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Openness, Wage Gaps and Unions in Chile:

A Micro Econometric Analysis

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Summary

This paper examines the relationship between wage gaps among twenty-nine sectors of the Chilean economy and differences in levels of openness as measured by trade and investment flows. Over the last three decades, this country liberalized its trade and foreign direct investment, which accelerated growth of flows in both areas, provoking in turn important changes in the labor market. Using cluster analysis, we divide 29 sectors into three groups of high, medium and low levels of trade and investment openness in 2003 and 2008. Subsequently, an average wage equation is estimated for salaried workers in each group based on their characteristics (gender, education, experience and union membership) using the Supplementary Income Survey (SIS) micro database. Differences between average wages in the three groups are decomposed with the Oaxaca-Blinder method. In accordance with the existing literature on the subject, the results show that the most open group of sectors pays a 'wage premium' to its workers. Moreover, we introduce labor market institutions as an additional factor explaining sectoral wage gaps. In particular, it turns out that the higher level of labor unionization in the most open group of sectors seems to explain most of the 'wage premium' to its workers.

Key words: Chile, openness, wage gap, unionization, Oaxaca-Blinder method, cluster analysis.

[1] This paper represents a collaborative effort between ECLAC and ILO for the second regional conference of the International Collaborative Initiative on Trade and Employment (ICITE) in Santiago on 14 – 15 June 2010, organized by the ECLAC, OECD and World Bank with financial support from the Government of Spain. The views expressed in this document are those of the authors and may not reflect the official views of ECLAC and ILO. For comments, please contact nanno.mulder@cepal.org.

Introduction

Important changes have taken place in both openness and wage gaps in Chile over the past decades, which may be related. Since the mid-1980s, the country has continuously reduced its trade barriers unilaterally, and through multilateral and multiple bilateral free trade agreements. This reduction in obstacles to trade, together with other factors, has contributed to a growing intensity in terms of exports and imports relative to GDP. Moreover, an attractive framework for foreign direct investment (FDI) created in 1974 contributed to high investment inflows, in particular after the return to democracy in 1990. Simultaneously, important changes in the wage gaps can be observed over time. After increasing during the 1980s and 1990s, the wage gap between workers with different levels education has fallen in the past decade. Also, the wage gap between the highest and lowest quintiles shrunk from 1996 to 2006, after which it increased.

This paper represents a joint ECLAC –ILO effort to analyse the relationship between trade and investment opening and sectoral wage gaps in Chile. It contributes to the existing literature by *a*) using cluster analysis instead an a priori classification of sectors according to levels of *de facto* openness considering actual trade and investment flows, *b*) the application of the Oaxaca-Blinder method to analyse wage gaps among groups of sectors according to levels of openness, c) the use of micro data on wages with national coverage (instead of the metropolitan area only), and *d*) the inclusion of unionization levels as a possible factors explaining wage differentials.

We use cluster analysis to allocate twenty-nine sectors of the economy into three groups of high, medium and low levels of openness. This clustering was based on three proxies of openness as suggested by the literature: *a*) the share of production exported (export coefficient); *b*) the import share of final consumption (external dependence); and *c*) foreign direct investment (FDI) relative to value added (FDI intensity).

With the help of the Supplementary Income Survey (ESI) micro data base of the National Institute of Statistics (INE), we estimated econometric regressions of the average salary for each of the three groups of sectors using gender, education, experience in the labour market and the degree of unionization as independent variables. In turn, average wage difference between groups of sectors were broken down into three parts through the Oaxaca-Blinder method: *a*) differences in the workers' characteristics, *b*) the discrimination effect indicating the 'premium' (or punishment) of working in a certain groups of sectors, and *c*) an interaction effect.

In line with other theoretical and empirical studies, we show that, both in 2003 and 2008, wage earners in the group of open sectors received a premium compared to their peers in the rest of the economy. Our paper shows that a large share of this wage premium is explained by a stronger level of unionization in the most open group. Our paper thus points to institutional factors, such as extent to which labour is "unionized", affecting sectoral wage levels. This important result can open up new areas of research focussing on the relationship between institutions, labor markets, and outward orientation.

In addition to this introduction, this paper has four sections. The next documents the process of economic opening and main labour market trends, with emphasis on wage trends. Section 3 summarizes available evidence on the link between openness and wages in Chile. Section 4 presents the empirical analysis, while the final section provides conclusions and ideas for future research.

2) Trends in international trade y labour market

2a) Trade and investment flows: trends in *de jure* liberalization and *de facto* flows

In 1973, Chile began a process of trade and financial opening as part of an outward oriented development strategy accompanied by a process of macroeconomic stabilization and privatization of state companies. Import liberalization took place by eliminating non-tariff barriers and a by reducing tariffs. The average tariff fell from 104% in 1973 to 10% in1979. Likewise, tariff dispersion was reduced to almost zero.[2] The severe financial and banking crisis that hit the country in the early eighties, which resulted in a significant economic contraction and rise in unemployment, reversed the process of trade opening as the tariff was raised to 35% in 1984.

As the economy started to recover in 1985, Chile resumed its trade opening process. The average tariff was reduced to 15% in 1988 and 11% in 1991. It also established measures such as *drawbacks* (a refund for non-traditional exports and exemption from payment of fees on importers of capital goods) to diminish the anti-export bias. But at the same time price bands and surcharges were also established, which raised the effective protection on some agricultural products.

The process of trade opening was consolidated after the early nineties, when Chile started to negotiate bilateral trade agreements in parallel to the multilateral Uruguay Round Agreement. The benefits of multilateral trade opening were mostly limited compared to the unilateral tariff reductions. Further on, bilateral agreements were the predominant route to promote trade. Following this strategy, Chile has signed (partial) agreements with almost every country in Latin America. The country has also signed agreements with several extra regional partners.[3] Currently, it has negotiated agreements with more than 50 trading partners, covering 93% of its trade. It is one of the countries with the highest number of preferential trade agreements in the world.[4]

The trade liberalization process was complemented with financial liberalization. This was initially reflected in the progressive liberalization of the interest rate structure, privatization of state-owned banks, reduction of entry barriers to the financial system, and creation of a private pension system. [5] In 1974, at the same time of the first tariff reductions, the Law Decree 600 was passed, which regulates foreign investment in the country. This law provides national treatment to foreign investors, allows them to hold up to 100% of the shares of companies in most sectors and grants the right to reinvest or repatriate net profits. [6] Between 1975 and 2006, over 75% of foreign investment entered Chile protected by this decree.

Tariff reductions and bilateral trade agreements contributed to trade dynamism *de facto* (Figure 1). In fact, exports of goods and services grew faster than the GDP, increasing the ratio between

[2] With the exception of the automotive sector for which tariffs remained in a range between 10% and 90%.

[3] The trade agreements signed by Chile are (with year of implementation in parentheses): Bolivia and Venezuela (1993), Mercosur (1996), Canada (1997), Mexico (1999), Costa Rica and El Salvador (2002), European Union and Japan (2004), EFTA, Republic of Korea and United States (2004), Brunei, China, New Zealand and Singapore (2006), India and Japan (2007), Cuba, Honduras and Panamá (2008), Australia, Colombia and Peru (2009), Ecuador and Guatemala (2010), and Turkey (2011).

[4] Chile also continued the process of unilateral trade opening. From 1997, a uniform and unilateral reduction by one percentage point per year of the general tariff was implemented, until it reached 6% in 2003. However, some exceptions remain for some agricultural products whose average tariff is 12.5%. The maximum tariff rate is 25% for all products except for some agricultural products which are taxed at 31.5%.

[5] The financial liberalization process was partially suspended during the financial crisis of the early eighties, but then resumed after the crisis along with better and more rigorous banking supervision practices. Despite the implementation of capital controls in the nineties, bilateral agreements (in particular the bilateral treaty with the USA) rushing the country into free transfer of capital, see Section 10.8 of the free trade agreement between Chile and the United States (WTO, 2009).

[6] A new bill, known as the "investment platform" law, was passed in 2002, but has had little effect attracting FDI.

both from 35% in the nineties to 50% in 2007. Imports, in turn, also grew faster than the GDP, resulting in a rising intensity from 30% to more than 40% in the same period. In the nineties, exports and imports grew at similar rates and the trade balance fluctuated between slightly positive and negative. However, after 2003, the value of exports grew faster than that of imports and as a result the trade surplus grew to 15% of GDP in 2008 (Figure 1a). Finally, the 2008–09 crisis affected trade stronger than the overall economy, which lowered the trade intensity. In the post–crisis period, values of imports and exports recovered, but they did not reach pre–crisis levels.

