with which they are not endowed. In this case, the exchange of goods would be an indirect form of production factors exchange. As long as each country exports those goods that use intensively the most abundant production factors, the prices of those goods tend to increase, compared to their prices without trade (since there is a new demand from the rest of the world) and, accordingly, the country's most abun-

dant factors, which are used intensively in their production, benefit because their retribution increases.

Galiani and Sanguinetti (2003) indicate that the liberalization of trade in the nineties, as mentioned in the introduction, was mainly an import liberalization (or in Lovely and Richardson (2000) terms, a trading shock on imports), and that it considerably affected wage inequality and employment structure. In particular, the industrial sector faced a strong competition from the international markets that reflected a dramatic increase on the import penetration index. Given that the industrial sector in Argentina employs more intensively unskilled work, the higher competition negatively affected the production of this sector and therefore the demand of unskilled workers, which suffered deterioration in their wages compared to skilled workers during the nineties. The opposite effect should be found after 2002. Our hypothesis is that the change on the trading policy caused a positive shock on the demand of industrial production, through exports. Being this sector in Argentina, as indicated above, relatively intensive in unskilled work, the demand of this group of workers and therefore their retribution had to improve compared to the other educational groups, which would be consistent with the evolution of wage differences from 2002 that has been shown before. Particularly, we should observe that, in those industries where exports increased more compared to imports, the less skilled workers retribution increased also relatively more compared to the more skilled ones. The rest of the paper tries to contrast this hypothesis rigorously.

III. The New Argentinean Economic Model: Trade Flows and Employment Structure

In the previous sections we mentioned the change of the macroeconomic policy that took place in Argentina after January 2002. From a strictly commercial point of view this change meant moving from a trading policy with an importing bias (predominant during the 90s) to another with an exporting bias. In reference to this topic, Galiani and Sanguinetti

(2003) underline that the import penetration index, calculated as the ratio of imports over the gross added value by industry, increased for the whole industrial sector from 5.7 percent in 1990 to 19 percent in 1999.

Table 3 shows the evolution of the external sector of the main industries of the country, taken at the 2-digit level. We have calculated a net import index as the ratio between imports minus exports and the gross added value by industry, which reflects the import or the export bias of each sub sector. A negative index implies that the industry exports more than what it imports. The last two columns of the Table 3 "int rel" and "ext rel", state the internal and external relevance of each industry in 2006.

Table 3. Index of net imports (imports minus exports over the gross added value per industry) -in percentages-

Industrial Sectors	1998	2000	2001	2002	2003	2005	2006	Rel. Int†	Rel. Ext‡
Food products and beverages	-47,96	-40,42	-39,72	-53,11	-64,10	-74,02	-80,98	27,32	21,05
Tobacco	-4,26	-4,64	1,94	1,19	0,53	2,57	1,80	0,70	0,06
Textiles Products	29,39	21,86	18,51	-12,30	10,60	19,54	21,97	3,55	1,74
Paper and paper products	38,17	28,43	23,87	0,18	1,65	8,34	6,97	4,33	2,05
Printing and Publishing	8,23	9,58	8,32	-0,81	-0,44	1,26	1,56	2,89	0,33
Petroleum destillery	-9,85	-32,46	-39,51	-59,43	-73,87	-72,15	-94,65	4,96	7,49
Chemicals and chemical products	41,23	34,30	25,90	11,97	18,91	23,57	25,71	19,79	17,70
Rubber and plastics products	29,95	25,28	21,51	0,62	12,79	17,32	19,13	4,58	2,46
Other non-metallic mineral products	17,19	16,22	11,74	-1,69	2,01	6,11	7,84	3,33	0,82
Basic metals	-0,34	-9,20	-10,85	-19,28	-14,73	-12,05	-12,69	8,53	4,17
Metal products (non machinery and equip.)	139,16	169,65	148,23	31,44	57,66	132,78	152,58	10,50	19,37
Motor vehicles, trailers and semi-trailers	47,37	22,42	1,28	-35,69	-13,60	48,03	34,50	9,53	16,70
TOTAL INDUSTRIAL SECTOR	**24,87**	**14,90**	**5,64**	**-23,05**	**-15,79**	**-0,83**	**-1,90**	100,00	

† *Internal relevance: ratio between the gross added value of each subsector and the gross added value of the whole industrial sector, multiplied by 100.*

‡ *External relevance: ratio between the sum of imports and exports of each subsector and the sum of exports and imports of the whole industrial sector multiplied by 100.*

Source: elaborated by the authors from data provided by ALADI and INDEC

To create the net import index of each subsector we proceeded as follows. The gross added value per industry can not be obtained from the information coming from the national accounts, since the agencies in

charge of its publication do not present it with such level of detail. Therefore, the information has been built taking into the account the annual industrial survey of the year 2002, the last published survey that the INDEC has carried out. In this survey, INDEC assessed the gross added value per industry. Even though this information is presented following the guidelines of the ISIC rev. 3 classifications, some sectors are not included and some others are grouped. Actually, **(i)** it does not include the blocks "clothing manufacturing, finishing and fur dying", "leather finishing and dressing, leather products manufacturing, etc" and "producing wood and manufacturing wood and cork products, except furniture; straw product manufacturing and braiding products"; **(ii)** the block of "textile products includes cotton and knitting spinning", according to the section 17 of the ISIC-3, while the sector of Synthetic and Artificial Fibers are integrated in the block Chemical Substances and Products; **(iii)** the blocks "metal products manufacturing except machinery and equipment", "machinery and n.c.p. equipment manufacturing", "office, accounting and technology machinery manufacturing", "manufacturing of machinery and n.c.p. electronic devices", "manufacturing of communication, television and radio devices", "manufacturing of medical, optical and watch manufacturing equipment", and "manufacturing of n.c.p transportation equipment" are added to the block "metal mechanic excluding car industry."

