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Economic Commission for Latin America and the Caribbean (ECLAC)

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Abstract

Using the results of seven nationally and regionally representative household surveys, this study analyzes the impact of trade liberalization on wage inequality through a channel in which applied tariffs, owing to the preferential margin given under numerous preferential trade agreements, would affect industry wage premiums during the 1992–2006 period in Chile. I find the skill premiums for high-skilled workers there to have decreased, especially after 2000; this circumstance is unlike that seen in most other Latin American countries or during Chile's initial reform period. The results of econometric analyses show that industries which experienced larger tariff reductions were those with initially higher shares of low-skilled workers and lower industry wage premiums, and a statistically significant negative relationship between applied tariffs and industry wage premiums, that is, tariff reductions contributed to an increase in initially lower industry wage premiums. However, the impacts of applied tariffs on industry wage premiums disappear, after controlling for unobservable time-invariant industry characteristics during the 2000–2006 period. Thus, I find no statistically significant relationship between applied tariffs and industry wage premiums. The findings suggest that, unlike a theoretical assumption that tariff reduction-induced productivity improvements lead to increases in industry wage premiums, industries with initially higher productivity tend to have lower applied tariffs and higher wage premiums in such a short time-period. Therefore, I cannot conclude that bi- or multilateral trade liberalization during this period has contributed to wage equalization through a channel in which applied tariffs affect industry wage premiums.

JEL classifications: F15, F16, and O15.

Key words: Chile, Applied tariffs, Industry wage premiums, Wage inequality.

Introduction

A number of previous studies have attempted to econometrically analyze the impacts of trade liberalization on wage distribution in Latin American countries (henceforth LACs). Many of the findings of those studies, whether based on country-specific or cross-country evidence, suggest that trade liberalization has adverse effects on wage distribution, except in a few cases.[1]

In order to explain the findings, which seem to contradict the traditional assumption inherent in Heckscher–Ohlin–Samuelson theory, Goldberg and Pavcnik (2007) provide comprehensive discussion based on an abundant body of empirical research. In summarizing the main points of discussion, two main explanations are provided. The first line of explanation for those findings focuses on between-industry changes. Those studies note that, contrary to expectations, unskilled labor-intensive sectors were in fact protected the most, prior to trade liberalization, and that they experienced the largest tariff reductions during trade liberalization. Therefore, the rise in wage inequality is exactly what Stolper-Samuelson would predict. On the other hand, the second line of explanation focuses on within-industry changes. According to those studies, one of the main factors contributing to the rise in wage inequality is an increase in demand for more skilled workers within industries, that is, skill-biased technological change (henceforth SBTC). This increase was caused by an increase in cheaper imports of capital goods that are complementary to skilled workers and defensive innovation caused by intensified competition from abroad after trade liberalization.

From this viewpoint, the experiences of Chile since the 1990s provide a very interesting case. First, during the 1990–2006 period, Chile —the first of the LACs to introduce a free-market strategy— had already implemented main economic reforms and its economic situation was relatively stable, unlike those of other LACs. Especially, Chile continued with trade liberalization via the enforcement of preferential trade agreements (henceforth PTAs) in this period, which will be discussed in greater detail in the second section. Second, Chile has succeeded in expanding nontraditional natural resource-based exports (e.g., fruit, forestry, fisheries), and so Chile has been the most successful LAC in terms of export-led growth.

Concerning the analytical methodology, we explore a variety of possible approaches to identify the impacts of trade liberalization on wage inequality. This study uses tariffs as measures of trade liberalization and analyzes the impacts of trade liberalization on wage inequality, through a channel in which tariffs would affect industry wage premiums, defined “as the part of worker wages that cannot be

1 Concerning the specific-country evidence of Latin American countries, Giordano and Florez (2009) summarize the methods and results of each study.

explained by observable workers' characteristics, but can be attributed to workers' industry affiliations" (Goldberg and Pavcnik 2007: 70); they can also be interpreted as the relative wage of each industry after controlling for observable workers' characteristics. Focusing on industry wage premiums allows us to show, quite clearly, the impacts of tariffs on wage inequality; different industries employ different proportions of skilled and unskilled workers, and the extent of tariff reductions will differ by industry. Thus, under the assumption that there is a lack of labor mobility, changes in industry wage premiums would translate into changes in the relative incomes of skilled and unskilled workers (Pavcnik et al. 2004; Perry and Olarreaga 2006). Therefore, the objective of this study is to analyze empirically whether trade liberalization in Chile has produced a distributional impact during a period in which the country had implemented important economic reforms and has continued with its sustained open economy strategy, focusing on industry wage premiums. For this purpose, this study takes advantage of data obtained through a series of comprehensive nationally representative household surveys, *Encuesta de Caracterización Socioeconómica Nacional* (henceforth CASEN); it also makes use of applied tariff rates, which are actually applied to imports as a part of PTA enforcement.

This paper is organized as follows. The first section reviews previous studies. The second section overviews the main feature of trade policy during the period in question. The third section describes the data and estimates skill premiums as measures of wage inequality, as well as industry wage premiums, in the first-stage estimation. The fourth section econometrically analyzes the relationship between tariffs and industry wage premiums in the second-stage estimation. The conclusions are summarized in the final section.

I. Literature review

Although the experiences of Chile provide a very interesting case —in that Chile was the first country to introduce trade liberalization and is the most successful case of export-led growth strategy among the LACs—, very few studies deal with the topic of trade liberalization in Chile. Beyer et al. (1999), the most frequently cited study on this topic in Chile, find that trade liberalization, measured as the volume of trade over GDP, widened the gap of wage premiums between skilled and unskilled labor during the 1960–1996 period. They argue that SBTC and the relative increase in demand for skilled labor in natural resource-based export sectors[2] following trade liberalization are the two main explanations for the results. Robbins (1994) analyzes the same household surveys used by Beyer et al. (1999), from 1957 to 1992, and finds that between-industry changes are weak and attributes the increase in wage inequality to within-demand changes favoring skilled workers, that is, SBTC after trade liberalization. Meller and Tokman (1996) analyze manufacturing sectors from 1968 to 1993 and find the ratio of skilled to unskilled workers —which is assumed to be a proxy variable for technology, that is, demand for skilled workers within industries— widened the gap between the relative wages of skilled and unskilled workers; thus, SBTC increased wage inequality. However, unlike other studies, they find the share to have a smaller effect on the relative wage since post-1975 trade liberalization.

Additionally, a few studies focus on the relationship among trade policy variables such as tariffs and industry wage premiums (Pavcnik et al. 2004). Feliciano (2001) analyzes the case of Mexico from 1986 to 1990, and finds that although there is no statistically significant relationship between tariffs and industry wage premiums, there is a statistically significant positive relationship between import licenses and industry wage premiums; she also finds that import-license coverage decreased the most in industries with the highest share of low-skilled workers. Thus, she asserts, trade liberalization could contribute to increases in wage inequality. Attanasio et al. (2004) analyze the case of Colombia from 1984 to 1998, and they find a statistically significant positive relationship between tariff reductions and declines in industry wage premiums; they also find that industries that experienced the largest tariff reductions were also those with the initially highest shares of unskilled workers and lowest wages. Thus, they too assert that trade liberalization could contribute to increases in wage inequality. Finally, Pavcnik et al. (2004) analyze the case of Brazil from 1987 to 1998, and they find that there is no statistically significant relationship between tariffs and industry wage premiums; thus, they say, there is no evidence that trade liberalization contributes to increases in wage inequality.

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2 They define “natural resources” as both mining and other nontraditional ones, for example, fruit and pulpwood.

However, all the aforementioned studies in the Chilean case only mainly cover the initial reform period, cover only urban areas or manufacturing sectors, and they use trade volumes as measures of trade liberalization. However, especially when one considers the specific Chilean context, trade volume has crucial flaws as a measure of trade liberalization. This is because the exports of Chile still heavily depend on a limited number of commodities, including copper, and thus trade volumes can be almost determined by copper price and the real exchange rate, neither of which are related to trade policy in itself. In fact, during the 1974–1996 period, the correlation coefficient between trade volumes and the real effective exchange rate was very high: 0.87.

II. Trade policy in Chile, 1992–2006: from "unilateral" to "reciprocal" trade liberalization

Chile started initiating drastic economic reforms in 1975, following the military coup d'état that overthrew Allende's government in 1973. Pinochet's government replaced the formerly inward-looking development strategy with an outward-looking one. At the end of Allende's administration, tariffs levied in each industrial sector varied widely, from 0% to 750%; the average tariff was 94%. The trade policy introduced by Pinochet's government bore the following characteristics. NTBs such as import quotas and permits were almost completely eliminated, and tariffs were progressively reduced and their dispersions decreased, so that by 1979 a flat tariff applied to most goods (Macario, 2000). The average tariff between 1979 and 1982 was 10.1% (Ffrench-Davis, Leiva and Madrid, 1992). Although tariffs were raised owing to the economic crisis between 1983 and 1985, tariff levels were again progressively reduced as the economy recovered post-1986.[3]

The economic administration of the center-left coalition government that took office in 1990 maintained the basic trade-policy principles of the former government, for example, an export-led growth strategy, openness to trade, further uniform tariff reduction, and intersectoral neutrality.[4] Therefore, Chile consolidated within the World Trade Organization a maximum tariff rate of 25%, bringing it down from 35% (Macario, 2000); meanwhile, the tariff rate of the most-favored nation (MFN) was progressively reduced from 11% in 1992 to 10% in 1999, 9% in 2000, 8% in 2001, 7% in 2002, and 6% in 2004.[5]

The most important feature of Chile's trade policy after the 1990s was in how it moved from unilateral, across-the-board liberalization toward a strategy that also included bi- or multilateral PTAs subject to reciprocal trade liberalization (Ffrench-Davis, 2010). Since the early 1990s, Chile has actively pursued PTA negotiations; most of the PTAs signed during that period fall into a category known as Economic Complementation Agreements (ECAs), which focus on the elimination of tariffs and NTBs for goods (Kuwayama, 2003). By 2006, Chile had executed ECAs with Mexico (1992), Venezuela (1993), Bolivia (1993), Colombia (1994), Ecuador (1995), and Peru (1998).[6] Moreover, since the mid-1990s, Chile has pursued a more comprehensive PTA style —that is, NAFTA-style

3 The average tariff from 1983 to 1985 was 22.7%; from 1986 to 1989, it was 17.6%. Data are obtained from Ffrench-Davis (2002).

4 Concerning trade policy since 1990, see for more details Ffrench-Davis (2008; 2010).

5 Data are obtained from World Integrated Trade Solution (WITS).

6 See, for more details: http://www.sice.oas.org/agreements_e.asp and Kuwayama (2003).

agreements or Free Trade Agreements (FTAs), which not only have faster and more universal tariff phase-out programs, but also include those areas not addressed by ECAs, such as investment, trade in services, competition policy, government procurement, and intellectual property rights (Kuwayama 2003). By 2006, Chile had executed FTAs of this type with MERCOSUR (1996), Canada (1997), Mexico (1999), Costa Rica (2002), El Salvador (2002), the European Union (2003), the United States of America (2004), the Republic of Korea (2004), the European Free Trade Association (2004), and China (2006); the Trans-Pacific Strategic Economic Partnership Agreement among Chile, New Zealand, Singapore, and Brunei Darussalam (2006) also falls into this category.[7]

As a result of these agreements, the share of import values from countries with which Chile has PTAs has drastically increased. As shown in Table 1, the share increased from 2% in 1992 to 85% in 2006. Furthermore, the import-weighted average applied tariffs[8] (henceforth, applied tariffs) levied in each industrial sector diverged from the MFN tariffs, owing to the preferential margin given under numerous PTAs and the many exceptions allowed by tariff phase-out programs.[9] This study attempts to use tariffs as measures of trade liberalization by employing applied tariffs. Additionally, what is relevant from the viewpoint of the impacts of trade liberalization on wage inequality is that applied tariffs not only lead to reductions in import tariffs but also prevent trade partners from arbitrarily increasing tariffs on Chilean exports; thus, applied tariffs ensure strong access conditions and stability for Chilean exports, both of which are afforded by the PTAs' principle of reciprocity.[10]

However, it is very difficult to calculate applied tariffs, given the many kinds of exceptions allowed by tariff phase-out programs, especially with respect to agricultural products (e.g., beef, sugar, wheat, wheat flour), [11] although some attempts have certainly been made to calculate them. Although Becerra (2006) provides a thorough calculation, it covers only the 2000–2005 period. Dúran (2008) covers the 1990–2007 period, but only calculates a proxy for applied tariffs (*arancel efectivo*), and thus assumes them to be equal to 0 on all products after any kind of PTA came into effect. Therefore, Dúran's (2008) assumption may be too strong and unrealistic, if they are to be used in actual empirical analyses. World Integrated Trade Solution (henceforth WITS) also provides a thorough calculation and defines the applied tariff as the minimum tariff granted by a reporter country to a partner for the product in question; it is equal to the MFN tariff, unless a preferential tariff exists in the database. However, the data apparently do not reflect the realities of applied tariffs. For example, all applied tariffs levied in each industrial sector in 2000 are at the homogenous rate of 9%, that is, they are identical to MFN tariff rates, although many PTAs had already come into effect in that year.

In summary, data from Becerra (2006) can be considered the only data available for empirical analyses. In fact, Ffrench-Davis (2008), one of the most widely accepted studies on the Chilean economy, uses data from Becerra (2006) vis-à-vis applied tariffs. However, in addition to covering a limited time-period, the classifications in Becerra's data do not necessarily coincide with the general industrial classification of economic activities, for example, the international standard industrial classification (ISIC). Some sectors are classified according to the 2-digit ISIC level (Rev.2), others are classified according to the 3-digit ISIC level (Rev.2), and still others are classified according to an

7 See, for more details: http://www.sice.oas.org/agreements_e.asp and Kuwayama (2003).

8 If Chile imports a good *i* from China, with which Chile has no kind of PTA, and the United States of America (USA), with which Chile does have an FTA, the import-weighted average applied tariff of good *i* is calculated as follows:

$$\tau^i = \tau^i_{MFN} \times \frac{M^i_{China}}{M^i} + \tau^i_{FTAUSA} \times \frac{M^i_{USA}}{M^i},$$

where M^i is the total import value of good *i* from a country.