In the first decade of the XXIst century, export prices rose much faster than import prices, which explain in large part why the volume of the former grew more slowly than the volume of the latter (Figure 1b). In terms of volume, post-crisis imports have already surpassed their pre-crisis levels. It is also noteworthy that in the period from 1986 until the Asian crisis in 1999, the volume of imports grew faster than that of exports, possibly thanks to the *de jure* opening process.

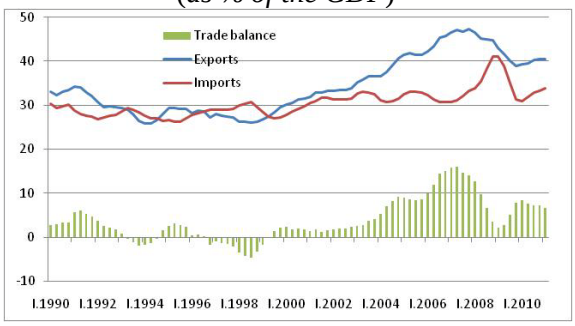
The rise in the value of exports from 2003 to 2008 is mostly due to higher foreign sales of copper (crude and refined). The share of this product in total exports therefore increased from 38% to almost 60% (Figure 1c). During this period, the country reversed a trend of more than two decades diversifying its export basket and reducing its external dependence on copper. As shown in Figure 1d, the number of exported products grew from 929 in 1990 1,054 in 1998 and the degree of export concentration was reduced. The concentration in terms of export destinations fell throughout this period, probably due to the better access to the markets of several of its trading partners through trade agreements.

Chile diversified its export basket mainly to other commodities and manufactures based on natural resources. The country became the world's largest salmon exporter, and developed into a major player in international markets of, among others, fruits, wine, wood and cellulose. Nevertheless, Chile's export structure in terms of technological intensity changed little over time (see Figure1e). However, a small increase in the participation of medium-tech products is observed, which refers mainly to the expansion of the chemical industry and its derivatives.

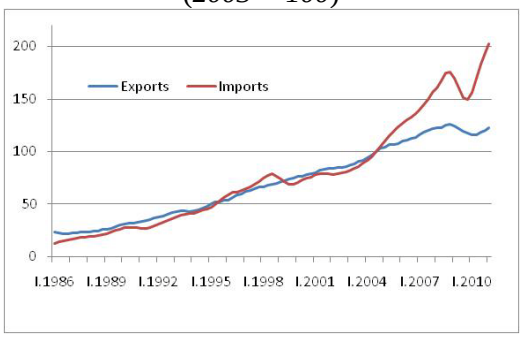
The attractive legal framework, in particular the Law Decree 600, alongside with its macroeconomic stability, the availability of large reserves of minerals such as copper and molybdenum and the investment opportunities in (network) services, contributed to growing flows of foreign investment, especially between 2005 and 2010. A new phenomenon is the growing investment by Chilean companies abroad, particularly in the retail sector in neighbouring countries.

Figure 1
Dynamism of trade and investment, 1985 to 2010

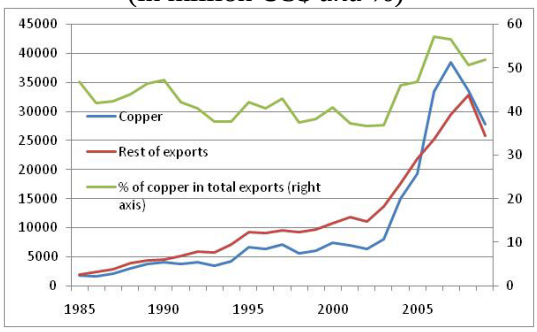
a) Trading in value and balance
(*as % of the GDP*)



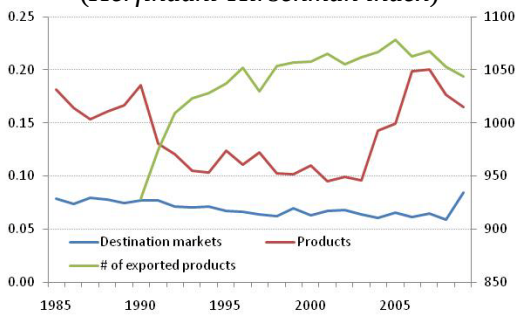
b) Volume growth of exports and imports
(*2003 = 100*)



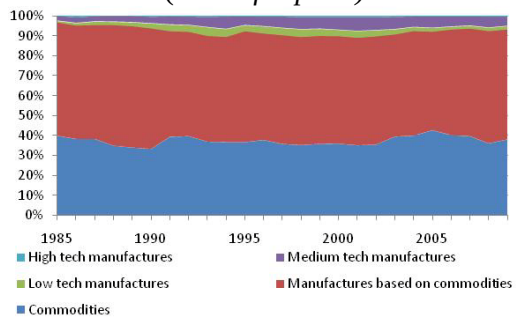
c) Exports of copper and rest
(in million US$ *and %*)



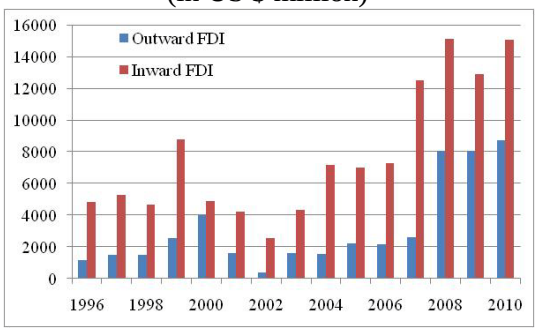
d) Export concentration
(*Herfindahl-Hirschman index*)



e) Technological content of exports
(*as % of exports)*



f) Foreign direct investment
(in US $ million)



Sources: Authors' calculations based on data from the Central Bank and UN-COMTRADE.

2b) Trends in the labour market and wages

From 1997 to 2009, the evolution of employment has followed a similar pattern as that of the economy. The average annual growth rate of GDP was 3.7%, while that of employment reached 1.9%. In addition, as shown in Figure 2a, 1999 and 2009 were recession years following the Asian crisis and the recent financial crisis, respectively. In those years, GDP registered drops of -1% and -1.7%, respectively, and employment contracted by -0.2% and -0.7%, respectively.

During this period, the composition of employment registered a slight trend in favour of wage-earners versus own account workers. In fact, in a context of sustained economic growth between 2000 and 2008, the proportion of wage-earners increased from 64% to 69% (see Figure 2b). Simultaneously, the proportion of own account workers fell from 27% to 23%. These trends, however, were reversed in 2009 due to the effects of the global crisis.[7]

Wage differentials show contrasting trends during this period. First, while both the real average and real minimum wages grew in the period (Figure 2c), the former increased more rapidly than the latter. The resulting gap rose from 36% in 1996 to 52% to in 2009. Second, the wage differential between workers with higher education compared to those with primary education shows a downward trend. That is, the ratio of wages of highly educated workers to those of workers with primary education dropped from 4.3 to 3.9 (Figure 2d). Third, the wage gap between those with secondary education and those with primary education also declined over time (the wage ratio between the two fell from 1.9 to 1.5).

Fourth, the gap between the quintile of highest wages and that of lowest wages fell from 1996 to 2006, but increased until 2009. This trend reversal coincides in a context in which the rate of employment generation was falling, reaching a negative number in 2009, along with a drop in economic activity (Figure 2e). Furthermore, the gap between deciles 5 and 1 remained practically stable during the period. However, the gap between the highest and lowest deciles of the wage distribution followed a similar pattern as that as of the differences between the top quintile and lowest quintiles. [8]

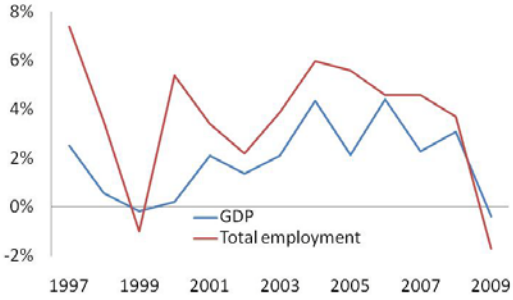
In sum, the trends in wage gaps by level of education differ from the evolution of the average to minimum wage ratio, and those by wage quintiles and deciles. This suggests there may be other factors at play than education levels affecting wage levels.