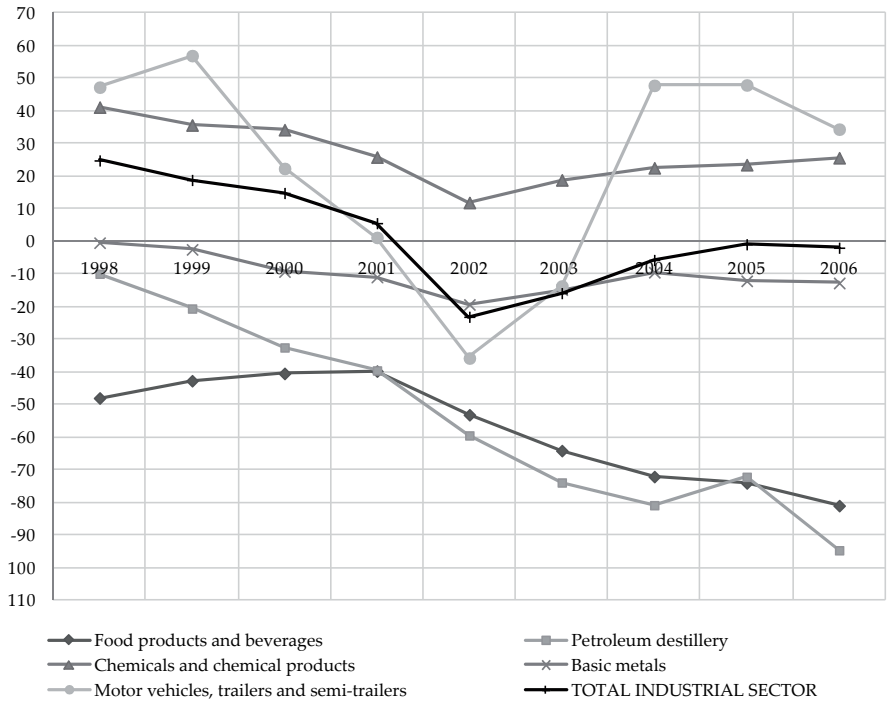
Following the information on gross added value per industry that we find on the annual survey of 2002, the "annual industrial estimator", also published by INDEC, has been used to assess its evolution for the rest of the years subject to analysis. This estimator is an index that measures the annual variation of the gross added value per industry.

The information on Argentinean international trade is provided by the Asociación Latinoamericana de Integracion (ALADI) following the ISIC rev.3 classification. However, to conciliate it with the information of the gross added value per industry, as INDEC presents it, import and export data have been reorganized as described in the previous paragraph.

The figures shown in Table 3 indicate that, in contrast with the import

bias that characterized the previous stage, the commercial expansion initiated after 2002 has had a clear export bias in the case of the industrial sector. For the entire sector, if we compare 1998 (last year with economic growth of the previous stage) to 2006, we can point out a significant fall of the net import index, from a 24.87 to a -1.90 percent, which reflects that we have moved from an industrial sector with an important trade deficit in 1998 to an industrial sector with a surplus. We can observe a wide variability among industries; however, in most of them the index has decreased, especially among the five most relevant industries from the internal and external point of view, this can be observed in figure 3.

Figure 3. Net imports index to the principal industries (imports minus exports over the gross added value per industry) -in percentages-



Source: elaborated by the authors with data provided by ALADI and INDEC

In reference to employment, several papers, mentioned in the introduction, document that during the nineties there was a significant change in the employment structure in Argentina. In fact, the industrial sector suffered a considerable destruction of employment in favor of the service sector. However, after the year 2002 the trend was reversed and a sharp recovery on employment in the industry began.

The information presented in Table 4 illustrates the evolution of employment per sector for the period 1998-2006. Data was obtained from the household survey (HS) carried out by INDEC. For 2003 we don't have the necessary information to identify the sector that the surveyed individual belongs to and therefore it is not included in the analysis. We can observe that the trend of industrial employment destruction in favor of the service sector present during the decade of the nineties continued until 2002. In contrast, after that year a recovery on employment in all the sectors of the economy took place, with the characteristic that the employment on the industrial and construction sector was stronger than that of the remaining sectors. This implied an increase in the share of industrial employment to total employment of the economy. Whereas employment in the industrial sector increased by 31 percent between 2002 and 2006, employment in the service sector and in the total economy increased between 15 and 18 percent respectively during those same years.