9 This is also pointed out by Macario (2000).

10 For more details, see Sáez and Valdés (1999).

11 For example, in the agreements between Chile and MERCOSUR, Chile includes some traditional agricultural products as the most restricted categories: they receive duty-free treatment after 15 and 18 years, respectively (Agosin, 1999). For a list of the exceptions due to tariff phase-out programs in 2004, see Schuschny et al. (2007).

aggregated 2 or 3-digit ISIC level (Rev.2), that is, aggregation of some 2 or 3-digit level sectors into one sector (see Table 2). Therefore, I reconstruct household surveys, as explained in greater detail in the next section, according to Becerra's (2006) own classification, and I apply this classification to the tradable sectors addressed in this study.

Table 2 shows the average applied tariffs according to this classification between Q2 2000 and Q4 2005, inclusive.[12] This table shows some noticeable trends. First, in the initial 2000 time period, applied tariffs were the highest in the agricultural (ISIC 11) and agricultural-based manufacturing (ISIC 311/312) sectors, both of which had many exceptions allowed by tariff phase-out programs. Second, applied tariffs levied in each industrial sector including the agricultural and agricultural-based manufacturing sectors drastically decreased after 2000. After that time, many important FTAs with quicker tariff phase-out programs came into effect, and most of the ECAs had already been in effect for 10 years. Therefore, the applied tariffs in 2006 nearly equal 0% in most of the industrial sectors.

TABLE 1
SHARE OF IMPORT VALUES FROM COUNTRIES WITH WHICH CHILE HAS PTAS, 1992–2006

Year	1992	1994	1996	1998	2000	2003	2006
PTA's share (%)	1.93	4.99	27.28	30.70	34.58	62.97	84.50

Source: Author's calculations, based on data from WITS, http://www.sice.oas.org/agreements_e.asp, and Kuwayama (2003: 178-179)

TABLE 2
APPLIED TARIFFS, 2000–2005
(Percentages)

ISIC (Rev.2)	Industry	Q2 2000	Q2 2003	Q4 2005
11	Agriculture and hunting	13.91	2.29	1.03
12	Forestry and logging	4.63	1.98	0.70
13	Fishing	9.01	5.40	2.34
21/22	Coal mining / Crude petroleum and natural gas production	4.88	1.37	2.47
23/29	Metal ore mining / Other mining	3.98	1.20	0.13
311/312	Food manufacture	13.10	3.50	2.61
313/314	Beverage industries / Tobacco manufacture	6.12	3.68	1.94
321/322	Manufacture of textiles / Manufacture of wearing apparel, except footwear	7.71	4.60	4.33
323/324	Manufacture of leather and products of leather / Manufacture of footwear	7.79	4.33	5.09
331	Manufacture of Wood and Wood and cork products	7.22	1.53	0.96
332	Manufacture of furniture and fixtures	7.01	3.94	3.78
341	Manufacture of paper and paper products	5.58	1.22	0.39
342	Printing, publishing and allied industries	2.53	1.51	1.14
351	Manufacture of industrial chemicals	5.80	2.89	1.38
352	Manufacture of other chemical products	6.90	3.21	2.01

(continues)

[12] There is a reason as to why I use data from Q2 2000 as initial tariff rates, to perform a Durbin–Wu–Hausman test for the endogeneity of applied tariffs; this is discussed in detail in the fourth section.

Table 2 (concluded)

ISIC (Rev.2)	Industry	Q2 2000	Q2 2003	Q4 2005
353/354/355/356	Petroleum refineries / Manufacture of miscellaneous products of petroleum / Manufacture of rubber products / Manufacture of plastic products	7.51	3.54	1.57
36	Manufacture of nonmetallic mineral products, except products of petroleum and coal	6.67	3.08	2.23
37	Basic metal industries	4.81	2.21	1.04
381/383/385	Manufacture of fabricated mital products, except pfoducts of petroleum and coal	7.39	3.36	2.57
382	Manufacture of machinery expect electrical	5.97	2.26	1.08
384	Manufacture of transport equipment	6.83	2.89	1.40
39	Other manufacture industries	8.15	4.94	4.79
MFN[a]		9.00	6.00	6.00

Source: Becerra (2006: 21-26)[b]

[a] MFN stands for Most Favoured Nation.

[b] The sector names were originally written in Spanish, and the ISIC codes are explicity written up to the 2-digit level. I use the name of eache sector to match Becerra's (2006) own classification to the general ISIC code, which is as detailed as possible, for example up to the 3-digit level. I refer to the United Nation's webpage (http://unstarts.un.org/unsd/cr /registry/) for Spanish to English translations.

III. Wage premiums in Chile, 1992–2006 (first-stage estimation)

A. Data used

I use data from seven comprehensive household surveys: CASEN, from the years 1992, 1994, 1996, 1998, 2000, 2003, and 2006.[13] Each is a nationally and regionally representative household survey carried out by MIDEPLAN (*Ministerio de Planificacion y Cooperación*).[14] The objectives of the survey are to generate a reliable portrait of socioeconomic conditions across the country and to monitor the incidence and effectiveness of the government's social programs (Valdés, 1999);[15] it is carried out in November of each year. Therefore, the survey provides detailed information on demographic characteristics, education, health, housing, employment, and various sources of income, including income transfers and government subsidies. The data is a repeated cross-section, and the sample size of each year is substantially large: each survey covers between 130,000 and 270,000 individuals, from between 33,000 and 74,000 households. As such, the data are available in two forms: individual and household levels; for the purpose of this study, I use the latter. The survey is unique, in that the employment data are reported at the 3-digit ISIC level (Rev.2) from 1992 to 1996, while data are provided at the 4-digit level from 1998 to 2006.[16]

I define "wages" as the sum of disposable income after tax from paid employment, that is, wage income and bonuses from principal occupation.[17] Therefore, they do not include income from other occupations, self-employment, asset income, income transfers, or subsidies. The samples used in this study are defined as comprising the population of working age (aged 14–65 years) who report positive income and positive work hours. The sample includes only salaried workers; thus, self-

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13 Although the year 1990 is also available, the classification of economic activity in this year is different from that of the others, and it is not consistent with any international classification. Therefore, we do not use data from this year.

14 Each survey is carried out by MIDEPLAN through the Department of Economics of the University of Chile. Once each survey is complete, the data are entrusted to ECLAC, which is in a position to evaluate the consistency of the information and generate a series of new variables that are compatible with other LACs (Valdés, 1999).

15 For more details, see: http://www.mideplan.cl/casen/en/descripcion.html.

16 In the 1990s, household surveys in LACs were far less internationally standardized than today. For this reason, the lack of an international framework vis-à-vis the concepts and classifications used in surveys is rather common.

17 Although I want to set aside income derived solely from principal employment, in CASEN 2006, we cannot distinguish income from bonuses.

employed —employers and independent workers— are not included.[18] Military personnel and unpaid family workers are also excluded from the sample, because their wages are not likely to be determined by market forces. The samples whose variables had not been answered at least one survey question are also eliminated.

For the 1992–1994 period, I construct hourly wages by dividing monthly wages by four weeks of working hours, owing to the unavailability of monthly working-hour figures during this period. Wages are deflated by the national consumer price index (December 2008 = 1).

B. Skill premiums

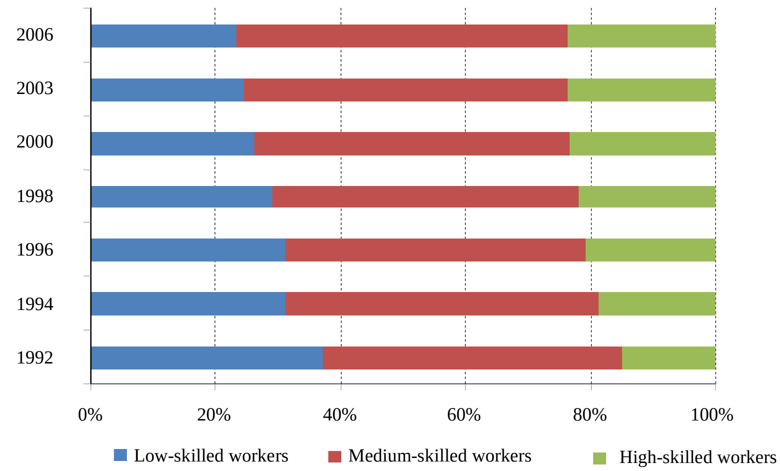
In this section, I estimate the narrowest measure of inequality —skill premiums.[19] This study defines the skill premiums as the returns to different levels of school attainment, after controlling for various observable individual characteristics. To estimate skill premiums, we define three educational categories: (1) low-skilled workers, who comprise workers who had completed up to elementary school education, (2) medium-skilled workers, who comprise workers who had not completed Centro de Formación Técnica (CFT) or Instituto Profesional (IP)-based education, as well as secondary school graduates or those workers who had not completed secondary school education, and (3) high-skilled workers, who comprise university graduates or those workers who had not completed a university education, and CFT or IP-based education graduates. The high-skill premiums are estimated as the returns to high-skilled workers relative to those for low-skilled workers, while medium-skill premiums are estimated as the returns to medium-skilled workers relative to those for low-skilled workers. These premiums are estimated in each year of the 1992–2006 period by using a Mincerian wage equation (1).

Figure 1 shows the evolution in the level of education attainment during the 1992–2006 period. What is evident from these descriptive statistics is that the share of low-skilled workers decreased from 37.2% in 1992 to 26.3% in 2000, while the share of high-skilled workers increased from 15.1% to 21.8% and that of medium-skilled workers remained relatively stable (about 50%). However, after 2000, the share of low-skilled workers slightly decreased —from 26.3% to 23.3% in 2006— while the share of medium skilled workers slightly increased from 50.5% to 53.1% in 2006 and that of high-skilled workers remained stable (23%).

[18] We cannot know the working hours of self-employed in 2006, because in this year the questions were asked only of salaried workers.

[19] The validity of the most frequently used inequality indices such as the Gini coefficient or coefficient of variation, especially over longer periods of time, has been questioned recently, because coverage of income sources and taxes tends to vary, and higher-income households tend to be truncated. Therefore, to avoid these problems, many studies have focused on the narrowest measure of inequality, that is, skill premiums (Goldberg and Pavcnik, 2007). However, even skill premiums are not immune to the aforementioned second problem, because very high wages can be also truncated, although wage incomes tend to be more equal than asset incomes. However, I use skill premiums as the measure of inequality, because the increase in inequality documented in many developing countries has been associated with an increase in skill premiums (Goldberg and Pavcnik, 2007).

FIGURE 1
EVOLUTION OF EDUCATION ATTAINMENT, 1992–2006



Source: Author's calculations, based on data from CASEN
Note: The calculated values are weighted using sample weights.

The wage-equation specification to be estimated is as follows:

$$\ln W_{ij} = cons + \beta_1 mskilled_{ij} + \beta_2 hskilled_{ij} + \beta_3 \exp_{ij} + \beta_4 \exp_{ij}^2 + X'_{ij}\beta + I_{ij} * wp_j + e_{ij} \qquad (1)$$

where *i* and *j* indexes individual and industry, respectively; *w* is hourly wage; *mskilled* is a dummy variable with a value of 1 for individuals who fall into the medium-skilled workers-category; *hskilled* is a dummy variable with a value of 1 for individuals who fall into the high-skilled workers category; and *exp* is potential labor experience (age —years of schooling— 6). The vector *X* contains demography dummies, a part-time dummy that has a value of 1 for workers working fewer than 40 h/week, an informal dummy that has a value of 1 for workers working without any kind of contract, 3 workplace characteristics dummies,[20] 8 occupational dummies,[21] and 25 region dummies.[22] A set of industry indicators (I) reflect worker i's industry affiliation[23] (see Table 3).

The results from equation (1) are reported in Table 3. The most striking finding from this wage equation is a decreasing trend in the skill premiums for high-skilled workers, while skill premiums for medium-skilled workers remained stable.[24] While the high-skilled workers earned 87.6% more than their low-skilled counterparts in 1992, that difference declined to 58.2% in 2006;[25] thus, wage inequality —that is, wage gaps between high-skilled and low-skilled workers, after

[20] This classification is based on Infante and Sunkel (2009). They consider establishments with fewer than nine people to be in low-productivity sectors. Establishments with one to five people are chosen as the base category.

[21] Unskilled workers are chosen as the base category. Unskilled workers (originally *trabajadores no calificados*) is another category different from low-skilled workers, who are categorized according to level of education attainment.

[22] Chile has 13 regions, each of which is classified into urban and rural areas. The urban area of the Metropolitan Region (Santiago) is chosen as the base category, because it absorbs the largest percentage of the population.

[23] The industry indicators are classified according to Becerra (2006) in tradable sectors and according to the 2-digit ISIC level (Rev.2) in nontradable sectors. Construction (ISIC code 50) is chosen as the base category, because it holds the largest employment share among all nontradable sectors.

[24] A possible concern with this estimation is that the level of education attainment correlates with unobservable variables, such as individual specific ability. Although this problem persists, it is unlikely that the impacts of unobservable variables on the level of education attainment substantially changed during the 1992–2006 period.

[25] As Halvorsen and Palmquist (1980) point out, the coefficient of dummy variable *(C)* in semi-logarithmic regressions like in equation (1) needs to be interpreted carefully. Not C but exp(C)-1 shows the effect of this dummy being equal to 1 on a dependent variable. Therefore, the percentage effect is given as 100・{exp(C)-1)}.

controlling for various observable individual characteristics— decreased during this period in Chile (see Fig. 2). Most findings observed in LACs, including those of Attanasio et al. (2004), and the initial reform period in Chile, including Beyer et al. (1999), show that the skill premiums for high-skilled workers, that is, a return to tertiary education, is in increasing trend. Therefore, concerning the skill premiums for high-skilled workers (henceforth, skill premiums), the aforementioned findings totally contradict those of most studies.

To confirm that the aforementioned trend of skill premiums certainly coincides with that of the frequently used inequality indices, the evolution of the variance of the natural logarithm of hourly wage and the difference between the 90th and 10th percentiles of the natural logarithm of the hourly wage are also shown in Table 4. Attanasio et al. (2004) also use those indices to measure inequality. The trend of skill premiums is nearly identical to that of those indices; wage inequality once increased in the mid- or late 1990s (i.e., from 1996 to 1998 or from 1994 to 1996), and after 1998 wage inequality decreased; it also slightly decreased during the 1992–2006 period. Moreover, I confirm that the aforementioned trend coincides with that of official statistics published by authorities, because the estimation of skill premiums is limited to salaried workers; that is, self-employed whose wages would be more unequal are excluded from this estimation. Table 4 also shows the ratio of the highest-income 20% of households to the lowest-income 20% of households (Q5/Q1) as calculated by ECLAC (2008), also using CASEN. This calculation also shows Q5/Q1 increased in the mid- or late 1990s (from 1994 to 1998),[26] decreased after 1998, and slightly decreased from 1994 to 2006 (see Table III.2). Moreover, some studies also mention this decreasing trend in wage inequality, especially after 2000: Ffrench-Davis (2008; 2010) points out that this trend was accentuated during the 2000–2006 period.