[7] Thus, the recession in 2009 destroyed about 120,000 jobs of wage earners, which was partially compensated by an increase of about 80,000 own-account jobs.

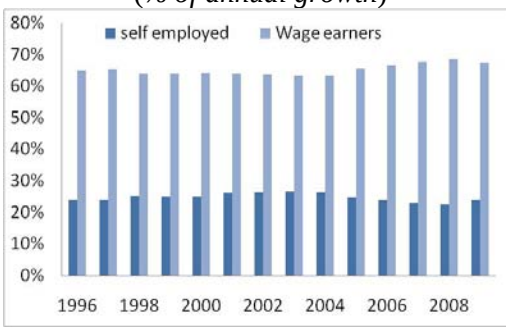
[8] Annual variations in the wage distribution should be interpreted with caution, as they may reflect technical challenges of income measurement through household surveys. This paper emphasizes structural explanations of the wage distribution rather than short-term variations and should therefore be less affected by measurement issues.

Figure 2
Trends in the labour market, 1996 to 2009

a) GDP and employment
(*% of annual growth*)

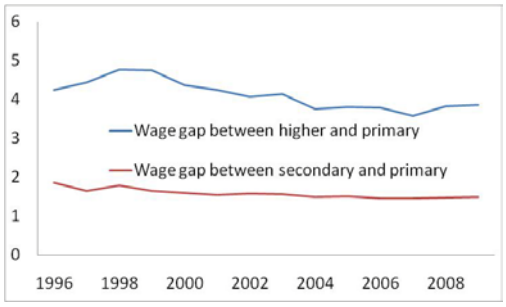


b) Wage-earners and self-employment
(*% of annual growth*)

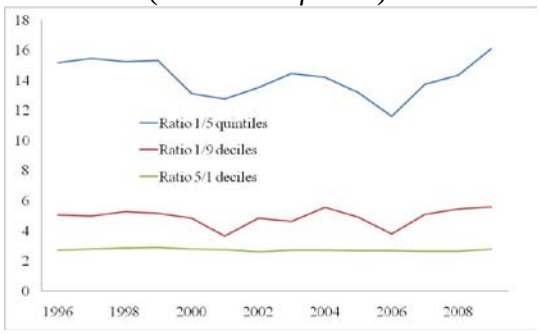


c) Average and minimum wages; minimum wage – average wage
(*in constant pesos and % of average wage*)

d) Wage gap by level of education
(*in number of times*)



e) Wage gap by quintiles of wages
(*in number of times*)



Sources: Authors' calculations based on data from the Central Bank, LA-KLEMS and the Supplementary Income Survey.

3) Possible links between trade and wages: A survey for Chile

Evidence for Chile up to the turn of the last century and other countries in the region shows that trade liberalization increases the wage gap between low and high-skilled workers.[9] This runs counter the predictions of the traditional Heckscher-Ohlin theory suggesting that increased trade between industrialized and developing countries should reduce the wage gap in the second group of countries, favouring less-skilled workers being the abundant factor in these economies.

The contrasting evidence of growing wage gaps in Chile -until recently- can be explained by three types of reasons elaborated in studies summarized below: skill biased technical change, the quality effects embodied in goods, plants and workers, and the role of labour market institutions.[10]

- Skill-biased technical change

Growing wage gaps can be explained in part by the increased demand for skilled workers resulting from skill biased technological change induced or accelerated by trade liberalization (Acemoglu, 2003). Endogenous technological change in developing countries takes place through imports of machinery, office equipment and other capital assets that require skilled labour. Lower tariffs reduce domestic prices of capital assets, which leads to an increase in imports and in turn raise the demand for skilled workers to operate this new equipment.[11] In this context, Wood (1995) introduces the term "defensive innovation" to describe the response of companies to trade opening. Increased competition from abroad induces firms to engage in R&D and incorporate modern foreign technologies unavailable before liberalization.

Robbins (1994a) examines trends in relative wages in Chile between 1967 and 1991. He argues that, for a given distribution of educational levels, an increase or decrease in the differential of relative wages tends to worsen or, improve respectively, the distribution of income. In his approach, the effects of educational experience can be decomposed in a *"composition effect"* and a *"wage effect"*. For a given rate of return on education, an increase in education reduces the variance in wages (composition effect). Additionally, in a context of an equal increase in the demand for factors, changes in relative supply generate changes in relative wages (wage effect).

The author tests the neutrality of changes in labour demand from 1974 onwards when trade liberalization began. From 1975 to 1990, relative incomes grew rapidly and demand for workers was biased towards those with higher education. He concludes that higher education is complementary to the export process, especially in marketing and distribution functions. This is compatible with the notion that trade increases the transfer of knowledge between countries and thereby increases the returns on education and relative wages.

The same author (Robbins, 1994b) extends the analysis to 1992 and finds a significant increase in wages of university graduates versus less educated workers. This trend is not explained by changes in labour supply nor by the composition of unemployment, but by shifts in demand in favour of more skilled workers.

[9] For example, the wage gap grew during the eighties and nineties in Argentina, Brazil, Colombia and Mexico. In Chile, the wage gap grew from 140% in the 1960s to 250% in the 1980s and 1990s (Gallego, 2011). However, between 2000 and 2009 there was a slight reduction in this gap.

[10] Annex 1 presents evidence for other Latin American countries.

[11] He anticipates that trade liberalization in a developing country increases imports of office equipment and advanced machinery from industrialized countries. The demand for skilled workers should be more pronounced in sectors that import this machinery.

For their part, Meller and Tokman (1996) analyze the impact of trade liberalization on relative wages in Chilean manufacturing in the period 1968 to 1992. They conclude that trade liberalization in the early seventies increased the wage gap. However, they also show that this gap narrowed during the export boom of the Chilean economy after the crisis of the eighties.

The ILO (1998), for its part, argues that trade opening in Chile stimulates the demand for goods used intensively in the exploitation and export of natural resources. Moreover, trade liberalization benefits the owners of this production factor and skilled workers, which are complementary to natural resources. In contrast, it reduces wages of unskilled workers in import-competing sectors. It confirmed these theoretical predictions in an empirical analysis for Chile. The regression of wage gaps on proxies of technological innovation, trade liberalization and the relative supply of labour confirmed the key role of the first factor, whereas the effect of the second turned out small.

Beyer *et al.* (1999) evaluate the long-term relationship (1960-96) between the wage premium by workers' qualification, product prices, trade opening and factor endowments. They conclude that openness increases wage inequality, although the effect is small. They also point out that Latin America is rich in natural resources, which traditionally are little exploited due to the existence of distorted economic environments. Once a country liberalizes its trade, its endowments will not be the only determinants of these changes in the wage gap. The authors find that the decrease in the relative price of labour intensive products and skill biased technical change tended to increase wage inequality, while the increasing proportion of university graduates helped to reduce it. Although trade opening amplified the skill premium in Chile during the period, this phenomenon apparently went beyond technology transfer.

Reinecke and Torres (2001) investigate whether trade liberalization after the mid-eighties contributed to higher inequality. The authors argue that the nature of Chile's trade specialization based on the extraction and export of natural resources increased the demand for skilled workers. Moreover, the export success increased income, and thus the demand for non-tradable goods (relatively intensive in skilled labour). After the mid-eighties, imports of capital goods embodying new technologies grew substantially, reinforcing the demand for skilled labour. They find that three factors explain most of the growing inequality, with technological change being the most important, whereas trade itself explains only 10% of the increase in wage inequality. In contrast, the increasing supply of skilled workers mitigated the above effects.

In a comparative study on the structural adjustment periods in Chile and Costa Rica, Gindling and Robbins (2001) note that wage inequality increased more in the former country. They identify rising skill premiums as an important cause of larger inequality due to a sharp increase in the demand for more qualified workers. Also, they note that the *composition effect* of the educational expansion was similar in both countries. The "price effect" of the increased demand for skilled workers came not come from changes in the quality of education, the power of unions, minimum wages or unemployment, but from trade liberalization. The increase of returns on education show a positive correlation with the increase of exports to GDP (*skill enhancing-trade*), and increased imports of machinery and physical capital.