Table 4. Average annual employment per sector (thousands)

Sectors	1998	1999	2000	2001	2002	2004	2005	2006
Industrial	1.252	1.206	1.159	1.104	1.075	1.360	1.359	1.410
Contruction	691	687	640	563	555	731	823	884
Commerce, restaurants and hotel	1.888	1.882	1.983	1.905	1.830	2.266	2.267	2.399
Transport, storage and commun.	620	699	679	629	612	647	648	644
Financial and business services	786	823	815	727	779	820	905	999
Personal and social services	2.813	2.869	2.914	2.925	3.436	3.369	3.415	3.509
Other sectors*	167	161	158	153	181	217	218	167
Total employment	**8.217**	**8.327**	**8.348**	**8.006**	**8.468**	**9.410**	**9.635**	**10.012**

**other sectors includes: 'Primary activities', 'Electricity, water and gas supply' and 'Extraterritorial organizations and organs'*

Source: INDEC

Table A.3 summarizes the evolution of the industrial employment index for the entire sector, discriminating by industry. We can see that until 2002 there was a progressive and systematic fall in all the industries, but later the trend was dramatically reversed and an accelerated recovery of employment started in all sub sectors. For the entire sector the index fell from 100 to 69 between 1997 and 2002, year in which the recovery started until it reached a level of 90 in the year 2006.

Finally, Table 5 presents the share of skilled workers employed in the industrial and service sectors and the whole economy. We can observe that the service sector is more intensive in skilled work than the industrial sector. In fact, the portion of skilled work in the industrial sector is the lowest of the economy.

Table 5. Share of skilled workers per sector (percentages)

	1998	2000	2004	2006
Total Economy	25,90	27,50	28,80	29,20
Industrial Sector	16,30	18,20	19,20	19,10
Service Sector	36,60	37,30	37,70	38,90

Source: INDEC, HS

In this section we have demonstrated how the industrial sector broke in 2002 the dominant trend of the 90s, enjoying a significant boost after this date. Clearly, commercial expansion with and export bias was an important factor for this change. If we also take into account, as Table 5 shows, that the industrial sector employs a greater portion of less skilled workers than other sectors, then the changes on trade policy that took place since 2002 should have had some effect on the skill wage premiums calculated in section 2. The objective of the following sections is to prove econometrically the presence and relevance of those effects.

IV. Relation Between Trade and Inequality: The Model

In this section we present the model that we use to analyze the link between trade flows and the skill wage premiums, and in the next section we will apply this model to estimate the relation between wage inequality and trade flows across industries in Argentina.

Following Lovely and Richardson (2000), in this study we use a model that leaves out the neoclassic assumption of perfect mobility among sectors and allows the existence of specific wage compensations among industries[7]. In the model each company considers the wage as given and pays a premium to workers to compensate them for certain characteristics associated to employment in each industrial sector in particular. This premium can obey to reasons like: specific required skills for the companies of a sector, disutility for a higher effort, hazardous working conditions, longer working weeks, etc. The companies face three different labor markets: unskilled, semi-skilled and skilled, and the premium paid on top of the given wage can differ among markets. The (dis)utility that a worker obtains from being employed by a particular industry varies within the population. Workers, in each market, choose to be employed by the industry that (minimizes) maximizes their (dis)utility. This characteristic of the labor force supposes that in each of the three market types, a firm of a specific industry faces an upward-sloping supply curve. Conventionally, the demand curve for each type of work is downward sloping.

The model proposed by Lovely and Richardson (2000) perceives the changes in the trade volume as a shock that only affects the demand of labor, without altering the supply. Changes are external to the industry and are produced by changes in the world demand of production of a certain industry. The model allows the treatment of those changes as an exogenous increase or reduction on the expense of final manufacturing.

7. There is wide evidence in favor of wage differences among industries. Kruger and Summer (1988), Katz and Summers (1989) and Gannon et al. (2007) indicate the existence of those differences and credit them to compensations related to the specific human capital that a specific sector uses and the correlation between being part of an industry and the non observed capacities of the workers.

Particularly, an exporting shock increases the domestic production of final goods and, on the contrary, an importing shock reduces, via substitution, the domestic production. The effect the shocks have over the skill wage premia will depend on the composition (or intensity) of the workload in the affected industries. If the production in these industries is intensive in a specific type of work, an export shock will make the demand curve in this market go up, increasing the premium that must be paid to this group of workers compared to other groups. On the other hand, an importing shock reduces the domestic final goods production. If the affected industries employ a certain type of work, the demand curve in that market will fall, reducing the premium that has to be paid to this group of workers compared to the other groups. There are other channels where international trade can affect the wage differentials based on education but they are not identified in this study.

Taking into account the previous paragraph and that in the previous section we have documented that the Argentinean industrial sector is relatively intensive in unskilled work, trade shocks will affect more the demand of this labor force than the demand of workers with some qualification. Since the liberation of trade in the nineties represented an intense increase in the import penetration index, Galiani and Sanguinetti (2003) have identified a positive relationship between the import penetration index on an industrial level and skill wage premium, highlighting that those industries where the import penetration index increased most are the ones where wage inequality increased most as well.