TABLE 3
FIRST-STAGE ESTIMATIONS: RESULTS OF WAGE EQUATION, 1992–2006

	1992		1994		1996		1998		2000		2003		2006	
Cons	5.8862	***	6.1015	***	6.2161	***	6.2975	***	6.2591	***	6.3246	***	6.4292	***
	0.0203		*0.0193*		*0.0234*		*0.0172*		*0.0160*		*0.0159*		*0.0153*	
Mskilled	0.1903	***	0.1833	***	0.1754	***	0.1717	***	0.1646	***	0.1579	***	0.1752	***
	0.0084		*0.0079*		*0.0098*		*0.0069*		*0.0062*		*0.0061*		*0.0059*	
Hskilled	0.6292	***	0.5605	***	0.5175	***	0.5507	***	0.5193	***	0.4760	***	0.4610	***
	0.0150		*0.0139*		*0.0166*		*0.0118*		*0.0107*		*0.0106*		*0.0102*	
Exp	0.0157	***	0.0149	***	0.0140	***	0.0124	***	0.0135	***	0.0128	***	0.0124	***
	0.0009		*0.0008*		*0.0010*		*0.0007*		*0.0007*		*0.0006*		*0.0006*	
Exp2	-0.0002	***	-0.0002	***	-0.0002	***	-0.0002	***	-0.0002	***	-0.0002	***	-0.0002	***
	0.0000		*0.0000*		*0.0000*		*0.0000*		*0.0000*		*0.0000*		*0.0000*	
Male	0.1214	***	0.1423	***	0.1274	***	0.1257	***	0.1219	***	0.1142	***	0.1280	***
	0.0092		*0.0086*		*0.0102*		*0.0072*		*0.0065*		*0.0062*		*0.0058*	
Head of the household	0.0695	***	0.0778	***	0.0987	***	0.0813	***	0.0797	***	0.0758	***	0.1008	***
	0.0084		*0.0077*		*0.0093*		*0.0066*		*0.0058*		*0.0055*		*0.0053*	

(continues)

26 Some studies also point out an increasing trend of wage inequality from 1996 to 1998. See, for example, Raczynski and Serrano (2005), Ffrench-Davis (2008; 2010). According to Ffrench-Davis (2010), the worsening wage inequality is attributable to the recession, which happened after 1998 and was influenced by the Asian crisis.

Table 3 (continued)

	1992	1994	1996	1998	2000	2003	2006
Married	0.0699 ***	0.0855 ***	0.0785 ***	0.0800 ***	0.0729 ***	0.0806 ***	0.0789 ***
	0.0074	*0.0067*	*0.0081*	*0.0057*	*0.0051*	*0.0050*	*0.0049*
Part	0.2987 ***	0.4565 ***	0.5164 ***	0.4479 ***	0.4120 ***	0.3441 ***	0.3054 ***
	0.0123	*0.0110*	*0.0112*	*0.0077*	*0.0069*	*0.0064*	*0.0065*
Informal	-0.1253 ***	-0.1983 ***	-0.2327 ***	-0.2040 ***	-0.2410 ***	-0.2404 ***	-0.2618 ***
	0.0088	*0.0078*	*0.0095*	*0.0067*	*0.0059*	*0.0060*	*0.0060*
Work place characteristics dummies							
Establishment with 200 or more	0.3308 ***	0.3038 ***	0.2854 ***	0.2444 ***	0.2256 ***	0.2118 ***	0.2414 ***
	0.0120	*0.0112*	*0.0149*	*0.0088*	*0.0080*	*0.0077*	*0.0076*
Establishment with 10-199 people	0.1663 ***	0.1602 ***	0.1509 ***	0.1159 ***	0.1267 ***	0.1293 ***	0.1481 ***
	0.0089	*0.0084*	*0.0101*	*0.0074*	*0.0066*	*0.0068*	*0.0068*
Establishment with 6-9 people	0.0787 ***	0.0889 ***	0.0829 ***	0.0697 ***	0.0762 ***	0.0837 ***	0.0841 ***
	0.0119	*0.0115*	*0.0120*	*0.0104*	*0.0089*	*0.0093*	*0.0095*
Occupational dummies							
Managers (public offices and prívate enterprices)	1.1290 ***	1.0598 ***	1.1843 ***	1.0175 ***	1.0137 ***	1.4528 ***	1.1884 ***
	0.0294	*0.0303*	*0.0357*	*0.0254*	*0.0236*	*0.0294*	*0.0288*
Professionals	0.8281 ***	0.8393 ***	0.9143 ***	0.8518 ***	0.8836 ***	0.9612 ***	0.8789 ***
	0.0188	*0.0177*	*0.0215*	*0.0155*	*0.0138*	*0.0138*	*0.0138*
Technical workers	0.6368 ***	0.5492 ***	0.6180 ***	0.5291 ***	0.5370 ***	0.5227 ***	0.4400 ***
	0.0172	*0.0152*	*0.0181*	*0.0132*	*0.0121*	*0.0119*	*0.0119*
Office workers	0.3994 ***	0.3811 ***	0.3968 ***	0.3084 ***	0.3254 ***	0.2998 ***	0.2341 ***
	0.0148	*0.0135*	*0.0164*	*0.0114*	*0.0104*	*0.0103*	*0.0101*
Sales	0.2031 ***	0.2191 ***	0.2038 ***	0.1336 ***	0.1583 ***	0.1402 ***	0.1313 ***
	0.0137	*0.0128*	*0.0152*	*0.0107*	*0.0097*	*0.0098*	*0.0093*
Agricultural and skilled workers	0.0759 ***	0.1142 ***	0.0680 ***	0.0987 ***	0.0698 ***	0.0662 ***	0.0900 ***
	0.0144	*0.0145*	*0.0181*	*0.0127*	*0.0087*	*0.0093*	*0.0090*
Craft-workers	0.1754 ***	0.1980 ***	0.1651 ***	0.1608 ***	0.1504 ***	0.1324 ***	0.1533 ***
	0.0117	*0.0110*	*0.0138*	*0.0101*	*0.0092*	*0.0089*	*0.0087*
Factory-workers	0.1524 ***	0.1793 ***	0.1989 ***	0.1415 ***	0.1509 ***	0.1576 ***	0.1768 ***
	0.0135	*0.0118*	*0.0148*	*0.0108*	*0.0094*	*0.0094*	*0.0088*
Regional dummies							
Regional I urban	-0.0437 **	-0.1159 ***	-0.1605 ***	-0.0982 ***	-0.1139 ***	-0.1190 ***	-0.0835 ***
	0.0210	*0.0229*	*0.0285*	*0.0225*	*0.0195*	*0.0189*	*0.0206*
Region I rural	-0.1520 ***	-0.1205 ***	-0.1903 ***	-0.1295 ***	-0.1480 ***	-0.2443 ***	-0.2097 ***
	0.0388	*0.0425*	*0.0516*	*0.0229*	*0.0228*	*0.0227*	*0.0274*

(continues)

Table 3 (continued)

	1992	1994	1996	1998	2000	2003	2006
Region II urban	-0.0397 **	-0.1420 ***	0.0272	0.0029	0.0315 *	-0.0137	0.0561 ***
	0.0174	*0.0159*	*0.0245*	*0.0199*	*0.0173*	*0.0171*	*0.0158*
Region II rural	-0.0292	-0.2020 ***	-0.2094 ***	-0.0077	-0.1047 ***	0.0080	-0.0212
	0.0359	*0.0386*	*0.0358*	*0.0311*	*0.0262*	*0.0301*	*0.0255*
Region III urban	-0.0585 ***	-0.2577 ***	-0.2112 ***	-0.1360 ***	-0.1201 ***	-0.0837 ***	0.0036
	0.0185	*0.0186*	*0.0275*	*0.0173*	*0.0169*	*0.0169*	*0.0167*
Region III rural	-0.1724 ***	-0.2926 ***	-0.2564 ***	-0.1845 ***	-0.1272 ***	-0.0688 ***	0.0371
	0.0331	*0.0347*	*0.0362*	*0.0250*	*0.0230*	*0.0250*	*0.0227*
Region IV urban	-0.2331 ***	-0.2883 ***	-0.2954 ***	-0.2145 ***	-0.1792 ***	-0.1905 ***	-0.1515 ***
	0.0234	*0.0172*	*0.0215*	*0.0153*	*0.0162*	*0.0150*	*0.0151*
Region IV rural	-0.2533 ***	-0.3398 ***	-0.4029 ***	-0.2347 ***	-0.2094 ***	-0.2202 ***	-0.1473 ***
	0.0300	*0.0187*	*0.0309*	*0.0164*	*0.0176*	*0.0163*	*0.0165*
Region V urban	-0.1528 ***	-0.1440 ***	-0.1827 ***	-0.1411 ***	-0.1257 ***	-0.1161 ***	-0.1006 ***
	0.0148	*0.0110*	*0.0137*	*0.0090*	*0.0096*	*0.0090*	*0.0086*
Region V rural	-0.0984 ***	-0.1794 ***	-0.1911 ***	-0.2052 ***	-0.1379 ***	-0.1193 ***	-0.0969 ***
	0.0250	*0.0174*	*0.0254*	*0.0147*	*0.0158*	*0.0146*	*0.0141*
Region VI urban	-0.1484 ***	-0.1669 ***	-0.2323 ***	-0.1974 ***	-0.1315 ***	-0.1330 ***	-0.1069 ***
	0.0187	*0.0211*	*0.0162*	*0.0128*	*0.0118*	*0.0120*	*0.0103*
Region VI rural	-0.1611 ***	-0.2071 ***	-0.2131 ***	-0.2051 ***	-0.1368 ***	-0.1113 ***	-0.1319 ***
	0.0214	*0.0257*	*0.0220*	*0.0162*	*0.0126*	*0.0154*	*0.0109*
Region VII urban	-0.1987 ***	-0.3116 ***	-0.3568 ***	-0.2178 ***	-0.1927 ***	-0.2034 ***	-0.2018 ***
	0.0183	*0.0145*	*0.0175*	*0.0137*	*0.0119*	*0.0114*	*0.0119*
Region VII rural	-0.2384 ***	-0.3193 ***	-0.3651 ***	-0.2806 ***	-0.2188 ***	-0.2082 ***	-0.1757 ***
	0.0230	*0.0143*	*0.0233*	*0.0189*	*0.0114*	*0.0116*	*0.0114*
Region VIII urban	-0.2964 ***	-0.3777 ***	-0.3473 ***	-0.2528 ***	-0.2271 ***	-0.2141 ***	-0.2063 ***
	0.0116	*0.0112*	*0.0139*	*0.0101*	*0.0089*	*0.0088*	*0.0087*
Region VIII rural	-0.3187 ***	-0.4450 ***	-0.5112 ***	-0.2866 ***	-0.3433 ***	-0.3428 ***	-0.3254 ***
	0.0134	*0.0135*	*0.0262*	*0.0191*	*0.0116*	*0.0121*	*0.0119*
Region IX urban	-0.2316 ***	-0.1918 ***	-0.4132 ***	-0.2859 ***	-0.2634 ***	-0.2646 ***	-0.2175 ***
	0.0198	*0.0222*	*0.0168*	*0.0139*	*0.0118*	*0.0114*	*0.0117*
Region IX rural	-0.2641 ***	-0.2428 ***	-0.4519 ***	-0.3017 ***	-0.2642 ***	-0.2895 ***	-0.2429 ***
	0.0285	*0.0326*	*0.0259*	*0.0198*	*0.0148*	*0.0149*	*0.0151*
Region X urban	-0.2021 ***	-0.2252 ***	-0.2807 ***	-0.2552 ***	-0.2094 ***	-0.1791 ***	-0.1316 ***
	0.0187	*0.0180*	*0.0192*	*0.0161*	*0.0126*	*0.0106*	*0.0106*
Region X rural	-0.2187 ***	-0.2749 ***	-0.3979 ***	-0.2946 ***	-0.1955 ***	-0.1905 ***	-0.1130 ***
	0.0231	*0.0261*	*0.0330*	*0.0293*	*0.0134*	*0.0124*	*0.0115*
Region XI urban	-0.0614 **	-0.1192 ***	-0.1137 ***	-0.1295 ***	-0.0681 ***	-0.0087	0.0989 ***
	0.0311	*0.0282*	*0.0302*	*0.0240*	*0.0257*	*0.0245*	*0.0239*
Region XI rural	-0.1843 ***	-0.1876 ***	-0.2045 ***	-0.1654 ***	-0.0958 ***	-0.0648 *	0.0322

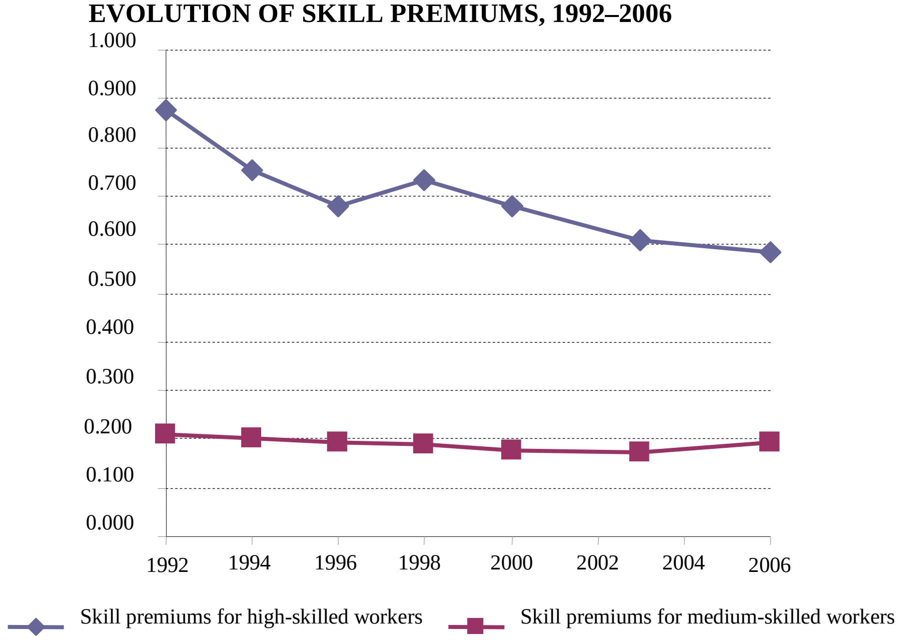
(continues)