Gallego (2006) studies the evolution of the wage gap between skilled and unskilled workers in the previous four decades. Using macroeconomic and sectoral time series, he confirms a positive correlation with the pattern of technological change in Chile and the United States.

In a more recent study, Gallego (2011) investigates the determinants of the skill premium between 1960 and 2000. He studies the hypothesis that changes in demand for skilled labour is a consequence of the international transmission of modern technology from developed to developing

countries, which in the case of Chile is the United States. He argues that the relative demand for skilled workers increases faster in Chile than in the United States in the same industries. This correlation is stronger for tradable and non tradable industries which are intensive in imported capital. Moreover, there is also between positive correlation between the skill premium in Chile and the United States. The evidence supports the above hypotheses, and emphasizes the role of technology transfer from developed to developing countries, which tends to favour disproportionately high-skilled workers.

- Quality effects embodied in goods, plants and workers

This approach focuses on the effects of trade reforms on productivity and the reallocation of resources within industries towards more efficient plants, which in turn affect wages. The idea is that trade liberalization improves the "quality" of companies in terms of their productivity or product quality.

Alvarez y Opazo (2011) show how relative wages respond to growing international competition from low-wage countries. In particular, they analyze how the competition of Chinese imports has affected relative wages in the Chilean manufacturing sector. Using plant level data for the period 1996-2005, they find that increasing imports from China (e.g., clothing, various manufactured and rubber goods) depressed relative wages in sectors with a high penetration of these imports between 4% and 25%. This effect was particularly strong for small businesses while large companies are less affected.

For their part, Alvarez and Lopez (2005) test three hypotheses to explain the superior characteristics of exporters over non exporters: self selection, learning by exporting, and the process of conscious self selection. Using plant level data for the period 1990 to 1996, they find that companies that export show superior initial performance compared to non-exporters, which is consistent with the self selection hypothesis. They also observe increases in productivity once the plants began to export, which supports the learning by exporting assumption. Finally, their evidence underscores the idea that self selection is a conscious process, as plants increase productivity in order to become exporters.

A complementary explanation is provided by Kandilov (2009), who evaluates the effect of an export subsidy programme for SMEs implemented in 1986. Using data from a manufacturing survey for the period 1979–96, he shows the grant mostly benefited medium-sized establishments in terms of increasing the probability to enter foreign markets. He shows the grant had only a discreet positive effect on wages of highly qualified workers. In more general terms, he finds little variance in the employment of skilled workers in the short term, but confirmed these workers earn higher wages due to specific industry skills that facilitate exports.

- The role of labour institutions

Several studies explored the role of labour institutions in explaining wage gaps. Generally speaking, higher rates of unionization as well as higher coverage and coordination of collective bargaining have been found to be associated with lower levels of income inequality and wage disparity, a lower gap between the wages of skilled and unskilled workers as well as a lower gap between men and women (Aidt and Tzannatos, 2002; OECD, 2004; Hayter and Weinberg, 2011), although recent studies raise the question whether the impact of unionization on inequality may have diminished more recently (Beccaro, 2008). In the case of Chile, Reinecke and Valenzuela (2011) argue that the potential role of unions and collective bargaining in improving the distribution of wages has been used in a very limited manner.

Few studies explicitly address the interaction between labour market institutions and international trade. For example, Goldberg and Pavcnik (2007) suggest that the relationship between trade reform and

informality depends on the institutional setting. Other institutions are the minimum wages and presence of unions.

Borghi (2005) analyzes the effect of trade liberalization on wage inequality between different groups of workers. He finds that trade liberalization increased wage differentials between workers with university degrees and those with secondary education only, as it did not affect the wage gap between workers with secondary and those with primary education. He cautions, however, that a limitation of the results is the assumption of perfect competition in labour markets, despite the fact that regulations, unions, collective bargaining and other labour institutions abound. The outcomes in the labour market induced by changes in trading policies could be very different if some of these features of labour markets were explicitly considered.

Along the same lines, Bussolo *et al*. (2002) suggest that patterns of economic growth and employment depend critically on the labour market conditions. They present empirical evidence on how labour market regulation can interact with the expansion of trade. It is analyzed how trade reforms affect the economy in a context of perfectly competitive labor markets, adding to the analysis relevant labor institutions in the country. In particular, the collective bargaining process is considered as the standard negotiating case resulting from bilateral monopoly.

They claim that a main consequence of the presence of imperfect wage bargaining processes is that real wages deviate from productivity levels, and that companies must pay a premium over the marginal product of labor. The size of this premium will depend directly on the preferences (unions and companies) and on the bargaining power of the parties (especially in the sectors of energy, copper (or mining), but also in the tobacco, paper and printing, financial services and chemicals industries).

By simulating a reduction of union bargaining power, justified by the observed reduction of unionization in the Chilean economy, we get a sharp fall in the initial income groups with specific skills to the sector, down to almost a third of the initial value, which explains the larger increase observed in the income of relatively more skilled workers than unskilled workers.

Finally, Landerretche *et al.* (2011), estimate that salary premium for education in Chile in the 2004 - 2009 period, is close to 20%, and they also find evidence that unions tend to rise the wages of those on the bottom of the wage distribution, and that economic sectors are important in the wage equation but not as much as firm size, however they do affect wages, especially in the unorganized sector.

In short, the studies reviewed suggest that the highest salary premium for education is explained by the effect of technological change in sectors that are particularly exposed to international trade. Trade opening is also an explanatory factor, as far as it relates to the addition of technical change from developing countries, and that institutional factors in the labor market, as the existence of unions should also be considered.

4) Analysis of sectoral wages according to their intensity in international trade and investment

The purpose of our empirical analysis is to test if wages in “open” (“tradable”) sectors are higher than those in “closed” (“non-tradable”) sectors. We define openness not only in terms of the share of production exported, but also the competition faced in the domestic market with imports and the role of foreign direct investment. In addition, we also consider the degree of unionization as a possible explanatory factor of wage gaps.

4a) The data

For the empirical analysis, we used the micro database of the Supplementary Survey on Incomes (ESI), which is part of the National Employment Survey (ENE) from the National Institute of Statistics for 2003 and 2008.[12] For each wage earner, this database reports years of education, age and gender, as well as monthly wages, working hours, sector and company size. Union membership data by sector was drawn from the Ministry of Labour.

4b) Definition of openness

To classify the 29 sectors of the Chilean economy into tradable and non-tradable groups, a cluster analysis was carried out. This analysis separates observations into relatively homogeneous groups (with minimum variance) called clusters or segments, which are as heterogeneous as possible between them (maximum variance).

The *clustering* was based on three proxies of openness for each of the 29 sectors. These are *a)* the proportion of total production exported *(export ratio), b)* the import share of final consumption (*external dependence*), and c) the ratio of foreign direct investment to value added (*FDI intensity*). All three variables turn out relevant to differentiate sectors. This clustering exercise was done for 2003 and 2008 using data from LA-KLEMS and the Foreign Investment Committee.

All sectors were classified into three groups (high, medium and low openness). The Euclidian distance based on group averages was used as a measure of similarity and as a final clustering criterion (see Annex 3). As expected, the most open sectors are those traditionally considered tradable and the low openness sectors as viewed as non tradable (see Table 1). Those grouped as "medium open" present a moderate participation in foreign trade and are a moderate driver of FDI. As a robustness test, the k-means clustering method was also applied yielding the same results.

The results for 2003 and 2008 are similar. The most open sectors are mining and some manufacturing industries such as machinery (mostly imported), which have maintained their status as highly tradable from 2003 to 2008. In the latter year, two sectors were added: textiles, leather and footwear, and chemicals and derivatives. The least open group, also referred to as "non tradable", includes most service sectors, plus some manufacturing sectors. From 2003 to 2008, some sectors (including food, beverages and tobacco, and transport and storage) moved from a "medium level" to a "low level" of openess.

[12] We did not consider 2009 or 2010, as these years are atypical because of the effects of the international crisis on the domestic economy and employment in 2009 and the recovery in the following year.