As it has been stated, after 2002 there was a change in trade policy and imports as well as exports started to increase at a fast pace, even thought export increase was more intense. This change should have had important effect on wage inequality. Following Lovely and Richardson (2000), it is expected that the increase on the exports (imports) was associated to a recovery (deterioration) of the relative wage of less skilled workers compared to the more skilled workers within the industrial sector. Given the Argentinean economy's characteristics described on sec-

tion 3, this effect would be in line with the reduction of wage inequality based on education, detected after 2002.

In this context, we specify the following regression function:

$$\ln(w_{ijt}) = \exp_{ijt}\delta + f_t(\exp_{ijt}) + dsex_{ijt}\varepsilon + \sum ds_{ijgt}\pi_{ijt}\alpha_{gs} + \sum ds_{ijgt}m_{jt}\beta_{gm} + \sum ds_{ijgt}x_{jt}\phi_{gx} + \sum ds_{ijgt}h_{jt}\psi_{gh} + c_t + \pi_j + u_{ijt} \quad (2)$$

Where w_{ijt} is the hourly wage of the individual i in the industry j at the moment t, ds_{ijgt} is a dummy variable that indicates the education level g of the individual i in the period t, π_{ijt} is a dummy variable that indicates the industry j in which the individual i works and α_{gs} is the average wage premium per educational level g paid in the industry j during the period of the sample. The coefficient β_{gm} and ϕ_{gx} indicate the correlation of these premiums with the trading variables m_{jt} and x_{jt}. The first is defined as the import penetration index computed as the ratio of imports and gross added value of the industry j at the moment t and the second as the export intensity index computed as the ratio of exports and gross added value of the industry j at the moment t. The experience of the individual is represented by the variable exp_{ijt} and δ is the effect of the experience on wages. f_t ($\exp_{ijt}$) is a quadratic function of the experience of the individual. $dsex_{ijt}$ is a dummy variable that indicates the gender of the individual and ε is its effect on wages. C_t is the constant in the period t (fixed effects per period), π_j is the fixed effect per industry and u_{ijt} is the error term for the individual i working in the industry j at the moment t.

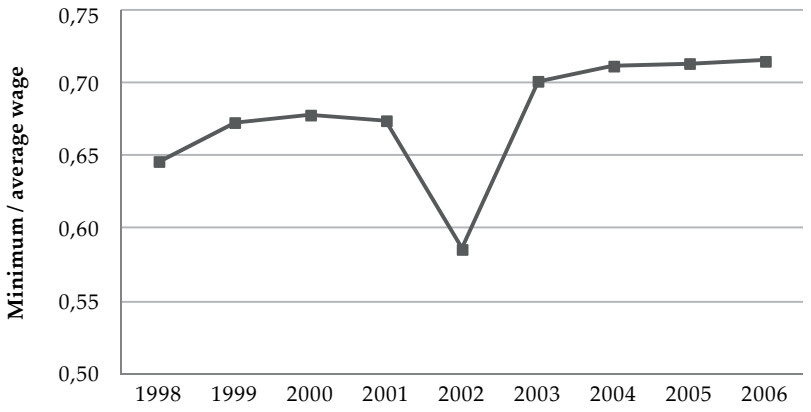
We can find that toughness of the regulation imposed by intensity of collective bargaining can affect inequality wage and skill premium. Since 2003 there has been a boom period in collective bargaining. According to data from Ministry of Labor of Argentina, whereas in the 90s an average of 187 annual bargainings had been approved, in 2003 380 bargainings were approved, in 2004 348 were approved, in 2005 568 and finally in 2006 were approved 930 collective bargaining. The number of

workers included in the bargaining followed a similar pattern; in the 90s were less than one million of worker in average for year, in 2006, the bargainings collective covered 3.5 million workers. This evolution could mean a significant impact on skill premium, so we need control this effect.

Following Machin and Manning (1994) and obtaining data by industry of minimum and average wage from the ministry of labor of Argentina we have created a measure of "toughness" respesented by the share of the minimum wage in the average wage. If this measure increases it could mean that the inequality wage decreases. Figure 4 shows how the toughness measure has changed over the time for all workers included in the collective bargaining. Effectively we observed that the measure has increased since 2003.

In equation (2) h_{ij} is the "toughness" measure in the industry j at the moment t, we incorporate it in interaction with dummy variables that indicate the education level g of the individual i in the period t, so the coefficient ψ indicates the correlation of skill premium with the toughness measure.

Figure 4. Toughness measure for all workers in industrial sector



Source: elaborated by the authors with data provided by MTESS

It is common to interpret the data panel models through its error components. The error term included in the equation (2) can be broken down as follows:

$$u_{ijt} = \mu_i + \theta_t + \pi_j + \varepsilon_{it}$$

μ_i represents the non observable effects that differ among the individuals but not overtime; we identify θ_t with the non quantifiable effects that vary over time but not among the units of study, π_j reflects the non quantifiable effects that vary among industries and ε_{it} refers to the purely random error term.

V. Data and Estimation Results

In this section we research the impact of trade flows on wage inequality in the industrial sector in Argentina for the period between 1998 and 2006. Using micro data of a panel form we test the effect of imports and exports on the skill wage premium. Actually, after controlling for other factors, including heterogeneity among workers, we investigate if those sectors in which exports increased more than imports are also the sectors in which, *ceteris paribus,* skill wage premium decreased relatively more. The correlation between the educational premium and trade flows are identified by making the trading variables interact with the level of education.