Table 3 (concluded)

	1992		1994		1996		1998		2000		2003	2006	
	0.0448		*0.0395*		*0.0423*		*0.0321*		*0.0347*		*0.0357*	*0.0332*	
Region XII urban	0.0776	***	0.0599	**	0.0265		0.0051		0.0700	***	0.0418	0.0644	***
	0.0252		*0.0300*		*0.0316*		*0.0267*		*0.0251*		*0.0262*	*0.0247*	
Region XII rural	0.0285		-0.0050		-0.0221		-0.1189	***	-0.0189		0.0089	0.0905	***
	0.0365		*0.0312*		*0.0456*		*0.0364*		*0.0357*		*0.0387*	*0.0304*	
Metropolitan rural	-0.0604	***	-0.1581	***	-0.0919	***	-0.0714	***	-0.0520	***	-0.0034	-0.0363	***
	0.0160		*0.0167*		*0.0272*		*0.0130*		*0.0125*		*0.0128*	*0.0139*	
Industry indicators	Yes		Yes		Yes		Yes		Yes		Yes	Yes	
Numbers of obs	31 461		35 056		28,217		40,850		48,882		51,739	58,458	
R-squared	0.5015		0.5220		0.4970		0.5059		0.5162		0.5187	0.4497	
R-squared without industry indicators	0.4813		0.5052		0.4797		0.4928		0.5041		0.5039	0.4380	
Variation attributed to industry indicators	0.0403		0.0322		0.0348		0.0259		0.0234		0.0285	0.0260	

Source: Author's calculations, based on data from CASEN
Note: Numbers in italics are standard errors. Industry-specific skill premiums and their standard errors are calculated using Haisken-Denew and Schmidt's (1997) procedure.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

FIGURE 2
EVOLUTION OF SKILL PREMIUMS, 1992–2006



Source: Author's calculations, based on data from CASEN

TABLE 4
EVOLUTION OF WAGE INEQUALITY, 1992–2006

Year	Variance log wage	90-10 Percentile	Skill premiums	Q5/Q1
1992	0.6218	1.8738	0.8762	no data
1994	0.6508	1.9351	0.7516	17.9
1996	0.7606	2.0202	0.6779	18.6
1998	0.6399	1.9459	0.7344	19.7
2000	0.6553	1.9302	0.6808	19.5
2003	0.6102	1.8608	0.6096	18.4
2006	0.5921	1.7641	0.5857	15.7

Source: Indices except for Q5/Q1 are from author's calculations, based on data from CASEN. Q5/Q1 indices are sourced from ECLAC (2008): Table 12.
Note: Calculated values are weighted using sample weights.

C. Industry wage premiums

As mentioned above, industry wage premiums are captured by the coefficient on the industry indicators of equation (1), *wp*, which shows the part of worker wages that cannot be explained by observable workers' characteristics but can be attributed to workers' industry affiliation. However, this study does not estimate industry wage premiums as deviations from a particular base category; instead, industry wage premiums are expressed as deviations from employment-share-weighted average wage premiums, and their exact standard errors are calculated by using Haisken-Denew and Schmidt's (1997) restricted least squares procedures.[27] The advantages and necessities inherent in the calculation are summarized as follows. First, this normalized industry wage premium can be interpreted as the proportional difference in wages for a worker in a given industry, relative to an average worker in all industries with the same observable characteristics (Attanasio et al. 2004), that is, a worker, who is employed in an industry whose normalized industry wage premium is larger than zero, earns more than the average wage, given the same observable characteristics. Second, the estimated standard errors of industry wage premiums differ widely from industry to industry; thus, it is natural in the second-stage estimation that we should put more weight on industries with smaller standard errors in industry wage premiums, and vice versa. Therefore, we need to calculate exact standard errors to perform weighted least squares in the second-stage estimation.[28]

Table 5 reports industry wage premiums from 1992 to 2006. We note some important features within the results. First, most of the industry wage premiums are statistically significant at the 10% level, and they vary widely across industries in each year; thus, the assumption that labor mobility across industries is imperfect because of labor rigidities is likely realistic during this period in Chile. For example, if we calculate the average of the estimated industry wage premiums from 2000 to 2006,[29] which is analyzed in the second-stage estimation discussed in the next section, then the metal ore mining/other mining sector (ISIC 23/29) has the highest industry wage premium (0.326), while the agriculture and hunting sector (ISIC 11) has the lowest industry wage premium (–0.085). In other words, a worker who maintains the same observable characteristics and who switches from the agriculture and hunting sector to the metal ore mining/other mining sector would experience a 50.1% increase in hourly

[27] Details of how to calculate these are shown in the annex.
[28] If we estimate industry wage premiums as deviations from a particular base category, we cannot calculate the standard error of the omitted base category, and the standard errors depend upon the industry we choose as the base category.
[29] I limit this calculation to tradable sectors whose industry wage premiums are statistically significant in all three periods examined.

wage.[30] As a general trend, the mining sector, which includes Chilean traditional export goods, shows a high industry wage premium, while the agricultural and light manufacturing sectors such as food manufacture, textiles, and apparel show low industry wage premiums (see Table 5).

Second, the time-series and cross-sectional structure of industry wage premiums did not change substantially during the 1992–2006 period in Chile, although applied tariffs substantially decreased after 2000. The year-to-year correlations among the industry wage premiums of tradable sectors are substantially high, with all correlation coefficients exceeding 0.62 and statistical significance occurring at the 1% level (see Table 6). These findings coincide with those of Pavcnik et al. (2004), who analyze the case of Brazil from 1987 to 1998, but they contradict those of Attanasio et al. (2004), who analyze the case of Colombia from 1984 to 1998.[31] The standard deviations of the industry wage premium differentials of the tradable sectors within the same year, as reported at the bottom of Table 5, fluctuated from 0.088 to 0.124; thus, they show little change. Therefore, the cross-sectional structure of the industry wage premiums is also relatively stable. This evidence suggests that trade liberalization is not likely to be associated with changes in industry wage premiums, which are analyzed in greater detail in the next section.

Finally, I find that industry wage premiums tend to be lower in industries that employ higher shares of low-skilled workers. Therefore, changes in industry wage premiums would also translate into changes in the relative incomes of high-skilled and low-skilled workers in the case of Chile.[32] The correlation coefficients of the industry wage premiums with the shares of low-skilled workers in tradable sectors are certainly negative, ranging from -0.585 in 1998 to -0.236 in 1992. If I pool industry wage premiums over time and regress them on the share of low-skilled workers, it yields a negative and statistically significant coefficient of -0.2807 (with a T-statistic of -5.34). Therefore, industry wage premiums tend to be lower in industries that employ higher shares of low-skilled workers,[33] such as the agriculture and hunting sector (ISIC 11), the forestry and logging sector (ISIC 12), the fishing sector (ISIC 13), and the wood-products manufacturing sector (ISIC 331). On the other hand, the mining sector, which has the highest average industry wage premium between 2000 and 2006, drastically decreased its share of low-skilled workers (see Table 7). Therefore, there is considerable heterogeneity across a variety of natural resource-related sectors with respect to the employment share of low-skilled workers.[34]

TABLE 5
FIRST-STAGE ESTIMATIONS: INDUSTRY WAGE PREMIUMS, 1992–2006

ISIC (Rev.2)	Industry	1992	1994	1996	1998	2000	2003	2006
11	Agriculture and hunting	-0.041 ***	-0.067 ***	-0.120 ***	-0.076 ***	-0.077 ***	-0.103 ***	-0.074 ***
		0.010	*0.009*	*0.012*	*0.008*	*0.007*	*0.007*	*0.006*
12	Forestry and logging	0.124 ***	0.046 ***	0.014	-0.005	-0.014	-0.033 **	-0.023 *
		0.017	*0.018*	*0.026*	*0.020*	*0.013*	*0.013*	*0.013*
13	Fishing	0.120 ***	0.051 **	0.144 ***	0.058 **	0.064 ***	0.135 ***	0.112 ***

(continues)

30 The value is calculated by exp{0.326 – (–0.085)}– 1.
31 In the case of Attanasio *et al.* (2004), year-to-year correlations in industry wage premiums are as low as 0.14.
32 The skill category is defined in the third section.
33 However, this tendency is not as evident as in Brazil (Pavcnik *et al.* 2004).
34 In some studies, for example, Leamer *et al.* (1999), the argument is that natural resource-related sectors, especially tropical crops and raw materials, are complementary to capital; thus, natural resource abundance increases inequality of LACs. However, Perry and Olarreaga (2006) show that net mining exports tend to correlate positively with the capital–unskilled labor ratio in LACs, while net food exports correlate negatively with that ratio. Therefore, while taking into consideration that Chilean agricultural products derive from temperate rather than tropical crops, the finding that the agricultural sector employs a higher share of low-skilled workers is not surprising.

Table 5 (continued)

ISIC (Rev.2)	Industry	1992	1994	1996	1998	2000	2003	2006
		0.025	*0.024*	*0.032*	*0.026*	*0.018*	*0.018*	*0.018*
21/22	Coal mining/Crude petroleum and natural gas production	0.145 ***	0.101 **	0.092	0.091	0.131 **	-0.022	0.290 ***
		0.041	*0.051*	*0.065*	*0.072*	*0.063*	*0.097*	*0.085*
23/ 29	Metal ore mining/ Other mining	0.375 ***	0.340 ***	0.370 ***	0.253 ***	0.342 ***	0.351 ***	0.286 ***
		0.018	*0.017*	*0.023*	*0.017*	*0.016*	*0.016*	*0.014*
311/ 312	Food manufacture	-0.034 **	-0.021	-0.059 ***	-0.051 ***	-0.050 ***	-0.072 ***	-0.050 ***
		0.017	*0.015*	*0.018*	*0.013*	*0.012*	*0.012*	*0.011*
313/ 314	Beverage industries/ Tobacco manufacture	0.019	-0.002	0.076 *	0.042	-0.031	-0.035	0.013
		0.041	*0.036*	*0.046*	*0.034*	*0.024*	*0.027*	*0.026*
321/ 322	Manufacture of textiles/Manufacture of wearing apparel, except footwear	0.011	-0.027	-0.067 **	0.001	-0.053 **	-0.056 **	-0.105 ***
		0.021	*0.023*	*0.028*	*0.023*	*0.022*	*0.025*	*0.026*
323/ 324	Manufacture of leather and products of leather/Manufacture of footwear	-0.015	-0.099 **	-0.003	-0.036	-0.051	-0.058	-0.159 ***
		0.036	*0.040*	*0.052*	*0.038*	*0.040*	*0.049*	*0.058*
331	Manufacture of wood and wood and cork products	0.064 **	-0.019	0.061 **	-0.022	-0.047 **	-0.023	-0.022
		0.027	*0.023*	*0.030*	*0.026*	*0.020*	*0.019*	*0.019*
332	Manufacture of furniture and fixtures	-0.022	0.028	-0.006	-0.020	-0.019	-0.006	0.006
		0.040	*0.037*	*0.043*	*0.031*	*0.032*	*0.030*	*0.032*
341	Manufacture of paper and paper products	0.188 ***	0.276 ***	0.224 ***	0.195 ***	0.148 ***	0.136 ***	0.131 ***
		0.041	*0.035*	*0.052*	*0.039*	*0.036*	*0.033*	*0.029*
342	Printing, publishing and allied industries	0.113 ***	0.104 ***	0.112 **	0.016	0.038	0.066 **	0.052
		0.042	*0.039*	*0.045*	*0.034*	*0.037*	*0.031*	*0.034*
351	Manufacture of industrial chemicals	0.196 ***	0.100	-0.099	0.114 *	0.132 **	0.045	0.141 **
		0.061	*0.074*	*0.102*	*0.060*	*0.067*	*0.059*	*0.064*
352	Manufacture of other chemical products	0.112 ***	0.150 ***	0.261 ***	0.134 ***	0.219 ***	0.209 ***	0.115 ***
		0.041	*0.042*	*0.046*	*0.036*	*0.033*	*0.035*	*0.038*
353/ 354/ 355/ 356	Petroleum refineries/ Manufacture of miscellaneous products of petroleum/ Manufacture of rubber products/Manufacture of plastic products	0.072 *	0.044	0.057	0.037	0.008	-0.033	-0.047 *
		0.043	*0.047*	*0.050*	*0.033*	*0.036*	*0.034*	*0.025*

(continues)

Table 5 (continued)