Table 1: Sector groupings based on levels of openness

2003	2008
High	**High**
Mining and extraction	Mining and extraction
Other machinery	Other machinery
Electrical and optical equipment	Electrical and optical equipment
Transport equipment	Transport equipment
Other manufactures	Other manufactures
	Textiles, leather and footwear
	Chemicals and derivatives
Medium	**Medium**
Wood	Wood
Pulp, paper products, printing and publications	Pulp, paper products, printing and publications
Refined petroleum	Refined petroleum
Rubber and plastic	Rubber and plastic
Basic metals and fabricated metallic products	Basic metals and fabricated metallic products
Chemicals and derivatives	
Textiles, leather and footwear	
Food, beverages and tobacco	
Transport and storage	
Lower	**Lower**
Other non metallic minerals	Other non metallic minerals
Electricity, gas and water	Electricity, gas and water
Construction	Construction
Trade	Trade
Hotels and restaurants	Hotels and restaurants
Postal services and telecommunications	Postal services and telecommunications
Financial Intermediation	Financial Intermediation
Real Estate	Real Estate
Business services	Business services
Public Administration and defence	Public Administration and defence
Education	Education
Health and social work	Health and social work
Other community and personal services	Other community and personal services
	Food, beverages and tobacco
	Transport and storage

Sources: Authors' calculations based on data in LA-KLEMS.

4c) Decomposition of wage differentials with the Oaxaca-Blinder method[13]

Wage levels among the three groups of sectors were compared following different steps. First, for

[13]This paper follows the procedures suggested by Lemieux (2002, 2006) and Firpo *et al.* (2010).

each group, an average wage equation was estimated using the Mincer function:

$$ln(w)=ß_0+ ß_1+Edu+ ß_2E_+ ß_3E^2+ ß_4\ man+ ß_5\ unionization + u \quad (1)$$

Where:

- *ln (w)* is the natural logarithm of the hourly wage,
- *Edu* is the education level in years,
- *E* is the experience in the labour market estimated by the individual's age,
- *E2* is a quadratic term of experience which captures possible nonlinearities between the logarithm of salary and experience,
- *Male* is a dummy variable for gender with value 1 for males and 0 for females,
- *Unionization* is a dummy variable with value 1 for workers in sectors with a union affiliation rate above 20% and 0 otherwise, and
- *u* is a random error.

Education and experience are proxies of human capital, while $ß_1$ and $ß_2$ are the returns on human capital. We can analyze the wage distribution based on the amount of human capital and its return. This equation was estimated for the three groups of sectors defined above with high, medium and low levels of openness.

Secondly, we decompose average wage differences between the three groups with the Oaxaca-Blinder methodology. This methodology separates the effects of various factors on the difference of average wages attributing them to different rebates to human capital in both sectors and the heterogeneity in the distribution of human capital. In particular, it decomposes the wage difference as follows:

$$E[\ln(w_T)]-E[\ln(w_{NT})]=[E(X_T)-E(X_{NT})]^{'} ß_{NT}+E(X_{NT})^{'}(ß_T - ß_{NT})+E(X_T)-E(X_{NT})]^{'}(ß_T - ß_{NT}) \quad (2)$$

Where

- T and NT indicate two of the three sectors with a high (T), medium or low level of openness (NT),
- $E[\ln(w_T)]$ is the expected natural logarithm of the wage per hour in the group with a high level of openness and $E[\ln(w_{NT})]$ in the group with a medium or low level of openness.
- $ß_T$ and $ß_{NT}$ are vectors of coefficients of the separate regressions for each group. $E(X_T)$ and $E(X_{NT})$ refer to characteristics in both groups of sectors. The right hand side is broken down into 3 parts.
- $[E(X_T)-E(X_{NT})]^{'} ß_{NT}$ is the part of the wage gap related to differences in the variables of human capital endowments between the "tradable" (high level of openness) and "nontradable" groups (medium or low level of openness).
- $E(X_{NT})^{'}(ß_T - ß_{NT})$ measures the contribution to the difference in coefficients of the equations of the two groups and refers to the part of the wage differential related to unobserved variables between the two groups. This term shows differences in rates of return on human capital between the two groups.
- $E(X_T)-E(X_{NT})]^{'}(ß_T - ß_{NT})$ is an interaction term which captures differences in endowments and coefficients simultaneously between the two groups.

4d) Econometric Results

For 2003 and 2008 we made 2 comparisons:

- Analysis of the wage gap between the group of sectors with a high level of openness (tradable group) versus the group with a level of openness (nontradable group).
- Analysis of the wage gap between the group of sectors with a high level of openness (tradable group) versus the groups with a medium and low level of openness (the rest).

In addition, in both years and for each comparison two types of regressions are performed: one regression including the union affiliation dummy variable and another excluding it. This is to single out the impact of the degree of unionization on wages.

The results including the variable of union affiliation show that:

- All independent variables are significant for both years.
- Education has a return of 13% to 14% for each additional year of studies for both groups of sectors with high and low levels of openness.
- Experience also has a significant effect on wages. In 2008, an additional year of experience increases the average wage 1.4 to 1.7%, while in 2003 this elasticity was higher in both groups.
- Men earn higher wages in both groups of sectors. In the group with a high level of openness, male wages are on average 27% higher than female wage, while in the group with low-openness this difference is smaller (20% to 22%).
- The effect of unionization is especially important in the group of high openness. An individual in this group earns on average 34% if he or she works in a sector with a high unionization rate, compared to a peer who works in a sector with a low unionization rate in 2008. In contrast, in the “nontradable group”, the premium of union penetration is much lower (6% and 8% in the same year). In 2003, the effect of unionization is 29% for the tradable group and between 7% and 10% for the non-tradable group.

Table 2
Wage regressions for groups with different levels of openness

a) Regressions for 2008

Dependable variable:	**With Unionization**				**With no Unionization**			
ln(wages)	High/Lower		High/Rest		High/Lower		High/Rest	
	High	Lower	High	Rest	High	Lower	High	Rest
Years of study	0.137	0.135	0.137	0.129	0.144	0.136	0.144	0.130
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Experience	0.014	0.017	0.014	0.017	0.016	0.017	0.016	0.017
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Exper*Exper	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)**	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Gender	0.267	0.216	0.267	0.200	0.368	0.222	0.368	0.205
	(0.003)***	(0.001)***	(0.003)***	(0.001)***	(0.003)***	(0.001)***	(0.003)***	(0.001)***
Unionization	0.336	0.060	0.336	0.078				
	(0.002)***	(0.001)***	(0.002)***	(0.001)***				
Constant	5.094	5.164	5.094	5.232	5.083	5.166	5.083	5.230
	(0.006)***	(0.001)***	(0.006)***	(0.001)***	(0.007)***	(0.001)***	(0.007)***	(0.001)***

a) **Regressions for 2003**

Dependable variable:	**With Unionization**				**With no Unionization**			
ln(wages)	High/Lower		High/Rest		High/Lower		High/Rest	
	High	Lower	High	Rest	High	Lower	High	Rest
Years of study	0.133	0.143	0.133	0.139	0.146	0.144	0.146	0.140
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Experience	0.024	0.018	0.024	0.019	0.025	0.018	0.025	0.019
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Exper*Exper	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Gender	0.225	0.183	0.225	0.157	0.326	0.190	0.326	0.163
	(0.003)***	(0.001)***	(0.003)***	(0.001)***	(0.003)***	(0.001)***	(0.003)***	(0.001)***
Unionization	0.289	0.070	0.289	0.095				
	(0.003)***	(0.001)***	(0.003)***	(0.001)***				
Constant	4.816	4.796	4.816	4.840	4.707	4.797	4.707	4.836
	(0.006)***	(0.002)***	(0.006)***	(0.001)***	(0.007)***	(0.002)***	(0.007)***	(0.001)***

Source: Authors' calculations based on data of ENE-ESI and LA-KLEMS.
Note: Standard errors in parentheses. *** and ** indicate significance levels at 1% and 5%, respectively.

Table 3 displays the results of the Blinder-Oaxaca decomposition. It consists of four columns per year, showing comparisons between *a*) groups of high and low levels of openness and *b*) groups of high

level of openness and two remaining groups (the rest). One set of regressions includes the unionization rate, while the other does not.

Table 3 has three parts. The first summarizes the results of the Oaxaca decomposition of the wage differential into 3 effects: endowments, discrimination and interaction. The second represents details by variable of the effect of differences in human capital, while the third illustrates the role of wage discrimination in the wage gap, with details for each variable included in the analysis.