Data

The microdata used in the estimation are provided by the Household Survey (HS) that the INDEC carries out annually. It affects all the urban agglomerates around the country and is statistically representative of the entire urban population. Each survey contains data of approximately 1,000,000 individuals each year, but in this study the sample is limited to workers with a positive remuneration in the industrial sector, which reduced the amount of individuals to approximately 2,000 per year from 1998 to 2006, a total of 18,000 observations.

The hourly wage, the experience and the education are defined as indicated in section 3. In the HS, each individual is assigned to an industrial sector following the classification ISIC rev. 3 until 2001 and CAES–MERCOSUR from 2002. However, following the criteria presented in section 3, the industrial activities are reorganized and grouped, resulting on a total of twelve industrial sectors that, together with the rest of the variables of specification (2), are detailed in annex A (Table A.4 and A.5).

Results

According to the equation (2) we estimate the relation between the logarithm of the hourly wage in the main occupation of the surveyed and the following variables: individual characteristics of the worker, dummy variables per industrial sector, interaction between dummy variables per industry and dummy variables per education level, import penetration, export intensity and their interaction with the dummy variables per level of education. In this study the main objective is to determine which was the impact of the trade variables on wage inequality. In this sense the interest coefficients are β and ϕ, that reflect the interaction among the trade and education variables; the sign of these coefficients is interpreted as the sign of the correlation between trade flows and the wage premium received by each educational group.

To determine the right specification we use the *F-test,* which provides a formal evidence to validate the use of a model with or without restrictions (related, in this case, to the inclusion or not of temporal effects). The substantial increase in the value of R^2 in the model without restrictions, where the restrictions are nine (one for each year) implies that, through the F-test, we validate the use of this model, meaning the inclusion of temporal effects. To determine if the estimation must be done including fixed or random effects we follow the standard procedure, the Haussmann test, which rejects the null hypothesis of absence of correlation between the error term and the explanatory variables, indicating that random effect estimators are inconsistent. Therefore, fixed temporal effects as well as

fixed effects per industrial sector have been included in the estimation.

Table 6 shows the correlation between the variables penetration of imports and intensity of the exports and the educational wage premium for the groups of the semi-skilled and skilled workers (base group: unskilled workers). The left part of the table contains the results of the regression (2). The only coefficient that is not significant is the one that relates the import penetration to the skilled worker premiums (those with university or college education). The other coefficients are significant and show that international trade generates distributional conflicts, since it hast opposite effects on the wages of the unskilled workers and of the workers with some sort of skill. The signs of the coefficients imply that an increase in the intensity of the exports reduces the premium paid to the semi-skilled and skilled workers compared to the unskilled workers and the increase on the import penetration tends to increase the premium paid to semi-skilled workers compared to the unskilled ones. Furthermore, workers with some skill, in industries with a high intensity of exports and a low penetration of imports receive a lower premium for their skills. The toughness variable is significant for semi-skill premiums.

Table 6: Impact of the trade variables on the semi skill-skill premium (base group: unskilled workers)
-coefficient and errors std. of the regression (2)-

	Panel with fixed effects		Panel with structural change	
	Semi-skill premium	Skill premium	Semi-skill premium	Skill premium
Export Intensity	-0,001683	-0,006922	-0,006811	-0,016119
	(0,000968)*	(0,001719)***	(0,001805)***	(0,000740)***
Import Penetration	0,001863	-0,000133	0,0022498	-0,000056
	(0,000584)***	(0,001084)	(0,000793)***	(-0,0011277)
Toughness	-0,040273	-0,033651	-0,041129	-0,0370977
	(0,187335)**	(0,321788)	(0,190035)**	(0,406522)
	R-squared = 0.415561		R-squared = 0.389109	
	Prob (F-statistic) = 0.000000		Prob (F-statistic) = 0.000000	

****Significant to 1% - **Significant to 5% - *Significant to 10%*
Note: dependent variable is logarithm of hourly wage. Observations: 16752, individuals: 2771

In reference to the intensity of the effects, an increase of 10 percent in the intensity of exports in a specific industry or in a certain year implies a reduction of the premium paid to skilled and semi-skilled workers compared to unskilled workers of 6.9 percent and a 1.7 percent respectively. On the other hand, in those industries or years in which there was an increase of 10 percent in the penetration of imports, the premium paid to semi-skilled workers increased by 1.8 percent compared to the wage of the unskilled workers. In reference to toughness, an increase of 10 percent in minimum wage in relation to average wage in a particular industry or some year implies a reduction of the premium paid to semi skilled workers compared to unskilled workers by 41.1 percent.