ISIC (Rev.2)	Industry	1992	1994	1996	1998	2000	2003	2006
36	Manufacture of nonmetallic mineral products, except products of petroleum and coal	0.129 ***	0.107 ***	0.012	0.118 ***	0.025	0.039	0.056
		0.035	*0.036*	*0.046*	*0.035*	*0.032*	*0.033*	*0.035*
37	Basic metal industries	0.164 ***	0.137 ***	0.117 **	0.112 ***	0.194 ***	0.207 ***	0.201 ***
		0.056	*0.049*	*0.059*	*0.039*	*0.044*	*0.050*	*0.032*
381/ 383/ 385	Manufacture of fabricated metal products/Manufacture of electrical machinery apparatus/Manufacture of professional and scientific and measuring controlling equipment	0.089 ***	0.106 ***	0.065 **	0.092 ***	0.091 ***	0.109 ***	0.119 ***
		0.025	*0.023*	*0.029*	*0.021*	*0.022*	*0.019*	*0.023*
382	Manufacture of machinery except electrical	0.170 ***	0.027	0.238 ***	0.169 **	0.196 ***	0.212 ***	0.136 ***
		0.062	*0.064*	*0.081*	*0.067*	*0.050*	*0.041*	*0.031*
384	Manufacture of transport equipment	0.251 ***	0.142 *	0.171 *	0.130 *	0.083	-0.053	0.033
		0.058	*0.076*	*0.088*	*0.067*	*0.053*	*0.050*	*0.058*
39	Other manufacture industries	-0.176 ***	0.150 **	0.054	-0.049	0.152 *	-0.131	0.011
		0.067	*0.064*	*0.133*	*0.124*	*0.087*	*0.089*	*0.093*
41	Electricity, gas and steam	0.287 ***	0.221 ***	0.338 ***	0.187 ***	0.148 ***	0.216 ***	0.087 ***
		0.045	*0.033*	*0.048*	*0.029*	*0.031*	*0.034*	*0.031*
42	Water works and supply	0.066	0.078	0.122 *	0.034	0.087 **	0.034	0.026
		0.059	*0.048*	*0.063*	*0.045*	*0.036*	*0.038*	*0.036*
50	Construction	0.095 ***	0.103 ***	0.080 ***	0.076 ***	0.039 ***	0.045 ***	0.053 ***
		0.012	*0.011*	*0.013*	*0.009*	*0.009*	*0.009*	*0.008*
61	Wholesale trade	0.078 ***	0.069 ***	0.054 *	0.016	0.047 ***	-0.027	0.014
		0.024	*0.026*	*0.027*	*0.017*	*0.017*	*0.018*	*0.023*
62	Retail trade	-0.059 ***	-0.054 ***	-0.069 ***	-0.057 ***	-0.054 ***	-0.086 ***	-0.054 ***
		0.013	*0.011*	*0.013*	*0.009*	*0.009*	*0.008*	*0.008*
63	Restaurants and hotels	-0.119 ***	-0.101 ***	-0.141 ***	-0.135 ***	-0.106 ***	-0.066 ***	-0.034 ***
		0.022	*0.019*	*0.023*	*0.016*	*0.014*	*0.013*	*0.012*
71	Transport and storage	0.079 ***	0.016	0.001	-0.021 *	-0.042 ***	-0.029 ***	0.000
		0.014	*0.013*	*0.016*	*0.012*	*0.011*	*0.010*	*0.010*
72	Communication	0.130 ***	0.116 ***	0.100 ***	0.144 ***	0.035	-0.013	0.013
		0.034	*0.032*	*0.038*	*0.025*	*0.023*	*0.025*	*0.024*
81	Financial institutions	0.441 ***	0.346 ***	0.372 ***	0.306 ***	0.241 ***	0.339 ***	0.290 ***
		0.030	*0.028*	*0.030*	*0.023*	*0.023*	*0.025*	*0.024*
82	Insurance	0.215 ***	0.207 ***	0.172 ***	0.199 ***	0.166 ***	0.292 ***	0.107 ***

(continues)

Table 5 (concluded)

ISIC (Rev.2)	Industry	1992	1994	1996	1998	2000	2003	2006
		0.041	*0.035*	*0.040*	*0.037*	*0.033*	*0.035*	*0.040*
83	Real estate and business services	0.097 ***	0.080 ***	0.117 ***	0.069 ***	0.055 ***	0.060 ***	0.071 ***
		0.023	*0.020*	*0.022*	*0.015*	*0.013*	*0.013*	*0.011*
91	Public administration and defence	-0.055 ***	0.037 **	0.111 ***	0.026 *	0.002	0.033 ***	0.011
		0.020	*0.017*	*0.022*	*0.014*	*0.011*	*0.012*	*0.012*
92	Sanitary and similar services	-0.050	-0.057	-0.162 ***	-0.093 ***	-0.033	-0.065 ***	-0.053 **
		0.044	*0.041*	*0.044*	*0.031*	*0.026*	*0.023*	*0.024*
93	Social and related community services	-0.179 ***	-0.172 ***	-0.132 ***	-0.114 ***	-0.079 ***	-0.057 ***	-0.087 ***
		0.011	*0.010*	*0.012*	*0.008*	*0.007*	*0.007*	*0.007*
94	Recreational and cultural services	-0.007	-0.027	-0.067 *	-0.037	-0.010	0.022	-0.019
		0.033	*0.030*	*0.036*	*0.026*	*0.025*	*0.022*	*0.022*
95	Personal and household services	-0.098 ***	-0.018 *	-0.009	0.033 ***	0.033 ***	0.057 ***	0.035 ***
		0.011	*0.010*	*0.013*	*0.009*	*0.009*	*0.009*	*0.009*
96	International and other extra-territorial bodies	0.459 ***	0.352 **	0.386 *	0.502 ***	0.842 ***	0.510 ***	0.375 ***
		0.158	*0.155*	*0.198*	*0.142*	*0.157*	*0.177*	*0.138*
Standard deviation (only tradable sectors)		0.117	0.104	0.123	0.088	0.111	0.124	0.117
Standard deviation (all sectors)		0.147	0.122	0.144	0.124	0.163	0.143	0.117

Source: Author's calculations, based on data from CASEN
Note: Numbers in italics are standard errors. Industry-specific skill premiums and their standard errors are calculated using Haisken-Denew and Schmidt's (1997) procedure.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

TABLE 6
YEAR-TO-YEAR CORRELATION MATRIX OF INDUSTRY WAGE PREMIUMS, 1992–2006

	1992	1994	1996	1998	2000	2003	2006
1992	1.0000	0.6409	0.6386	0.8678	0.6245	0.7255	0.6896
1994	0.6409	1.0000	0.7149	0.7809	0.8360	0.6394	0.7460
1996	0.6386	0.7149	1.0000	0.7665	0.7788	0.7733	0.6331
1998	0.8678	0.7809	0.7665	1.0000	0.8163	0.8169	0.7841
2000	0.6245	0.8360	0.7788	0.8163	1.0000	0.7912	0.8414
2003	0.7255	0.6394	0.7733	0.8169	0.7912	1.0000	0.7301
2006	0.6896	0.7460	0.6331	0.7841	0.8414	0.7301	1.0000

Source: Author's calculations, based on data from CASEN.

TABLE 7
EVOLUTION OF THE SHARE OF LOW-SKILLED WORKERS IN EACH INDUSTRY EMPLOYMENT

ISIC (Rev.2)	Industry	1992	1994	1996	1998	2000	2003	2006
11	Agriculture and hunting	0.7624	0.7378	0.7400	0.7290	0.6980	0.6424	0.5877
12	Forestry and logging	0.6207	0.6399	0.5651	0.5448	0.5984	0.5516	0.5253
13	Fishing	0.4155	0.4178	0.4709	0.3501	0.4360	0.4463	0.4070
21/22	Coal mining/Crude petroleum and natural gas production	0.4577	0.2544	0.2754	0.1776	0.2169	0.2308	0.1382
23/29	Metal ore mining/Other mining	0.3201	0.2327	0.2298	0.2200	0.1455	0.1466	0.1799
311/312	Food manufacture	0.3494	0.3281	0.3330	0.2585	0.2791	0.2389	0.2102
313/314	Beverage industries/Tobacco manufacture	0.3522	0.2759	0.2792	0.2290	0.2983	0.2381	0.1873
321/322	Manufacture of textiles/Manufacture of wearing apparel, except footwear	0.3537	0.3085	0.2206	0.2203	0.2430	0.2073	0.2505
323/324	Manufacture of leather and products of leather/Manufacture of footwear	0.3845	0.3895	0.3418	0.2619	0.2216	0.2213	0.1947
331	Manufacture of wood and wood and cork products	0.5169	0.5467	0.4660	0.5020	0.3933	0.4625	0.3731
332	Manufacture of furniture and fixtures	0.3775	0.3430	0.4439	0.3467	0.2376	0.2506	0.2526
341	Manufacture of paper and paper products	0.2222	0.2956	0.2680	0.1569	0.1366	0.1038	0.1786
342	Printing, publishing and allied industries	0.1718	0.1636	0.1852	0.1402	0.1161	0.0971	0.0872
351	Manufacture of industrial chemicals	0.1946	0.1885	0.1534	0.1711	0.2082	0.1911	0.1164
352	Manufacture of other chemical products	0.1461	0.0959	0.1504	0.0968	0.0718	0.1404	0.1385
353/354/ 355/356	Petroleum refineries/Manufacture of miscellaneous products of petroleum/Manufacture of rubber products/Manufacture of plastic products	0.2683	0.2672	0.2799	0.2274	0.1850	0.1890	0.2378
36	Manufacture of nonmetallic mineral products, except products of petroleum and coal	0.4401	0.2965	0.3470	0.3640	0.2622	0.4115	0.3496
37	Basic metal industries	0.3811	0.2306	0.1475	0.1242	0.2042	0.1520	0.1612
381/383/385	Manufacture of fabricated metal products/Manufacture of electrical machinery apparatus/Manufacture of professional and scientific and measuring controlling equipment	0.2109	0.2350	0.2312	0.2374	0.1754	0.1908	0.1773
382	Manufacture of machinery except electrical	0.1180	0.0652	0.1104	0.0852	0.1521	0.0655	0.0981
384	Manufacture of transport equipment	0.1940	0.1406	0.0841	0.0845	0.1216	0.1805	0.1962
39	Other manufacture industries	0.2081	0.1635	0.0443	0.2556	0.0550	0.2068	0.1316
41	Electricity, gas and steam	0.1961	0.1485	0.0652	0.2082	0.1091	0.0869	0.0979
42	Water works and supply	0.2721	0.2794	0.1641	0.1848	0.1749	0.2666	0.1788
50	Construction	0.4947	0.4562	0.4705	0.3917	0.3819	0.3499	0.3281
61	Wholesale trade	0.2104	0.1622	0.2132	0.1871	0.2336	0.1444	0.1137
62	Retail trade	0.2106	0.1654	0.1449	0.1583	0.1304	0.1158	0.0896
63	Restaurants and hotels	0.3736	0.3052	0.2584	0.2690	0.2385	0.2155	0.1934
71	Transport and storage	0.3152	0.2474	0.2791	0.2589	0.2451	0.2196	0.2019
72	Communication	0.1557	0.0795	0.0453	0.0941	0.0274	0.0273	0.0261
81	Financial institutions	0.0257	0.0243	0.0100	0.0140	0.0085	0.0119	0.0147
82	Insurance	0.0251	0.0088	0.0135	0.0165	0.0271	0.0150	0.0112
83	Real estate and business services	0.1014	0.0671	0.0808	0.1247	0.0879	0.0690	0.0927
91	Public administration and defence	0.1894	0.1151	0.1411	0.1068	0.1656	0.1169	0.1098
92	Sanitary and similar services	0.4731	0.4513	0.4951	0.3683	0.4574	0.3565	0.4610
93	Social and related community services	0.1181	0.0885	0.0968	0.0944	0.0723	0.0623	0.0546
94	Recreational and cultural services	0.2335	0.1888	0.2980	0.1881	0.1397	0.0894	0.1068
95	Personal and household services	0.5690	0.5427	0.5190	0.5127	0.4540	0.4460	0.4383
96	International and other extra-territorial bodies	0.1711	0.0582	0.0865	0.0460	0.0000	0.0000	0.0266
all sectors		0.3716	0.3110	0.3117	0.2912	0.2627	0.2459	0.2326

Source: Author's calculations, based on data from CASEN
Note: The calculated values are weighted using sample weights.

IV. Impacts of trade policy on wage inequality (second-stage estimation)

A. Industry wage premiums and tariffs

In this section, I econometrically analyze the relationship between trade liberalization and wage equalization as shown in the previous sections, through a channel in which tariffs would affect industry wage premiums. However, the limited data availability vis-à-vis applied tariffs makes it impossible to analyze the full period after 1992; therefore, I limit the analysis to the 2000–2006 period and use applied tariffs data from Q2 2000 for 2000, that from Q2 2003 for 2003, and that from Q4 2005 for 2006.

Studies that show that trade liberalization contributes to increases in wage inequality, through a channel in which tariffs would affect industry wage premiums, assume the following logic chain. (i) In the first stage, these studies estimate industry wage premiums from the standard Mincerian wage equation and show that industry wage premiums tend to be lower in industries that employ higher shares of low-skilled workers. (ii) Industries that experienced larger tariff reductions were those with initially higher shares of low-skilled workers and lower industry wage premiums. (iii) In the second-stage estimation, these studies show there is a statistically significant positive relationship between tariff reductions and declines in industry wage premiums. (iv) Therefore, wages in industries with initially lower wages and higher shares of low-skilled workers declined relative to economy-wide average wages; thus, tariff reductions contribute to an increase in wage inequality. The current study has already shown (i); however, unlike the aforementioned studies, in the current study, wage inequality tends to decrease. Therefore, to show that trade liberalization would contribute to wage equalization through a channel in which tariffs would affect industry wage premiums, we assume the following procedures as analogous to (ii) and (iii). If industries that experienced larger tariff reductions were those with initially higher industry wage premiums, that is, a regression of tariff reductions on initial wage premiums yields a positive coefficient, the positive coefficient of industry wage premiums on tariffs is the “correct” sign in the second-stage estimation. On the other hand, if industries that experienced larger tariff reductions were those with initially lower industry wage premiums, that is, a regression of tariff reductions on initial wage premiums yields a negative coefficient, the negative coefficient of industry wage premiums on tariffs is the “correct” sign in the second-stage estimation. Therefore, we need to show the protection pattern prior to the tariff reductions, before performing the second-stage estimation.

In this context, I review a possible theoretical assumption vis-à-vis the association between tariffs and industry wage premiums. First of all, the most natural point of departure for thinking about the effects of tariffs on industry wage premiums is the specific factors model (Attanasio et al. 2004). This model is short-term by nature, as it considers factors of production immobile across industries (Attanasio et al. 2004; Pavcnik et al. 2003). According to the simple prediction made via the specific factor model, sectors that experienced relatively large tariff reductions, that is, larger declines in their prices, will see a decline in the returns to specific factors, relative to those of the economy-wide average. Therefore, this model predicts a positive association between tariffs and industry wage premiums. Second, Pavcnik et al. (2003) and Feliciano (2001) each point out that trade polices including tariffs and NTBs would generate industry rents. Therefore, the tariff reductions would decrease industry rents, because trade liberalization likely lowers the profit margins of domestic firms that were previously sheltered from foreign competition (Pavcnik et al. 2003); they also predict a positive association between tariffs and industry wage premiums.