For 2008, the logarithm of the average hourly wage is 7.47 for individuals working in the group with a high level of openness, while that of individuals working in the group with a low level of openness is 7.26. In other words, the wage gap is 0.22 logarithm points (column1). The average wages in the first group is about 25% higher than that of the second.

The decomposition of the wage difference shows that:

- Excluding the variable of union affiliation, 0.07 logarithm points or 32% of this gap is due to differences in the characteristics of individuals (endowment effect). That is, if workers in the nontradable group would have the characteristics of their peers in the tradable group, the natural logarithm of the hourly wage of the former would be 0.07 higher. In addition, 0.12 logarithm points refer to differences in the coefficients of separate regressions for both groups, i.e., 55% corresponds to the "price or discrimination effect". This effect indicates the wage premium paid to all workers in a particular group of sectors, in this case the tradable group, independent of their characteristics.
- Comparing the group of high openness with the rest, we see that the difference equals 0.27 logarithm points. This gap is larger than the comparison of high openness with low openness. In this case, 39% corresponds to the endowment effect and 49% to the price effect.
- When union membership is included in the analysis, we find that 0.09 logarithm points of the gap is explained by differences in workers' endowments between the two groups. The price effect, however, diminishes and explains only 6% of the difference, showing a slight discrimination effect in favour of the high openness group.

Among the workers' endowments, the most important factor is the gender variable (0.04 logarithm points), followed by years of study and unionization (0.02 logarithm points each). In the comparison of the group with high openness versus the rest, the endowment effect is higher than in the previous case, explaining over 50% of the difference in the wage gap. However, the price effect (or discrimination) drops to explain 6%.

In 2003, the wage differential is 0.17 logarithm points corresponding to an hourly wage differential of about 18%. A decomposition without union membership shows that the endowment effect explains 30% of the gap, while the price effect explains 55% of the wage differential. That is, the relationships remained very stable between 2003 and 2008.

When union affiliation is included to explain the wage gap, the endowment effect explains 43% in the high/low openness comparison and 58% when comparing high openness with the rest of the economy. Furthermore, in the high/low openness comparison 9% is explained by the discrimination effect, while in the comparison high/the rest this effect explains 11%.

In 2003, as in 2008, when including the impact of union affiliation to explain the wage differential, the endowment effect increases significantly while the effect of discrimination is diluted.

Table 3: Oaxaca-Blinder decomposition, 2003 and 2008

	2008				2003			
	With no Unionization		With Unionization		With no Unionization		With Unionization	
Total	**High/Lower**	**High/the Rest**	**High/Lower**	**High/the Rest**	**High/Lower**	**High/the Rest**	**High/Lower**	**High/the Rest**
"Tradable"	7.47	7.47	7.47	7.47	7.14	7.14	7.14	7.14
"Non tradable"	7.26	7.20	7.26	7.20	6.97	6.90	6.97	6.90
Difference	0.22	0.27	0.22	0.27	0.17	0.25	0.17	0.25
Endowments	0.07	0.11	0.09	0.14	0.05	0.11	0.07	0.14
Discrimination	0.12	0.13	0.01	0.02	0.09	0.11	0.01	0.03
Interaction	0.03	0.03	0.12	0.12	0.02	0.02	0.08	0.08
Endowment								
Years of study	0.02	0.08	0.02	0.07	0.02	0.10	0.02	0.09
Experience	0.01	0.00	0.01	0.00	0.00	-0.01	0.00	-0.01
Exper*Exper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gender	0.04	0.03	0.04	0.03	0.03	0.02	0.03	0.02
Unionization			0.02	0.03			0.02	0.03
Discrimination								
Years of study	0.11	0.16	0.02	0.08	0.03	0.07	-0.12	-0.06
Experience	-0.02	-0.02	-0.07	-0.07	0.14	0.12	0.12	0.09
Exper*Exper	0.04	0.04	0.06	0.07	-0.06	-0.05	-0.07	-0.05
Gender	0.08	0.10	0.03	0.04	0.08	0.10	0.02	0.04
Unionization	-0.08	-0.15	0.05	0.04	-0.09	-0.13	0.04	0.03
Constant			-0.07	-0.14			0.02	-0.02

Source: Authors' calculations based on data from ENE-ESI and LA-KLEMS.

Table 4: Decomposition of hourly wage, 2003 and 2008

(*In 2008 pesos and %*)

	2008				2003			
	With no Unionization		With Unionization		With no Unionization		With Unionization	
	High/Lower	**High/the Rest**	**High/Lower**	**High/the Rest**	**High/Lower**	**High/the Rest**	**High/Lower**	**High/the Rest**
High	1.763	1.763	1.763	1.763	1.604	1.604	1.604	1.604
Lower or the Rest	1.416	1.343	1.416	1.343	1.356	1.255	1.356	1.255
Difference	25%	31%	25%	31%	18%	28%	18%	28%
Endowment	31%	39%	41%	51%	30%	44%	43%	58%
Coefficients	55%	49%	6%	5%	55%	47%	9%	11%
Interaction	14%	12%	53%	44%	15%	9%	48%	31%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Source: Authors' calculations based on data of ENE-ESI and LA-KLEMS.

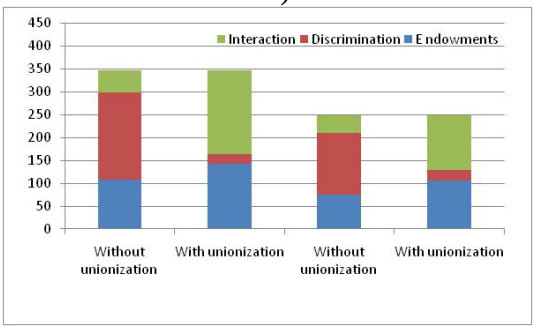
Figure 3 shows the decomposition of wage differentials between the sectors of high versus low openness and high openness versus the rest. In 2008, a worker in the group of high openness sectors earned on average 350 pesos more per hour than a worker in the low openness group (first bar of Figure 3a). About 100 pesos of this larger remuneration corresponds to the workers' greater attributes (e.g. level

of education) in the first group, while 200 pesos correspond to the “high openness sector premium". However, when the workers’ affiliation to a union is also considered, this sector "premium" is strongly reduced (second bar in Figure 3a). In other words, the higher level of union membership in the tradable sector seems to explain most of the industry premium. In 2003, the wage gap was smaller, but the explanations for the difference seem similar.

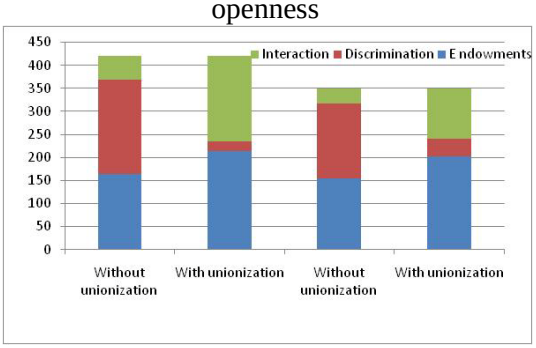
In comparison, the wage gap between the sectors of high versus low and medium openness (Figure 3b) was higher than between the sectors of high openness versus low. This is mainly due to the presence of the agricultural sector in the group of medium openness, where the average income is low. The wage gaps are explained by the similar reasons as in the case of the comparison in Figure 3a.

Figure 3
Decomposition into three components of per hour wage gap between high openness group versus the low group and lower-medium openness, 2003 and 2008
(*in constant 2008 pesos*)

a) High openness versus low openness
b)



b) High openness versus low and medium openness



Source: Authors' calculations based on data of ENE-ESI and LA-KLEMS.

5) Conclusions and future research

The study attempts to explain average wage gaps between the tradable and nontradable sectors in 2003 and 2008. The 29 sectors of the economy were grouped into three groups of high, medium and low levels of openness with a novel form of clustering considering three dimensions: export ratio, external dependence and foreign direct investment intensity. Using the micro database of the INE-ESI, wage-earners were split into the three groups defined above. We find a significant wage gap between individuals working in the most open sector and those working in the rest of the economy.

The hourly wage gap between the tradable and non-tradable sectors has increase from 18% in 2003 to 25% in 2008. Furthermore, in both years the group of sectors with a medium degree of openness has lower average wages than both other groups – with high and lower opening. This is mainly due to the negative influence exerted by agriculture, stockbreeding, hunting, forestry and fishery, which represent 12% of total employment and is one of the sectors with the lowest average wage.