The effects found are consistent with the evolution of wage inequality described on section 2. Even though partially, the evolution of wage inequality between 1998 and 2006 can be explained on the basis of the international trade evolution. In reference to exports, taking into account that, on average, the intensity of the exports in the industrial sector increased by 23 percent between 1998 and 2006, this would imply a decrease in wage differentials between skilled and unskilled workers of 15.9 percent, 12.3 percent between skilled and semi-skilled workers and almost 4 percent between semi-skilled and unskilled workers. In reference to import penetration, it does not have an important effect because it almost didn't change in this period. Taking into account that, between 1998 and 2006, the average in the industrial sector decreased by 5 percent, this would imply a reduction of 0.9 percent among the wages of the semi-skilled and unskilled workers (the relation between import penetration and wage premium to skilled worker is not significant under the adopted specification). In any case, the evolution of international trade between 1998 and 2006 had an equalitarian effect among the education-based wages.[8]

The changes in the macroeconomic and trade policies that have taken place in Argentina after 2002 could have been translated into a structu-

8. To illustrate the existence and magnitude of the inter-industry wage premiums in annex B we include the coefficient of the dummy variables per industry and its significance.

ral change in the estimated model, meaning that the coefficients of regression (2) might have not been constant throughout the entire period. In order to assess the stability of the model (2) we introduce a dummy variable that divides the period of the sample in two parts: 1998-2001 and 2002-2006. The dummy variable is introduced to consider a change in the intercept of the model as well as a change in the coefficient of the interest variables, i.e. the interaction of the level of education with the trading variables. The results are shown on the right part of Table 6.

When we introduce a structural change, the signs of the coefficient remain as in the previous specification and all of them, except the interaction between the import penetration and the premium to skilled workers, are significant at the 1 percent level. According to those results, the distribution conflict generated by international trade would be sharper than the one reflected in the first part of the panel and the evolution of international trade between 1998 and 2006 would explain a bigger portion of the trend of wage inequality described in section 2. In the case of the exports, the increase in their intensity that took place between 1998 and 2006 would have implied a reduction of wage differentials between skilled and unskilled workers of 37 percent, of 22 percent between skilled and semi-skilled workers and 15 percent between semi-skilled and unskilled workers. In reference to the reduction of the import penetration between 1998 and 2006, it would have generated a reduction of 1.10 percent between the wages of semi-skilled and unskilled workers. As in the specification without structural change, the relation between import penetration and wage premium to skilled workers is not significant.

In annex B an alternative focus is included, to estimate the correlation between the skill wage premium and trading flows.

VI. Conclusions

The economic debate about the effects of globalization on the growth seems to have reached a consensus in the past years, and in general it is accepted that, even though some sectors are affected negatively, its

effects on average growth are positive. However, the distributive implications of globalization are ambiguous, varying according to the country, the moment in history and the intensity and extension of the measures which tend to globalize.

This paper has focused on one of many implications of globalization, assessing the distributive effect of international trade on industrial workers in Argentina in the period 1998-2006. Combining data of industrial sub sectors to microdata coming from household surveys, we have tested the effects of import penetration and the intensity of exports on the wage differential based on education. The results of the estimation indicate that once we control for the individual and specific characteristics of the industry, international trade has significant and important effects on wage inequality. Moreover, it is observed that wage differentials among workers with different skill levels tend to increase in industries or years with a high rate of import penetration and a low rate of export intensity. On the contrary, we observe that in industries or years with a low rate of import penetration and a high rate of export intensity, wage differentials tend to decrease.

These effects are consistent with the evolution of wage inequality and the trends of the trade flows during the analyzed period. Until 2001 Argentinean international trade was characterized by a clear importing bias, consistent with the increasing skill wage premia. After 2002, changes in the macroeconomic and trade policies modified the trading profile and started a period where industrial exports grew at a much faster pace than industrial imports. This change of trading profile is also consistent with the reduction in the skill wage premiums observed after 2002.

Another relevant finding is that the evolution of international trade, besides having a significant impact on wage inequality, explains an important part of its evolution. Particularly, the evolution of international trade between 1998 and 2006 would explain a fall in the wage differentials between skilled and unskilled workers of up to 37 percent and between semi-skilled and unskilled workers of 15 percent. In the first case it

is almost 40 percent of the total fall of the period and, in the second case, it represents 80 percent.

In summary, we can conclude that international trade has had clear effects on the evolution of wage inequality among Argentinean industrial workers and in addition, these effects have been among the most important explanatory factors of the evolution of wage inequality during the period 1998-2006.

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Annex A

Table A.1. Estimated coefficients in regression (1) for all sectors of the economy

Variable	1998	2000	2001	2002	2003	2004	2006
Constant	0,201076 (0,012894)	0,116866 (0,015232)	0,079820 (0,016619)	0,081966 (0,015721)	0,213909 (0,015359	0,378959 (0,014056)	0,797942 (0,011736)
Experience	0,044985 (0,001050)	0,043822 (0,001196)	0,042911 (0,001317)	0,043549 (0,001200)	0,039456 (0,001146)	0,037192 (0,001082)	0,038214 (0,000911)
Experience^2	-0,000628 (2,10E-05)	-0,000592 (2,36E-05)	-0,000567 (2,61E-05)	-0,000573 (2,32E-05)	-0,000493 (2,22E-05)	-0,000457 (2,11E-05)	-0,000491 (1,77E-05)
Gener (binary)	-0,113517 (0,008234)	-0,103976 (0,009271)	-0,092163 (0,010053)	-0,092956 (0,009069)	-0,091919 (0,008920)	-0,134586 (0,008270)	-0,176443 (0,007141)
Semi skilled (binary)	0,518087 (0,009319)	0,534666 (0,010523)	0,521762 (0,011426)	0,493049 (0,010428)	0,479557 (0,010392)	0,460556 (0,009684)	0,493782 (0,008191)
Skilled (binary)	1,154659 (0,012445)	1,148280 (0,013905)	1,155204 (0,014927)	1,103881 (0,013659)	1,095906 (0,013057)	1,079920 (0,012191)	1,109169 (0,010393)
R-squared	0,315922	0,301709	0,286587	0,294182	0,288562	0,287772	0,280412
Adj, R-squared	0,31577	0,301521	0,28638	0,293989	0,288382	0,287607	0,280302
Observations	22530	18604	17247	18239	19761	21599	32739
Prob (F-statistic)	0	0	0	0	0	0	0