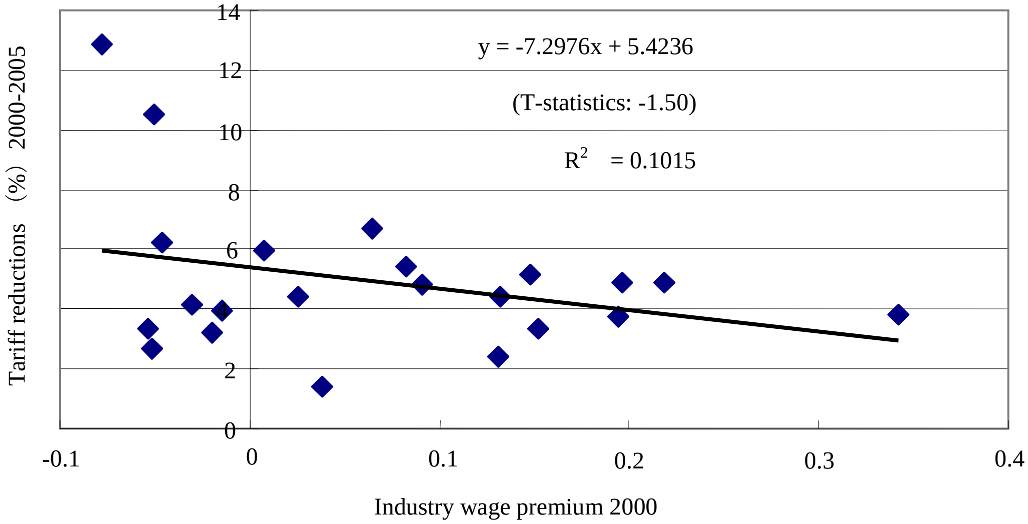
On the other hand, a negative association between tariffs and industry wage premiums can also be assumed. Empirical studies find strong evidence that decreases in tariffs are associated with productivity improvements.[35] As tariffs declined, firms had to become more productive to remain competitive. If the productivity enhancements had been partially passed onto workers through higher industry wages, wages would increase in the industries with the largest tariff reductions (Pavcnik et al. 2003). Therefore, the aforementioned channel assumes a negative association between tariffs and industry wage premiums.

Fig. 3 plots the tariff reductions between 2000 and 2005 against the industry wage premiums in the first year of my sample, 2000. A regression of the tariff reductions between 2000 and 2005 on the industry wage premiums of 2000 yields a coefficient of -7.23, but it is not statistically significant at 10% (p-value: 0.149). However, if we follow the aforementioned logic chain, a negative coefficient of industry wage premiums on tariffs is the "correct" sign.

Moreover, what is relevant in terms of the objective of this study is the protection pattern prior to the trade liberalization of natural resource-related sectors. Although I point out that if natural resource-related sectors had been included, the protection pattern prior to the trade liberalization could have been changed, the current study's findings show that the agriculture and hunting sector (ISIC 11) was precisely the sector that initially had the highest applied tariffs. This was owing to the existence of many kinds of exceptions allowed by tariff phase-out programs, as discussed in the second section, and thus, that industry experienced the largest tariff reductions (see again Table 2). Moreover, this sector employed the highest share of low-skilled workers and thus had the lowest industry wage premiums. Therefore, if various sectors of its economy, including natural resource-related ones, are included, it becomes clear that the protection pattern prior to the trade liberalization had not changed, that is, industries that experienced larger tariff reductions were those with initially lower industry wage premiums, during the 2000–2006 period in Chile. This has also been shown to be the case with Colombia from 1984 to 1998 (Attanasio et al. 2004), although there, this tendency among tradable sectors was not entirely evident.

[35] In the specific case of Chile, Pavcnik (2002) finds that there are significant within-plant productivity improvements in import-competing industries from 1979 to 1986.

FIGURE 3
TARIFF REDUCTIONS AND INITIAL (2000) WAGE PREMIUMS



Source: Author's calculations, based on data from CASEN and Becerra (2006)

The model of the second-stage estimation is as follows:

$$wp_{jt} = cons + T'_{jt}\alpha_T + Y'_t\alpha_D + u_{jt} \quad (2)$$

where *j* and *t* indexes industry and time, respectively, and wp is industry wage premiums. The vector *T* contains industry characteristic-related variables, which include applied tariffs and also other controls, such as share of professionals and technical workers in each industry employment, lagged exports, and lagged imports.[36] The vector *Y* consists of a set of year indicators.

I include lagged imports and exports to control the trade-oriented characteristics of each industry, that is, whether the industry is export-oriented or import-competing. Although the share of exports and imports of the total output of each industry should be used for this purpose, I cannot obtain the total output of each industry classified according to at least the 2-digit ISIC level. Therefore, I use the absolute values of lagged exports and lagged imports, according to the specification of Attanasio et al. (2004). I assume that the common changes across all industries, such as macroeconomic shocks, are absorbed by year indicators; I also assume that unobserved time-invariant industry characteristics are absorbed by industry fixed effects (industry indicators) or removed by first differences.

However, my specification is different from those of the aforementioned studies, that is, Pavcnik et al. (2003) and Attanasio et al. (2004), in that it includes the share of professionals and technical workers employed in each industry (*PTshare*). The reasons for this difference are that unlike previous studies, this study uses import-weighted average applied tariffs instead of MFN tariffs, as discussed in the second section; this could possibly cause endogeneity problems. The problem stems from the fact that applied tariffs are weighted by import origins, because each industry can change its

[36] Values are expressed as US$100,000, at current prices. Because trade flows are arguably endogenous, I include the first lags of exports and imports measures, rather than their current values (Attanasio *et al.* 2004).

import origins according to which have lower tariffs as a result of PTAs, and because the import origins of a industry can correlate with skill intensity in that sector. Furthermore, the skill intensity in each industry can also correlate with its industry wage premium, because we can assume an industry with more demand for skilled workers tends to offer higher wages. Therefore, applied tariffs can be an endogenous variable. The simple solution for this problem is to control for skill intensity in each industry; however, if we use the ratio of skilled to unskilled workers in each industry as the skill-intensity value, the ratio is also an endogenous variable. Although the problem that it is still an endogenous outcome variable rather than exogenous technological shocks persists (Goldberg and Pavcnik, 2007), *PTshare* is a more appropriate variable for skill intensity.

An additional concern vis-à-vis the endogeneity of applied tariffs can derive from political context, because it is likely that tariff phase-out programs are influenced by some kind of political power, such as industry lobbying. If such kinds of industry lobbying constitute time-varying industry characteristics and they also correlate with industry wage premiums, the results will be biased. To perform a Durbin–Wu–Hausman test for endogeneity, I use presample applied tariffs (Q1 2000) interacted with the MFN tariffs in each year as the instrumental variable. [37] The MFN tariffs in each year are flat in the case of Chile, as discussed in the second section, and thus they are exogenously determined with respect to industry wage premiums. Moreover, both applied tariffs and MFN tariffs show a decreasing trend during the 2000–2005 period (see Table 2), and thus presample applied tariffs interacted with the MFN tariff in each year highly correlate with applied tariffs.[38] Therefore, they may be good instrumental variables for applied tariffs.

In estimating equation (2), I perform not only panel data analysis but also weighted least squares (WLS), because the dependent variable is estimated. When performing WLS, I use the inverse of the exact standard errors of industry wage premiums, calculated by using in the first stage Haisken-Denew and Schmidt's (1997) restricted least squares procedures as the weights. This procedure puts more weight on industries with smaller standard errors in industry wage premiums[39] I perform a model specification test, that is, the Hausman test, Breusch-Pagan test, and F test in the case of panel data analysis, while I perform an F test for the significance of industry indicators in the case of WLS.

Table 8 reports the results of estimating equation (2). The results of the panel data analysis are presented in columns 1–8, while the results of WLS are presented in columns 9–14. The coefficients on applied tariffs are negatively significant in the pooling models (columns 3 and 7) and in the WLS models without industry indicators (columns 10 and 13). However, those models are rejected as a result of the specification tests. The coefficients on applied tariffs are still negative; thus they show the "correct" sign but they are not statistically significant in the fixed-effects models (columns 1 and 5); in the WLS models with industry indicators (columns 9 and 12), which are adopted as a result of the specification tests; or in the first-differences models (columns 4, 8, 11, and 14). The results show that the impacts of applied tariffs on industry wage premiums disappear after controlling for unobservable time-invariant industry characteristics. Therefore, the observed negative relationship between applied tariffs and industry wage premiums is spurious; that is, unobservable time-invariant industry characteristics correlate with both industry wage premiums and applied tariffs. The findings suggest that, unlike the aforementioned theoretical assumption, the industries with higher productivity tend to have lower applied tariffs and higher wage premiums, rather than that the tariff reductions themselves lead to productivity improvements in such a short time-period.

Concerning other variables, the *PTshare* coefficients are positively significant in all models; these are the expected signs. This suggests that the industries with more demand for skilled workers

[37] Pavcnik *et al.* (2003) and Attanasio *et al.* (2004) each use presample tariffs interacted with exchange rate, as the instrumental variable. However, this is not an appropriate instrumental variable in our case of Chile, because in the 2000–2005 period, applied tariffs show a decreasing trend but the exchange rate shows no such trend. Therefore, presample applied tariffs interacted with exchange rate do not correlate with applied tariffs.

[38] A regression of applied tariffs on presample applied tariffs that interact with the MFN tariff yields a positive and statistically significant coefficient of 0.120 (with a *T*-statistic of 10.39).

[39] In the case of WLS, I assume there to be no serial correlations in the error term of equation (2).

tend to offer higher wages. The coefficients on lagged exports and lagged imports are not statistically significant, except for the pooling model (columns 7), and the inclusion of these additional controls hardly changes the coefficients on applied tariffs. The results of Durbin–Wu–Hausman tests for endogeneity show we cannot reject the exogeneity of applied tariffs; the p-value is 0.501 and 0.383 in the fixed-effects model and the WLS model with industry indicators, respectively.[40] The results are not surprising, because the policy-making process has been very technocratic since Chile's military *coup d'état*, and this situation persists under the center-left coalition government; thus, there seems to be little room for industry lobbying in Chile.[41]

Overall, I find no statistically significant relationship between applied tariffs and industry wage premiums, after controlling for unobservable time-invariant industry characteristics.[42] The findings are robust, because my estimations take into account the potential endogeneity of applied tariffs, and I perform WLS while putting more weight on industries with smaller exact standard errors of industry wage premiums. Moreover, I perform a Durbin–Wu–Hausman test for the endogeneity of applied tariffs that would be caused by an omitted time-varying industry characteristic, such as industry lobbying.

B. Industry-specific skill premiums and tariffs

Although the aforementioned findings show there to be no statistically significant relationship between applied tariffs and industry wage premiums after controlling for unobservable time-invariant industry characteristics, trade liberalization could still contribute to wage equalization through a channel in which applied tariffs affect industry-specific skill premiums. Industry-specific skill premiums are defined as the incremental wage premiums that skilled workers earn in an industry, in addition to the base industry wage premiums (Pavcnik et al. 2003). Therefore, in the first stage, I estimate the following wage equation (3):

$$\ln W_{ij} = cons + \beta_1 mskilled_{ij} + \beta_2 hskilled_{ij} + \beta_3 \exp_{ij} + \beta_4 \exp_{ij}^2 + X'_{ij}\beta + I_{ij} * wp_j + I_{ij} * hskilled_{ij} * swp_j + \varepsilon_{ij} \quad (3)$$

This model differs from equation (1), in that I add interaction terms between industry indicators and high-skilled dummies; thus, the coefficient of interaction terms, swp, captures the industry-specific skill premium.

40 In both cases, *PTshare*, lagged exports, and lagged imports are included as exogenous variables.

41 Concerning the technocratization of policy-making in Chile, see, for example, Silva (1991).

42 Another possible method involves combining the repressors in equations (1) and (2) and estimating the relationship between applied tariffs and wages directly in one stage, that is, in what Galiani and Porto (2006) call a "stronger identification strategy." However, this method cannot control for individual fixed effects, because this individual-level data are not panel but repeated cross-section. Moreover, we must drop all observations who are employed in non-tradable sectors in each year, and dropping these observations may cause sample-selection bias. Although I implement this one-stage estimation, the coefficient on applied tariffs is as small as 0.0048 and not at all statistically significant (*p*-value: 0.405). Therefore, the results also show there to be no statistically significant relationship between applied tariffs and wages.

TABLE 8
SECOND-STAGE ESTIMATION: APPLIED TARIFFS AND INDUSTRY WAGE PREMIUMS

	1	2	3	4	5	6	7	8
Applied tariff	-0.0009	-0.0048	-0.0191 ***	-0.0015	-0.0013	-0.0062	-0.0142 ***	-0.0017
	0.0042	*0.0041*	*0.0060*	*0.0030*	*0.0042*	*0.0043*	*0.0053*	*0.0027*
PTshare	0.4722 ***	0.5191 ***	0.6474 ***	0.5483 ***	0.4572 ***	0.5250 ***	0.6215 ***	0.5291 ***
	0.0741	*0.0732*	*0.1091*	*0.0868*	*0.0758*	*0.0771*	*0.0945*	*0.0682*
Lagged exports					-0.000001	0.000008	0.000021 ***	-0.000001
					0.000005	*0.000005*	*0.000005*	*0.000005*
Lagged imports					0.000014	0.000019	0.000024 ***	0.000022
					0.000012	0.000010	0.000009	0.000022
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Robust	No	No	No	Yes	No	No	No	Yes
Model	Fixed	Random	Pooling	First-differences	Fixed	Random	Pooling	First-differences
Number of obs	66	66	66	44	66	66	66	44
Number of groups	22	22	22		22	22	22	
R-squared			0.4843	0.5809			0.6374	0.6026
within	0.5345	0.5261			0.5516	0.5043		
between	0.4339	0.4783			0.4195	0.6589		
overall	0.4095	0.4470			0.4149	0.5894		
	Hausman test: 13.31***				Hausman teset: 43.46***			
	Breusch-Pagan test: 30.24***				Breusch-Pagan test: 14.58***			
	F test 11.94***				F test: 7.79***			
Model specification	Fixed				Fixed			

	9	10	11	12	13	14
Applied tariff	-0.0008	-0.0125 **	-0.0008	-0.0007	-0.0114 **	-0.0007
	0.0021	*0.0050*	*0.0021*	*0.0022*	*0.0044*	*0.0022*
PTshare	0.4494 ***	0.8626 ***	0.4494 ***	0.4411 ***	0.8235 ***	0.4411 ***
	0.0821		*0.0821*	*0.0859*	*0.1115*	*0.0859*
Lagged exports				-0.000002	0.000002 ***	-0.000002
				0.000004	*0.000005*	*-0.000004*
Lagged imports				-0.000001	0.000016	-0.000001
				0.000011	*0.000011*	*0.000011*
Year indicators	Yes		Yes	Yes	Yes	Yes
Industry indicators	Yes		No	Yes	No	No
	First differences	No		Yes	No	Yes
Weight	Yes		Yes	Yes	Yes	Yes
Number of obs	66		44	66	66	44
R-squared	0.9676		0.4126	0.9677	0.6595	0.4166
Model specification	F test: 25.71*** Industry indicators: yes	F test: 17.25*** Industry indicators: yes				

Source: Author's calculations, based on data from CASEN and Becerra (2006)
Note: Numbers in italics are standard errors.
*** and ** indicate significance at the 1% and 5% levels, respectively.