The study explains average wage levels by years of education, experience, gender and unionization. The average wage regressions show that all independent variables are significant. The coefficients associated with education have shown a return of between 13% and 14% per additional year of education for the groups of high and low openness. In both groups, an additional year of experience produces an increase over 0.14% in average wages. Men have higher wages in both groups of sectors,

particularly in sectors with a high degree of openness. The effect of unionization is important in high openness sectors: the wage of unionized workers is 34% (29%) higher than those who are not affiliated to a union in 2008 (2003).

Decomposing the wage gap between groups of high and low openness in 2008, excluding the union membership variable, shows that 32% is explained by workers' endowments. Moreover, 55% corresponds to the price effect, indicating a strong discrimination in favour of workers in the high openness group. When union membership is included in the analysis, however, the endowment effect increases to 41%, while the price effect drops to 6%. In other words, the discrimination effect in favour of the tradable sectors almost disappears. The results for 2003 are similar to those in 2008, even though wage differential between the sectors of high versus low and medium opening increased between 2003 and 2008.

In sum, wage differentials can be decomposed into three factors. Higher average salaries in the tradable group are due in part to better workers' endowment compared to other sectors of the economy. Moreover, there is a discrimination effect between groups of sector in favour of the high openness group. However, when unionization is included as an explanatory factor of wage differentials, this discrimination effect is strongly reduced and the interaction effect increases. In other words, union membership in the group of high openness sectors appears to be of great importance.

This paper could be complemented in several ways:

- Cluster analysis of tradable and non-tradable sectors could be complemented with other indicators of participation in the global economy, which under different theories affect wages. Examples of this are the proportion of imported consumables as the total of intermediate consumption (excluding energy), and the importance of imported capital goods from industrialized countries as a mechanism of technological transfer from the knowledge generators of to the country (see Gallego, 2011).
- This analysis could be carried out for some benchmark years in the eighties and nineties, to analyze, on the one hand, changes in wage differentials between tradable and non tradable sectors, and on the other hand, the link with trade opening of the Chilean economy both *de jure* and *de facto*. The analysis in this paper has already noticed some major changes between 2003 and 2008, suggesting that for previous year the differences could be greater.
- Following more precisely previous studies, the 29 sectors could be split into two instead of three groups on the basis of a single criterion such as the share of production exported.
- The results are complementary to the reviewed studies and suggest that the wage gap is explained by the effect of technological change in sectors that are particularly exposed to international trade. Trade openness is also an explanatory factor, as far as it relates to the incorporation of technology from industrialized countries, and institutional factors in the labor market, as the existence of unions should also be considered.
- The impact of unionization on wages, especially in sectors most exposed to international trade, deserves additional analysis, if possible incorporating micro data on union membership.

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Annex 1: Trade and skill premiums in Latin America - A review of selected studies

To analyse the link between trade and increasing skill premiums in Latin America observed over the past decades, we followed three out of six theoretical approaches proposed by Pavcnik *et al*. (2007). [14] These are skill biased technological change, industry specificities and compositional changes within industries, and the exporting and "quality" upgrading of products, plants and workers.

- Skill biased technological change

Studies on Latin America show that trade liberalization affected the distribution of wages, although in many cases this effect was small in relation to the role of technological change. The latter can be considered as an indirect effect of trade liberalization, since most innovations are embodied in machinery, equipment and inputs imported from industrialized countries.

For example, **Colombia** experienced growing wage inequality in the context trade liberalization (Attanasio *et al.*, 2002). With an estimated Mincer-type wage equation based on household survey data, these authors find that trade policy contributed to the increasing skill premium, in particular in the form of technological change favouring qualified workers. In a 2004 study, the same authors documented that during 1984 - 1998, the increase in the demand for skilled workers in Colombia was greater in the sectors that experienced the largest tariff reductions. This supports the finding that technological change was an endogenous response to trade liberalization.

In the case of **Brazil**, Pavcnik *et al*. (2002) conclude that trade reforms contributed to rising inequalities mostly through skill biased technological change induced by trade liberalization. Empirical evidence on the direct contribution of import liberalization to increasing wage gaps is mixed and inconclusive.

- Industry wages

Another explanation of increased skill premiums is the “industry wage”. This approach focuses on how trade liberalization affects specific industries through several channels:

- In models with short to medium term horizons, where workers cannot easily move across sectors, tariff cuts translate into proportional declines in wage premiums in the most affected industries.
- In models with imperfect competition, profitable industries share part of their income with their workers because of their union bargaining power. In these industries, labour unions may agree to lower wages in exchange for employment security in the context of tariff cuts.
- When trade liberalization improves productivity, these gains may be passed on to workers by wage increases.

Empirical evidence on the response of industry wage premiums to trade reforms is mixed. No association was found for this relationship in **Mexico** (Feliciano, 2001) nor **Brazil** (Pavcnik *et al.*, 2004), whereas a positive association was found in **Colombia** (Goldberg and Pavcnik (2004). For their part,

[14] To explain rising *skill premiums*, Goldberg and Pavcnik (2007) refer to the Stolper-Samuelson effects, the role of intermediate goods and outsourcing, the increase of capital flows and rising capital-skilled labor ratios, skill biased technological change, the composition of quality changes within industries and changes in returns in high-skilled jobs. Among the additional pathways, transitional unemployment, industry wages, uncertainty, labor standards and the production and consumption of households, are considered.

Kaplan and Verhoogen (2005) present proof that wages increased in plants with higher productivity, and that these increases were explained by higher wages of incumbent workers rather than newcomers.

Other studies point to the fact that industries that experienced wage declines following trade liberalization were also the ones facing the largest tariff cuts, having the highest proportions of unskilled workers and paying the lowest wages. Following trade liberalization, less-skilled workers suffer a double shock in terms of the increasing skill premiums and wage declines in industries that employ high proportions of unskilled workers.

Nevertheless, most studies finding proof of increasing wage inequality following trade liberalization show that the magnitude of this effect is rather small. This can be explained in part by the large informal sector in many developing countries offering alternative a buffer to trade shocks. In **Brazil**, Pavcnik *et al*. (2004) indicate that while industry affiliation is an important component of the worker's earnings, the structure of each industry wage premiums is relatively stable over time, and there is no statistical association between changes in the industry wage premiums and changes in trade policy.

- The quality effect in products, plants and workers

This approach focuses on the effect of trade reform on productivity and factor reallocations within industries towards more efficient plants. Import liberalization induces “quality” upgrading of companies, both in terms of "firm productivity" and "product quality”. Following trade opening, quality improves because firms face greater competitive pressure from imports and because resources are transferred from nontradable to export sectors, with the latter being more productive (Melitz, 2003). For the growing wage inequality debate, a connection needs to be established between, on the one hand, compositional changes within an industry and the "superior quality" of firms with higher demand for skilled labour, and, on the other hand, the increased skill premium. If higher quality products require a higher proportion of skilled workers, the shift towards higher quality products will benefit the latter.

Verhoogen (2008) adopts this “quality” approach in the case of **Mexico** using panel data of manufacturing plants. In a model with heterogeneous plants and quality differentiation, he finds that more productive plants produce higher quality goods and pay higher wages to maintain a more skilled workforce than less productive plants. Moreover, these more productive plants produce goods for exports that are of better quality than those made for the domestic market. He finds that more productive plants increased the proportion of export to sales, pay better wages and have more ISO 9000 certifications, than less productive plants in the decade following the 1994 Tequila crisis.

Galiani and Sanguinetti (2003) study whether trade liberalization has played a role in the evolution of the wage structure in **Argentina** during the nineties. Specifically, they tests if sectors where import penetration deepened are also the sectors where, *ceteris paribus*, a greater increase in the wage inequality is observed. Although the results support this hypothesis, the authors conclude trade deepening explains only a small part of the observed increase in wage inequality.

In a more recent study, Brambilla *et al*. (2010), investigate the link between exports and the wage premium in manufacturing **Latin America and the Caribbean**. They show that exporting firms in general are bigger, more productive, employ more workers and pay higher wages. Also, they analyse the possible association between exports and wage premiums, considering that export activities are skill-intensive requiring marketing and quality upgrading (labelling, warranties and certification). Using firm-level data, the authors find support for such a link, as they find a positive and statistically significant relationship between wage premiums and the level of exports. This elasticity is, however, small, because a doubling of exports is associated with an increase of only 0.28 percentage points of the wage premium.