All coefficients are significant at 1%.
Dependent variable is the logarithm of hourly wage – Base Group: unskilled workers
Source: Elaborated by the authors from data of INDEC, HS

Table A.2. Estimated coefficients in regression (1) for industrial sector

Variable	1998	2000	2001	2002	2003	2004	2006
Constant	0,172839 (0,034945)	0,066688 (0,043725)	0,029090 (0,048306)	0,047623 (0,052950)	0,199980 (0,047758)	0,413722 (0,039031)	1,017679 (0,034614)
Experience	0,051913 (0,003012)	0,053271 (0,003740)	0,049307 (0,003867)	0,047416 (0,004368)	0,040812 (0,003710)	0,069555 (0,001082)	0,032031 (0,002763)
Experience^2	-0,000768 (6,01E-05)	-0,000830 (7,54E-05)	-0,000669 (7,371E-05)	-0,000633 (8,45E-05)	-0,000474 (6,94E-05)	-0,000979 (4,69E-05)	-0,000400 (5,37E-05)
Gener (binary)	-0,160770 (0,026462)	-0,123465 (0,031645)	-0,122612 (0,035248)	-0,205691 (0,035642)	-0,186906 (0,033115)	-0,197571 (0,028013)	-0,218930 (0,024708)
Semi skilled (binary)	0,515440 (0,024656)	0,515423 (0,029539)	0,515868 (0,033234)	0,484682 (0,033975)	0,496571 (0,032425)	0,587918 (0,023701)	0,411579 (0,023266)
Skilled (binary)	1,289597 (0,054122)	1,283349 (0,055969)	1,221193 (0,063394)	1,129103 (0,061161)	1,179258 (0,055280)	1,369187 (0,047809)	0,966490 (0,039417)
R-squared	0,282649	0,276374	0,244852	0,244971	0,288562	0,227442	0,188626
Adj, R-squared	0,281339	0,274591	0,242739	0,242697	0,288382	0,226131	0,18747
Observations	2743	2036	1792	1666	1916	2363	3516
Prob(F-statistic)	0	0	0	0	0	0	0

All coefficients are significant at 1%
Dependent variable is the logarithm of hourly wage – Base Group: unskilled workers
Source: Elaborated by the authors from data of INDEC, HS

Table A.3. Industrial employment index per subsector (base 197=100)

Industrial Sectors	1998	2000	2001	2002	2003	2005	2006
Food products and beverages	96,88	88,46	84,76	80,50	84,50	95,47	97,77
Tobacco	86,38	76,77	85,65	98,86	100,71	126,10	122,95
Textiles products	90,35	72,44	69,74	61,11	68,13	78,61	81,98
Apparel	93,89	73,51	65,30	53,67	56,55	71,91	76,91
Leather and footwear	96,98	90,97	84,64	77,06	87,86	94,05	93,73
Wood production (non-furniture)	100,74	84,24	78,23	71,14	75,87	87,80	90,95
Paper production and paper products	88,69	77,00	73,97	69,98	70,35	81,47	86,19
Printing and Publishing	102,94	93,88	88,12	78,12	76,10	82,34	83,98
Petroleum Distillery	99,73	88,72	87,13	87,47	86,97	91,19	94,32
Chemicals and chemical products	98,15	89,10	85,01	80,72	83,21	94,03	98,00
Rubber and plastics products	99,08	84,57	80,39	75,51	80,95	90,27	94,35
Other non-metalic mineral products	94,79	77,74	69,65	58,07	60,45	76,27	84,83
Basic Metals	97,61	83,70	79,24	73,91	77,49	87,91	90,59
Metal products (non-machinery and equip.)	96,49	77,25	66,86	56,93	60,83	74,55	81,37
Machinery and equipment	102,35	80,27	72,74	65,09	70,89	96,02	106,56
Electrical machinery and apparatus	97,10	72,77	67,87	57,87	62,45	74,24	80,27
Radio, television and communication	99,49	80,55	67,81	48,05	48,76	77,95	93,75
Medical, ophthalmic, watchs, etc.	95,96	75,12	72,44	64,73	66,53	79,19	85,20
Motor vehicles	99,46	67,02	59,27	49,85	48,58	65,77	76,03
Other transport equipments	100,41	89,67	85,21	76,51	78,39	94,29	104,04
Furniture and manufacturing n.e.c	99,79	82,37	73,53	61,56	62,04	71,46	75,96
Total Industrial Sector	**96,98**	**82,14**	**76,73**	**69,71**	**73,33**	**85,87**	**90,46**