As in the case of industry wage premiums, industry-specific skill premiums are also expressed as deviations from the employment-share-weighted average skill premium, and their exact standard errors are calculated by using Haisken-Denew and Schmidt's (1997) restricted least squares procedures. This normalized industry-specific skill premium can be interpreted as the proportional difference in wages through the channel of industry-specific skill premiums for a high-skilled worker in a given industry, relative to average high-skilled workers who have the same observable characteristics, across all industries (Pavcnik et al. 2003). That is to say: a worker who is employed in an industry whose normalized industry-specific skill wage premium is larger than zero earns more than the average wage of a high-skilled worker, given the same observable characteristics.

The theoretical assumption that trade liberalization contributes to wage equalization through a channel in which applied tariffs affect industry-specific skill premiums goes as follows. We assume high-skilled workers are less mobile across industries than low- or medium-skilled workers, that is, high-skilled workers are immobile (specific) factors and low-skilled workers are mobile factors, in the short to medium term.[43] Under this assumption, wage equalization is exactly what the specific factor model (or Ricardo–Viner model) would predict: high-skilled workers, that is, immobile factors employed in industries that experience more tariff reductions, will see a greater decline in their wages than those employed in industries that experience fewer tariff reductions, and the effects of mobile factors, that is, low- or medium-skilled workers, are ambiguous. Therefore, whatever protection patterns exist prior to tariff reductions, those reductions would decrease industry-specific skill premiums, and would thus contribute to economy-wide wage equalization, as long as we can assume that high-skilled workers are less mobile than low- or medium-skilled workers. Thus, the positive coefficient of industry wage premiums on tariffs is the expected sign in the second-stage estimation.

Table 9 reports industry-specific skill premiums from 1992 to 2006, wherein we see some important features. First, more than half of all industry-specific skill premiums are statistically significant at the 10% level, and they vary widely across industries in each year; thus, one can plausibly assume that high-skilled workers were more or less immobile across industries during this period in Chile. For example, if we calculate the average of the estimated industry-specific skill premiums from 2000 to 2006,[44] we see that, for example, in the forestry and logging sector (ISIC 12), the highest industry wage premium was 0.259, while in the coal mining/crude petroleum and natural gas production sector (ISIC 21/22), the lowest industry wage premium was -0.208; therefore, a high-skilled worker with the same observable characteristics who switched from the coal mining/crude petroleum and natural gas production sector to the forestry and logging sector would experience a 59.5% increase in hourly wage.[45] As a general trend, the forestry and forestry-processing industries such as paper and paper products, which in Chile are newly growing export sectors, show high industry-specific skill-premiums (see Table 9).

Second, unlike industry wage premiums, the structure of industry-specific skill premiums is not stable. The year-to-year correlation coefficients of the industry-specific skill premiums of tradable sectors are low: a maximum of 0.614 (between 1992 and 1994) and a minimum of 0.101 (between 2000 and 2003). Moreover, the standard deviations of industry-specific skill premium differentials among tradable sectors within the same year, as reported at the bottom of Table 9, fluctuated from 0.153 to 0.333; thus, they show substantial change, and the standard deviations in themselves are relatively larger than those of industry wage premiums.

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[43] Needless to say, we can also assume that low- or medium-skilled workers are less mobile across industries than high-skilled workers. It is also a natural assumption that high-skilled workers can easily move across industries, because highly educated workers accumulate general, transferable skills. However, if we take into consideration the reality of Chile, the assumption that low-skilled workers are mobile seems to be plausible. Raczynski and Serrano (2005) point out that an important current characteristic of the poor in Chile is that they are employed in various kinds of temporary and precarious economic activities, including those in the agriculture, manufacture, construction, and service sectors.

[44] I limit this calculation to tradable sectors whose industry wage premiums are statistically significant in more than two periods, at the least.

[45] The value is calculated by $\exp\{(0.259 - (-0.208)\} - 1$.

TABLE 9
FIRST-STAGE ESTIMATIONS: INDUSTRY-SPECIFIC SKILL PREMIUMS, 1992–2006

ISIC (Rev.2)	Industry	1992		1994		1996		1998		2000		2003		2006	
11	Agriculture and hunting	0.168	***	0.179	***	0.179	**	0.068		0.135	***	0.163	***	0.069	**
		0.057		*0.050*		*0.071*		*0.045*		*0.036*		*0.036*		*0.030*	
12	Forestry and logging	0.101		0.327	***	0.475	***	0.257	***	0.332	***	0.094		0.352	***
		0.095		*0.081*		*0.107*		*0.078*		*0.064*		*0.060*		*0.082*	
13	Fishing	0.097		0.176	**	0.315	**	-0.028		0.166	**	0.006		0.157	**
		0.083		*0.088*		*0.125*		*0.085*		*0.072*		*0.068*		*0.068*	
21/22	Coal mining/ Crude petroleum and natural gas production	0.319	*	0.158		0.279		0.230		0.305	*	-1.097	**	0.169	
		0.163		*0.153*		*0.303*		*0.240*		*0.171*		*0.510*		*0.206*	
23/29	Metal ore mining/Other mining	0.146	***	0.167	***	0.131	**	0.233	***	0.091	**	0.142	***	0.035	
		0.044		*0.043*		*0.061*		*0.043*		*0.042*		*0.040*		*0.036*	
311/312	Food manufacture	0.224	***	0.177	***	0.334	***	0.029		0.167	***	0.156	***	-0.001	
		0.065		*0.062*		*0.060*		*0.049*		*0.044*		*0.049*		*0.041*	
313/314	Beverage industries/ Tobacco manufacture	-0.049		0.090		0.299	**	0.290	**	-0.042		0.148	*	0.148	**
		0.127		*0.118*		*0.135*		*0.122*		*0.082*		*0.081*		*0.075*	
321/322	Manufacture of textiles/ Manufacture of wearing apparel, except footwear	0.270	***	0.286	***	0.162	*	0.170	*	0.405	***	-0.009		0.035	
		0.088		*0.096*		*0.090*		*0.089*		*0.079*		*0.098*		*0.097*	
323/324	Manufacture of leather and products of leather/ Manufacture of footwear	0.758	***	0.447		0.255		0.110		-0.194		-0.762	***	0.591	*
		0.176		*0.312*		*0.346*		*0.137*		*0.162*		*0.196*		*0.303*	
331	Manufacture of wood and wood and cork products	-0.213	*	-0.003		0.182		0.198	*	0.196	**	0.201	**	0.220	**
		0.128		*0.108*		*0.122*		*0.106*		*0.092*		*0.079*		*0.093*	
332	Manufacture of furniture and fixtures	0.294		0.260	*	0.565	*	-0.191		-0.244	*	-0.497	***	0.187	
		0.210		*0.139*		*0.299*		*0.132*		*0.147*		*0.122*		*0.117*	
341	Manufacture of paper and paper products	0.493	***	0.143		-0.192		0.326	***	0.254	**	0.170	**	0.222	***
		0.111		*0.091*		*0.146*		*0.089*		*0.103*		*0.085*		*0.072*	
342	Printing, publishing and allied industries	0.125		-0.150		0.018		0.213	**	0.010		-0.037		-0.142	*
		0.098		*0.129*		*0.113*		*0.083*		*0.093*		*0.071*		*0.077*	

(continues)

Table 9 (continued)

ISIC (Rev .2)	Industry	1992	1994	1996	1998	2000	2003	2006
351	Manufacture of industrial chemicals	0.322 **	0.251	0.011	0.065	0.358 **	-0.124	0.172
		0.138	*0.158*	*0.222*	*0.161*	*0.162*	*0.149*	*0.151*
352	Manufacture of other chemical products	0.178	0.106	0.302 ***	0.180 **	0.195 ***	0.229 ***	0.222 **
		0.117	*0.107*	*0.105*	*0.077*	*0.071*	*0.072*	*0.087*
353/ 354/ 355/ 356	Petroleum refineries/Manufacture of miscellaneous products of petroleum/Manufacture of rubber products/Manufacture of plastic products	0.048	0.268 *	0.522 ***	0.377 ***	0.031	0.195 **	0.017
		0.163	*0.147*	*0.161*	*0.108*	*0.100*	*0.093*	*0.087*
36	Manufacture of nonmetallic mineral products, except products of petroleum and coal	0.392 **	0.331 **	0.270 *	0.150	0.231 **	0.047	0.352 ***
		0.185	*0.139*	*0.144*	*0.102*	*0.103*	*0.110*	*0.116*
37	Basic metal industries	0.203	0.123	-0.078	-0.155	0.101	-0.067	0.088
		0.174	*0.124*	*0.136*	*0.109*	*0.129*	*0.115*	*0.085*
381/ 383 /385	Manufacture of fabricated metal products/Manufacture of electrical machinery apparatus/Manufacture of professional and scientific and measuring controlling equipment	0.049	0.122 *	0.085	0.085	0.041	0.044	-0.153 **
		0.076	*0.069*	*0.086*	*0.067*	*0.064*	*0.058*	*0.064*
382	Manufacture of machinery except electrical	-0.053	-0.052	-0.396 **	0.004	0.229 *	0.067	-0.004
		0.160	*0.201*	*0.200*	*0.165*	*0.119*	*0.092*	*0.085*
384	Manufacture of transport equipment	0.206	0.021	-0.056	0.078	-0.159	0.174	0.052
		0.164	*0.218*	*0.243*	*0.185*	*0.166*	*0.130*	*0.156*
39	Other manufacture industries	-0.106	-0.557 ***	0.165	0.394	0.789 ***	-0.092	0.539
		0.217	*0.213*	*0.370*	*0.292*	*0.240*	*0.267*	*0.524*
41	Electricity, gas and steam	0.090	0.305 ***	0.231 **	0.253 ***	0.131 *	0.300 ***	-0.074
		0.103	*0.075*	*0.111*	*0.077*	*0.079*	*0.083*	*0.074*
42	Water works and supply	0.103	0.390 ***	0.233	0.084	0.128	0.188 *	0.196 *
		0.169	*0.143*	*0.153*	*0.127*	*0.110*	*0.110*	*0.106*
50	Construction	0.299 ***	0.228 ***	0.325 ***	0.126 ***	0.136 ***	0.123 ***	0.178 ***
		0.045	*0.043*	*0.047*	*0.034*	*0.032*	*0.029*	*0.028*
61	Wholesale trade	0.077	0.309 ***	0.099	0.247 ***	0.205 ***	0.131 ***	0.232 ***
		0.061	*0.065*	*0.069*	*0.046*	*0.053*	*0.044*	*0.053*

(continues)

Table 9 (concluded)

ISIC (Rev.2)	Industry	1992	1994	1996	1998	2000	2003	2006
62	Retail trade	0.082 **	0.085 ***	0.033	0.070 ***	0.038	0.054 **	0.023
		0.037	*0.033*	*0.036*	*0.027*	*0.024*	*0.023*	*0.021*
63	Restaurants and hotels	-0.137	-0.040	-0.010	-0.078	-0.202 ***	0.044	0.075 **
		0.091	*0.086*	*0.079*	*0.051*	*0.050*	*0.042*	*0.037*
71	Transport and storage	0.069	0.165 ***	0.047	0.153 ***	0.113 ***	0.106 ***	0.150 ***
		0.050	*0.050*	*0.052*	*0.039*	*0.037*	*0.032*	*0.031*
72	Communication	0.185 **	0.264 ***	0.208 ***	0.151 ***	-0.019	0.237 ***	0.179 ***
		0.087	*0.071*	*0.080*	*0.055*	*0.052*	*0.052*	*0.049*
81	Financial institutions	0.051	-0.087	0.000	0.079 *	-0.062	0.113 **	0.064
		0.061	*0.056*	*0.057*	*0.045*	*0.045*	*0.048*	*0.046*
82	Insurance	-0.109	-0.003	0.039	-0.346 ***	-0.147 **	-0.032	-0.106
		0.082	*0.070*	*0.077*	*0.073*	*0.067*	*0.068*	*0.079*
83	Real estate and business services	0.154 ***	0.115 ***	0.166 ***	0.062 **	0.048 *	0.000	0.038
		0.049	*0.039*	*0.046*	*0.031*	*0.028*	*0.027*	*0.024*
91	Public administration and defence	-0.057	0.042	-0.036	-0.030	0.001	0.059 **	0.081 ***
		0.044	*0.035*	*0.045*	*0.029*	*0.026*	*0.024*	*0.024*
92	Sanitary and similar services	0.921 ***	0.170	0.233	0.147	0.082	0.049	0.067
		0.187	*0.207*	*0.184*	*0.140*	*0.140*	*0.107*	*0.097*
93	Social and related community services	-0.164 ***	-0.163 ***	-0.184 ***	-0.131 ***	-0.101 ***	-0.118 ***	-0.135 ***
		0.014	*0.013*	*0.016*	*0.012*	*0.011*	*0.010*	*0.011*
94	Recreational and cultural services	0.217 **	0.083	0.086	0.082	-0.028	-0.015	-0.024
		0.085	*0.073*	*0.090*	*0.064*	*0.066*	*0.051*	*0.050*
95	Personal and household services	-0.082	0.007	0.006	-0.131 ***	-0.168 ***	-0.119 ***	0.071 *
		0.065	*0.059*	*0.068*	*0.047*	*0.045*	*0.039*	*0.042*
96	International and other extra-territorial bodies	0.833 ***	0.017	0.436	-0.075	0.494	0.529	0.138
		0.319	*0.328*	*0.418*	*0.291*	*0.341*	*0.408*	*0.278*
Standard deviation (only tradable sectors)		*0.211*	*0.205*	*0.229*	*0.153*	*0.225*	*0.333*	*0.187*
Standard deviation (all sectors)		*0.252*	*0.182*	*0.199*	*0.160*	*0.207*	*0.276*	*0.161*

Source: Author's calculations, based on data from CASEN

Note: Numbers in italics are standard errors. Industry-specific skill premiums and their standard errors are calculated using Haisken-Denew and Schmidt's (1997) procedure.