Annex 2: Trade and employment in Chile - A review of selected studies

Literature on the Chilean experience with the effects of trade on employment have traditionally focused on ex-post evaluations of the effects of trade liberalization, while more recent studies estimated the impact of free trade agreements on employment.

Meller and Tokman (1996) analyse employment behaviour in manufacturing after trade opening in the seventies. This process increased the relative demand for skilled workers, especially in the tradable sectors competing with imports and, within the non-tradable sector, in banking and insurance. Less-skilled labour also increased in export sectors. During the second stage of the opening process after 1984, skilled labour grew in the import-competing sector and did not change in the export sector.

On their part, Marquez and Pages (1997) criticise the studies such as the one above as they do not control for simultaneous effects affecting the demand of labour. These include changes in productivity, real exchange rate, real wages, and the terms of trade. Their study assesses the impact trade liberalization in 18 countries in Latin America and the Caribbean. Using a panel data approach, they conclude that trade liberalization had a small direct negative effect on employment, in part resulting from the parallel appreciation of the exchange rate in many countries.

Levinson (1996) points out that import liberalization in combination with macroeconomic shocks resulted in an 8% decline of manufacturing employment from 1979 to 1986. Despite the absence of job creation, there was a very dynamic process of job creation and destruction within all sectors, as about 25% of all workers changed jobs every year. Firm level data suggest that the recovery following the recession in the early eighties resulted in a consolidation of employment in large firms.

Several studies used input-output matrices to evaluate the employment impact of trade liberalization. First, the Ministry of Planning (Mideplan, 2003) used the input-output matrix of 1996 to evaluate the employment impact of the growth in exports in the 1990s. It finds that the expansion of exports created 59 thousand permanent jobs. Second, Guardia *et al.* (2004a) and (2004b), made ex-post evaluations of Chile's trade agreements with Canada and Mexico, respectively, using the same methodology. In the case of the agreement with Canada, they report a positive effect of trade liberalization on employment as the net increase of jobs was 13,000 or 3.4% of all net jobs created during the 1997-2003 period. In the case of the agreement with Mexico, the net job growth was 73,000 jobs or 6.5% of total net job growth in the 1992-2003 period.

Finally, ILO (2008) estimates jobs creation resulting from trade agreements signed by Chile, incorporating the effect of FDI. Using input-output matrices for 1996 and 2003, it is shown that wage-earning employment associated to exports amounted to 716,624 jobs in 2003. This was a 29% increase relative to the level recorded in 1996. Total employment generated by exports accounted for 16% and 20% of total private wage-earning employment in 1996 and in 2003, respectively. When employment generated by FDI is included, wage-earning employment generated is equivalent to 22% of the total economy.

Annex 3
Cluster Analysis by Euclidian Distances

The distance function ***d***( ) between points x_i and x_j defined in ***l*** dimensions can be represented by:

$d(x_i,x_j) = d_{ij}$
$(x_i , x_j) \geq 0$
$(x_i , x_j) = 0$ when $x_i = x_j$
$(x_i , x_j) = d(x_j , x_i)$

The distances are represented in square symmetrical matrixes, where the *n* rows and the *n* columns are elements or objects on the basis of which we are calculate the distances. Thus, a distance matrix is:

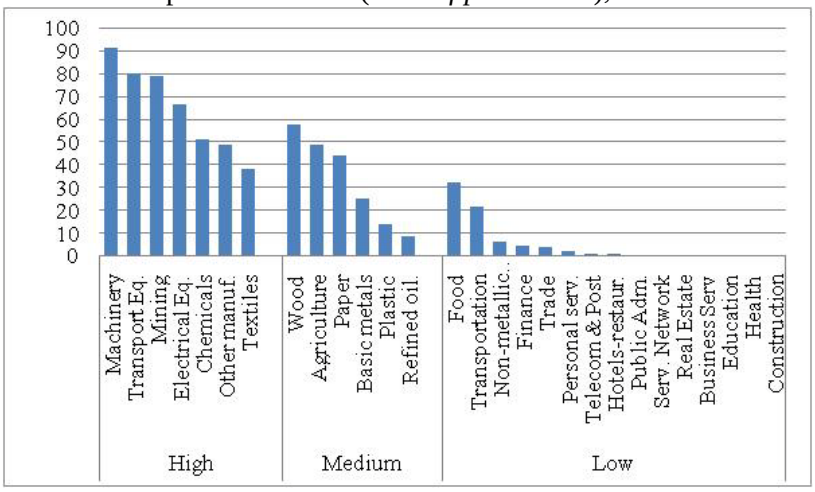
$$D = \begin{bmatrix} d_{11} & d_{12} & \dots & d_{1n} \\ d_{21} & d_{22} & \dots & d_{2n} \\ : & : & . & : \\ d_{n1} & d_{n2} & \dots & d_{nn} \end{bmatrix}$$

A frequently used distance measures is the Euclidean distance expressed by:

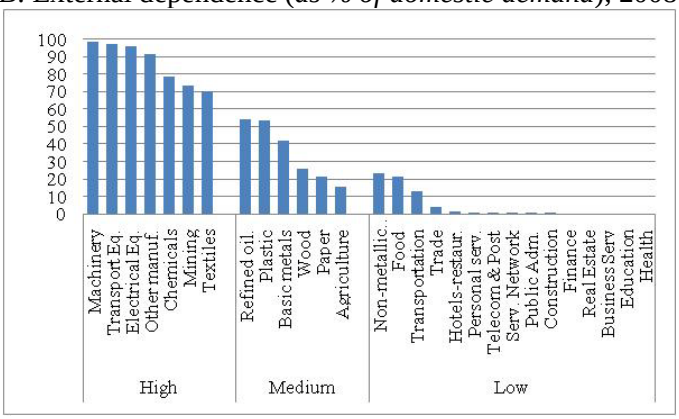
$$d_{ij} = \sqrt{\sum_{l=1}^{p} \left(x_{il} - x_{jl} \right)^2}$$

Where X_{il} represents the average element or indicator being measured. In this paper, we use hierarchical clustering of the divisive type, which starts with all observations within one single cluster and subsequently divides the elements into smaller clusters.

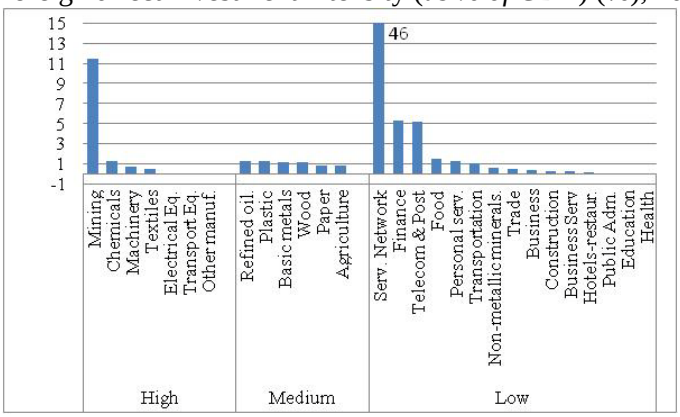
Export Coefficient (*as % of production*), 2008



B. External dependence (*as % of domestic demand*), 2008



C. Foreign direct investment intensity (*as % of GDP*) (%), 2008



Sources: Authors' calculations on the basis of LA-KLEMS and Foreign Investment Committee.

Description of the indicators

Indicator	Description	Formula	Variables	Data source
Export Coefficient	Share of production sold abroad	$CE = \frac{X}{GO} \times 100$	*X*: exports (basic prices)	Central Bank of Chile
			GO: gross production value (basic prices)	Central Bank of Chile
External Dependence	The import share of final consumption	$D = \frac{M}{(GO + M - X)} \times 100$	*M*: imports (basic prices)	Central Bank of Chile
			GO: gross production value (basic prices)	Central Bank of Chile
			X: exports (basic prices)	Central Bank of Chile
Foreign Direct Investment (FDI) Intensity	Ratio of FDI to value added	$I = \frac{IED}{VA} \times 100$	*IED*: foreign direct investment (FDI)	Foreign Investment Committee of Chile
			VA: added value (basic prices)	Central Bank of Chile