Source: INDEC, Monthly Industrial Survey

Table A.4. Descriptions of the variables used in the regression (2)

Variable	Details
Experience	Age of the individual minus the years of Studies minus six
Sex	0 if is a man -1 if is a woman
Education	Unskilled: workers that did not complete high school education
	Semi-skilled: workers that completed high school education
	Skilled: workers that completed college or university education
Industry	Defines the twelve sectors: food and drink manufacturing, tobacco goods manufacturing, textile manufacturing, paper and paper derivates manufacturing, publishing, printing and reproduction of records activities, coke (fuel), refinery products, nuclear fuel and oil manufacturing; chemical substances and products manufacturing, rubber and plastic manufacturing; other non metallic mineral products manufacturing; standard metal products manufacturing; metal mechanic industry except car industry, car manufacturing.
Import penetration	Imports on the gross added value of the industrial sector.
Export intensity	Exports over the gross added value of the industrial sector.

Table A.5. Dummy variable coefficient per industry in the estimation (2) (base: Chemicals and chemical products)

Industries	Coefficients	*p-value*
Motor vehicles, trailers and semi-trailers	0.150101	0.051278
Rubber and plastics products	0.039378	0.037345
Printing and publishing	0.060932	0.041395
Petroleum distillery	0.364132	0.091104
Textiles products	-0.050713	0.032684
Basic metals	0.108490	0.045851
Metal products (non- machinery and equipment)	-0.046369	0.044221
Other non-metallic mineral products	-0.322635	0.037568
Paper and paper products	-0.075219	0.044565
Tobacco	0.085881	0.127197
Food products and beverages	-0.212219	0.040617

Annex B. Alternative approach: two-stage regression

The alternative approach proposes estimation in two-stages to capture the correlation between skill premium and trade flows. This approach was used by Lovely and Richardson (2000) and similar one was used by Katz and Summers (1989).

In the first stage of this procedure industry wage premiums are estimated. The dependent variable is logarithm of hourly wage of individual *i* in the industry *j* and, as explanatory variables, we include individual worker characteristics and interaction between dummy variables per industry and dummy variables per education level. We estimate the following set of equations for each of the 9 years between 1998 and 2006:

$$\ln(w_{ij}) = \exp_{ij}\delta + f(\exp_{ij}) + dsex_{ij}\varepsilon + \sum ds_{ijg}\pi_{ij}\alpha_{gs} + \varepsilon_{ij} \qquad (3)$$

The variables of estimation (3) are defined as estimation (2). Because our data include 12 industries and 9 sample years, we estimate 108 coefficients to each education level: semi skilled and skilled. These sets of estimated premiums are used as dependent variable in a second-stage regression, designed to estimate the relationship between skilled and semi-skilled wage premiums and industry-specific trade flows.

The regressions in second stage take the form:

$$\alpha_l = m_{jt}\beta_l + x_{jt}\varphi_l + \mu_{jt}\,; \quad j = 1,\ldots, J;\ t = 1,\ldots, T \qquad (4)$$

$$\alpha_h = m_{jt}\beta_h + x_{jt}\varphi_h + \eta_{jt}\,; \quad j = 1,\ldots, J;\ t = 1,\ldots, T \qquad (5)$$

Where, α_l is semi-skill wage premium in each industrial sector to each of the annual estimations in the first stage and α_h is the skill wage premium in each industrial sector to each of the annual estimations in the first stage; m_{jt} *and* x_{jt} represent the import penetration and export intensity, respectively, in the industry *j* in the period *t*. μ and η are random error terms. As discussed by Lovely and Richardson (2000), the dependent variables in the second stage are themselves estimated regression coeffi-

cients. Hence, the disturbances in these regressions are heteroscedastic. Because the exact form of the heteroscedasticity in these regressions is not known, we use White´s method to estimate robust standard errors for the second stage coefficients. We obtained the following results

Table B.1. two-stage estimation: correlation between trade flow and semi-skill wage premium

Variable	Coefficient	Std. Error	*p-value*
Constant	0.536536	0.030449	0.0000
Export intensity	-0.000319	0.001136	0.7794
Import penetration	0.000198	0.000273	0.4693
R-squared= 0.579947			
Prob(F-statistic)= 0.000000			

Note: dependent variable is interaction between semi-skill premium and industry dummy variables (coefficients estimated in regression (3))

Table B.2. two-stage estimation: correlation between trade flow and skill wage premium

Variable	Coefficient	Std. Error	*p-value*
Constant	1.357286	0.041581	0.0000
Export intensity	-0.003761	0.001525	0.0155
Import penetration	-0.001187	0.000701	0.0936
R-squared= 0.307847			
Prob(F-statistic)= 0.000832			

Note: dependent variable is interaction between skill premium and industry dummy variables (coefficients estimated in regression (3))

The upper panel shows the correlation between trade flows and semi-skill wage premium. The sign of these coefficients is consistent with the evolution of inequality wage between 1998 and 2006, moreover they are

the same as those obtained in specification (2); however, are not significant. The results in lower panel show the correlation between trade flows and skill wage premium. The sign of coefficients are consistent with specification (2). In this case, export is consistent at 10% and import at 5%.