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

As is the case with industry wage premiums, the estimated industry-specific skill premiums, *swp*, are pooled over time and regressed on industry characteristic-related variables, including applied tariffs. The specification and estimation method are the same as those of industry wage premiums.

Table 10 reports the results: the results of panel data analysis are presented in columns 1–8, while those of WLS are presented in columns 9–14. The coefficients on applied tariffs are not statistically significant in all models. They still have the "correct" (i.e., positive) signs in the pooling model (columns 3 and 7), WLS models without industry indicators (columns 10 and 13), which are adopted as a result of the specification tests.[46] However, they have the "wrong" (i.e., negative) signs in the first-differences models (columns 4, 8, 11, and 14). Therefore, I find no statistically significant relationship between applied tariffs and industry-specific skill premiums.

Concerning other variables, the *PTshare* coefficients are positively significant, which are the expected signs, except for the WLS model with lagged exports and lagged imports. This suggests that industries with more demand for high-skilled workers tend to pay them relatively higher wages. The coefficients on the lagged imports and lagged exports, except for the pooling model (column 7), are not statistically significant. The results of Durbin–Wu–Hausman tests for endogeneity again show that we cannot reject the exogeneity of applied tariffs; the p-value is 0.218 and 0.178 in the pooling model and the WLS model without industry indicators, respectively.[47] Therefore, the findings are also robust when one takes into account the potential endogeneity of applied tariffs.

In summary, I find no statistically significant evidence that trade liberalization in Chile during the examined time-period contributed to wage equalization through a channel in which applied tariffs affect industry-specific skill premiums.

46 Unlike in the case of industry wage premiums, the significance of industry fixed effects (industry indicators) is very low.
47 In both cases, *PTshare*, lagged exports, and lagged imports are included as exogenous variables.

TABLE 10
SECOND-STAGE ESTIMATION: APPLIED TARIFFS AND INDUSTRY-SPECIFIC SKILL PREMIUMS

	1	2		3	4		5	6	7	8
Applied tariff	0.0080	0.0191		0.0191	-0.0064		0.0093	0.0176	0.0176	-0.0061
	0.0251	*0.0178*		*0.0175*	*0.0230*		*0.0255*	*0.0179*	*0.0177*	*0.0231*
PTshare	1.3633 ***	0.7482 **		0.6804 **	2.1980 ***		1.4098 ***	0.8421 ***	0.7825 **	2.2336 ****
	0.4429	*0.3206*		*0.3161*	*0.5532*		*0.4551*	*0.3217*	*0.3170*	*0.5794*
Lagged exports							- 0.000013	- 0.000006	- 0.000005	- 0.000007
							0.000030	*0.000016*	*0.000016*	*0.000023*
Lagged imports							- 0.000068	- 0.000058 *	- 0.000057 *	- 0.000064
							0.000074	0.000031	0.000030	0.000112
Year indicators	Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes
Robust	No	No		No	Yes	No		No	No	Yes
Model	Fixed	Random		Pooling	First-differences	Fixed		Random	Pooling	First-diffe rences
Number of obs	66	66		66			66	66	66	44
Number of groups	22	22		22			22	22	22	
R-squared				0.1829					0.2298	0.4918
within	0.3274	0.2986					0.3455	0.3218		
between	0.0002	0.0021					0.0384	0.0713		
overall	0.1507	0.1825					0.2024	0.2295		
	Hausman test: 4.07		Hausman test: 3.42							
	Breusch and Pagan test: 0.30		Breusch and Pagan test: 0.12							
	F test: 1.35		F test: 1.18							
Model specification	Pooling		Pooling							

	9		10	11	12		13	14
Applied tariff	-0.0030		0.0000	- 0.0030	-0.0011		0.0009	-0.0011
	0.0142		0.0110	0.0142	0.0144		0.0112	0.0144
PTshare	0.7713	*	0.1450	0.7713 *	0.7806		0.1998	0.7806
	0.4536		0.2387	0.4536	0.4699		0.2413	0.4699
Lagged exports					- 0.000001		- 0.000006	- 0.000001
					0.000019		0.000010	0.000019
Lagged imports					- 0.000069		- 0.000035	- 0.000069
					0.000063		0.000024	0.000063
Year indicators	Yes		Yes	Yes	Yes	Yes		Yes
Industry indicators	Yes		No	No	Yes	No		No
First differences	No		No	Yes	No	No		Yes
Weight	Yes		Yes	Yes	Yes	Yes		Yes
Number of obs	66		66	44	66		66	44
R-squared	0.4383		0.0505	0.0120	0.4557		0.0865	0.0428
Model specification	F test: 1.31 Industry indicators: no	F test: 1.23 Industry indicators: no						

Source: Author’s calculations, based on data from CASEN and Becerra (2006).
Note: Numbers in italics are standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Conclusions

This study empirically analyzes the impact of trade liberalization on wage inequality in Chile at a time when various sectors of its economy, including natural resource-related ones, during a period in which the country had implemented important economic reforms and has continued with its sustained open economy strategy.

As a result of the first-stage estimation, I find wage inequality measured by skill premiums for high-skilled workers shows a decreasing trend during the 1992–2006 period; this trend is especially evident after 2000, and is quite the opposite of those of other LACs or that of Chile's initial reform period starting in the mid-1970s. Moreover, I confirm that industry wage premiums vary widely across industries in each year. However, the findings of the second-stage estimation show that there is no statistically significant relationship between applied tariffs and industry wage premiums, after controlling for unobservable time-invariant industry characteristics during the 2000–2006 period. Moreover, I find no statistically significant relationship between applied tariffs and industry-specific skill premiums. Therefore, I find no evidence that bi- or multilateral trade liberalization during the period contributed to wage equalization through a channel in which applied tariffs affect industry wage premiums.

The contribution of this study to the literature that empirically analyzes trade and wage inequality is summarized as follows. First, this study is one of only a few to focus on tariffs —the most direct measures of trade policy— rather than indirect outcome variables such as trade volumes (Pavcnik et al. 2003). As pointed out by Rodriguez and Rodrik (2001), tariffs are the most direct measures of trade policy, and thus, findings of an analysis of the impact of trade liberalization on wage inequality using tariffs are more reliable. Moreover, this study is probably the first to analyze empirically the impacts of bi- or multilateral trade liberalization on wage inequality while using applied tariffs, owing to the preferential margin given under numerous PTAs since the 1990s in Chile.

Second, the results of econometric analyses show that the unobservable time-invariant industry characteristics correlate with both industry wage premiums and applied tariffs. Therefore, the findings suggest that, unlike the theoretical assumption that tariff reduction-induced productivity improvements lead to increases in industry wage premiums, industries with higher productivity tend to have initially lower applied tariffs and higher wage premiums in such a short time-period.

Third, once again, it is noticeable that none of the previous studies find statistically significant effects that trade opening or openness reduces wage inequality in LACs (Perry and Olarreaga, 2006). Therefore, while the finding that trade liberalization does not necessarily contribute to an increase in wage inequality —at least since 2000 in Chile— is in itself very important, this study cannot show that trade liberalization contributes to wage equalization through a channel in which applied tariffs affect industry premiums. Moreover, what is relevant from the viewpoint of comparisons between initial liberalization episodes since the mid-1970s subject to across-the-board indiscriminate unilateral opening and sustained liberalization episodes since the 1990s subject to reciprocity is that the former had adverse effects on wage distribution, but that the latter did not. These findings basically coincide with those of Galiani and Porto (2006), who analyze the case of Argentina from 1974 to 2001. They also compare the two liberalization episodes of the 1970s and 1990s and find that tariff reductions increased wage inequality in both periods. However, those adverse effects were much less marked in the 1990s, when tariff reductions were mainly due to the enforcement of MERCOSUR. Those results suggest that tariff reductions due to reciprocal PTAs do not necessarily have adverse effects on wage distribution.

Much work remains to be done. I had to limit the second-stage estimation during the 2000–2006 period owing to data availability vis-à-vis applied tariffs. If I were to obtain reliable data regarding applied tariffs between 1992 and 1998, I could perform the second-stage estimation for the whole of the 1992–2006 period.[48] Moreover, other trade characteristic-related variables such as foreign direct investment (FDI) may be important determinants of industry wage premiums or industry-specific skill premiums. However, in addition to the total output of each industry, I have been unable to obtain the FDI of each industry classified according to at least up to the 2-digit ISIC level. If I were to perform the second-stage estimation including those variables, I may find another possible channel through which trade liberalization has affected wage equalization in Chile since the 1990s.

Further research needs to be conducted to determine the aforementioned unobservable time-invariant industry characteristics that correlate with both industry wage premiums and applied tariffs, and whether those characteristics relate to the effects of PTAs not captured by traditional trade theory. Sala-i-Martin (2009) argues that, among these benefits, perhaps the most important is the transmission and coordination of policies and institutions that lead to greater economic efficiency, greater productivity, and higher growth rates. Such factors, for example, quality of institution in each industry, may constitute part of the aforementioned unobservable time-invariant industry characteristics. However, no such empirical analyses were undertaken in this study; this area will be an interesting subject of future research.

[48] Applied tariffs from WITS levied in each industrial sector from 1992 to 1998 are not at the homogenous rate of 11%, though they have few variances, while they are at the homogenous rate of 9% in 2000, as discussed in the second section. Therefore, we can at least use the data from WITS as an approximation of applied tariffs. Thefore I performe the second stage estimation during the 1992–2006 period using applied tariff data, that is, using data from WITS during the 1992–1998 period and data from Becerra (2006) during the 2000–2006 period, as a robustness check. The findings as follows. First, regarding industry wage premiums, the coefficients on applied tariffs are negatively significant in the pooling models and in the WLS models without industry indicators. However, those models are rejected as a result of the specification tests and the significance disappears after controlling for unobservable time-invariant industry characteristics. Second, regarding industry-specific skill premiums, the coefficients on applied tariffs are not statistically significant in all specifications. Therefore, the findings are excactly identical to those of analyzing the 2000–2006 period; thus the aforementioned fidings may be robust when icluding the 1992–1998 period.

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Annex

Calculating industry wage premiums and industry-specific skill premiums by using Haisken-Denew and Schmidt's (1997) restricted least squares (RLS) procedures

We consider the following regression model:

$$y = Z\delta + X\beta + \varepsilon \qquad \text{A.1}$$

where y is an $n \times 1$ vector of dependent variable, Z is an $n \times g$ matrix of repressors, X is an $n \times (k+1)$ matrix containing a constant term as its first element, and k dummy variables, that is, industry indicators and interaction terms between industry indicators and high-skilled dummies in the case of industry wage premiums and industry-specific skill premium, respectively, δ and β are $g \times 1$ and $(k + 1) \times 1$ vector, respectively; ε is an $n \times 1$ vector of random errors. If we include k dummy variables in this equation, it necessarily causes multicollinearity. To estimate the coefficients of k dummy variables and their exact standard errors, we impose an additional restriction. In this study, the coefficients of dummy variables are expressed as deviations from a weighted average; thus, the restriction is as follows:

$$w'\beta = 0 \qquad \text{A.2}$$

where the weights w are captured by $w = (0, w_1 \cdots w_k)'$ and $w'i = 1$ for $i = (1, \cdots, 1)'$ w is each industry's share in total employment and the share of the number of high-skilled workers in each industry's employment, weighted by each industry's share in the case of industry wage premiums and industry-specific skill premiums, respectively.

In order to state the first-order condition for this minimization problem, we make use of the following Lagrangian function:

$$L = (y - Z\delta - X\beta)'(y - Z\delta - X\beta) + \lambda(w'\beta) \qquad \text{A.3}$$

Where λ is the Lagrange multiplier associated with this restriction. The first-order conditions are as follows:

$$\frac{\partial L}{\partial \delta} = -Z'(y - Z\delta - X\beta) = 0 \qquad \text{A.4}$$

$$\frac{\partial L}{\partial \beta} = -X'(y - Z\delta - X\beta) + \lambda w = 0 \qquad \text{A.5}$$

and

$$\frac{\partial L}{\partial \lambda} = w'\beta = 0 \qquad \text{A.6}$$

If we express equations (A.4)–(A.6) in matrix form and denote estimates as $\hat{\delta}$, $\hat{\beta}$ and $\hat{\lambda}$, respectively

$$\begin{pmatrix} Z'Z & Z'X & 0 \\ X'Z & X'X & w \\ 0 & w' & 0 \end{pmatrix} \begin{pmatrix} \hat{\delta} \\ \hat{\beta} \\ \hat{\lambda} \end{pmatrix} = \begin{pmatrix} Z'y \\ X'y \\ 0 \end{pmatrix} \qquad \text{A.7}$$

$$\begin{pmatrix} \hat{\delta} \\ \hat{\beta} \\ \hat{\lambda} \end{pmatrix} = \begin{pmatrix} Z'Z & Z'X & 0 \\ X'Z & X'X & w \\ 0 & w' & 0 \end{pmatrix}^{-1} \begin{pmatrix} Z'y \\ X'y \\ 0 \end{pmatrix} \qquad \text{A.8}$$

Then, we obtain equation (2) of Haisken-Denew and Schmidt (1997). If we use the following notation

$$\begin{pmatrix} Z'Z & Z'X & 0 \\ X'Z & X'X & w \\ 0 & w' & 0 \end{pmatrix}^{-1} = \begin{pmatrix} C_{11} & C_{12} & C_{13} \\ C_{21} & C_{22} & C_{23} \\ C_{31} & C_{32} & C_{33} \end{pmatrix} \qquad \text{A.9}$$

the variance-covariance matrix of $\hat{\delta}$ and $\hat{\beta}$ is given by

$$Var\begin{pmatrix} \hat{\delta} \\ \hat{\beta} \end{pmatrix} = \sigma_{\varepsilon}^{2} \begin{pmatrix} C_{11} & C_{12} \\ C_{21} & C_{22} \end{pmatrix} \qquad \text{A.10}$$

Therefore, we obtain equation (3) of Haisken-Denew and Schmidt (1997). The industry wage premiums and their standard errors and industry-specific skill premiums and their standard errors, as reported in Tables 5 and 9, respectively, are calculated by using equations (A.8) and (A.10). However, σ_{ε}^{2} is an unknown parameter, and thus I estimate it from the standard error of the OLS estimate of equation (A.1), which drops *X* from one base category.

PROJECT DOCUMENTS

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