

Erasmus University Rotterdam
Erasmus School of Economics
Master thesis



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

Author: Alain Kras
Student number: 306027
Supervisor: Dr. L.D.S. Hering

Rotterdam, April 2012

Abstract

In this paper the relation between trade liberalization and individual wages for Chile between 1990 and 2009 is studied. Since the seventies, the economy of Chile changed from a closed to an open economy. This resulted in high economic growth, but inequality remained remarkably high. The exports and imports have indeed increased enormously and wage differences between 1990 and 2009 have narrowed. The effect of trade liberalization on the wage structure of Chilean individuals is studied by the Heckscher-Ohlin-Samuelson (HOS) model. This empirical study distinguishes three groups: (1) all persons, (2) low educated and (3) high educated persons. The effects of imports and exports together is tested, as well as imports and exports separately and the trade openness within these groups. The results are mixed. The impact of exports is in favor for high skilled persons but not significantly. The effect of imports and trade openness show a pro-poor growth, because the effect of imports on individual wages is higher for low than for high educated persons. Overall can be concluded, that the impact of import and trade openness on individual wages is in line with the Heckscher-Ohlin theory.

Keywords: trade liberalization, wage inequality, Heckscher-Ohlin-Samuelson, Chile

Table of Contents

1	Introduction	4
2	Theoretical background	8
2.1	Literature on the theoretical framework	10
3	Trade liberalization	13
3.1	Free Trade Agreements	14
3.2	Literature on trade liberalization	15
4	Wage distribution in Chile	17
5	Empirical Research	19
5.1	Methodology	19
5.2	Data	19
5.2.1	Individual data	19
5.2.2	Trade data	21
5.3	Results	22
6	Conclusion	27
7	References	28
8	Appendix	30

1 Introduction

Since the early seventies, the economy of Chile has changed substantially. Over time, the economy changed from a closed economy to an open economy with great economic successes. Nowadays Chile has one of the highest GDP per capita in Latin America.¹ Before those successes however, Chile had a closed economy under the regime of the socialist President Allende. Between 1970 and September 1973 he extended the governmental control over the Chilean economy. At that time there was a high public deficit; import tariffs and inflation were high, resulting in social unrest throughout the country. On September 11 in 1973, there was a military coup and the military government initiated structural economic reforms. The military government's main purpose was to give the (free) market a significant role in the Chilean economy. Therefore, prices were left to market forces, instead of being set by the authorities. The process of reforms also consisted tax reforms, lowering of tariff and non-tariff barriers and a deregulation in the labor market (Beyer et. al. (1999)). Privatization of among others the social security, the banking system and others resulted in a change of the public budget into a surplus. However in 1975 an important recession affected the Chilean economy. This recession was the result of a downturn in terms of trade and fiscal adjustments. As a consequence, unemployment rose and GDP fell 11% that year. The economy recovered between 1977 and 1981. Table 1 shows that the annual GDP growth was positive during this period and was more than 8 percent in 1980. Nevertheless Chile was hit by another recession between 1982 and 1983. This crisis had major impact on the banking system, as a lot of banks went bankrupt. It was a period where privatized firms returned to be controlled by the state (see Table 1: merchandise trade) and the government wanted to increase the tariffs again. This did not happen on a very large scale and economic perspectives were very good after this recession.

Since 1984 the Chilean economy grew incredibly. The average annual growth of GDP between 1984 and 2008 is almost 6 percent. GDP per capita rose from 2.530 dollar (current international dollar) in 1980 to 14.543 dollar in 2008. Furthermore unemployment was constantly below 6.3 percent between 1988 and 1998. The reason for this low unemployment at that time was that the economic model underlined the development of employment of intensive industries. The past decade unemployment is higher (around 8 percent) but remains stable. Economic recessions and a more inflexible labor market are reasons for this higher unemployment. Moreover privatization processes were largely applied.

Nowadays Chile is seen as an upper middle income country by the World Bank.² The population of Chile was just under 17 million people in 2009 and the Metropolitan area (including Santiago) consisted of about 7 million inhabitants at that moment. This means that about 40 percent of total Chilean population lives in Santiago. Worldwide the average population living in the biggest city is about 16 percent. Although Chile is a large country, expressed in population it can be seen as a small economy. Chile is, among others characterized by its richness in minerals, especially copper. In 2010 Chile was the first Latin American country to access the OECD and in the recent past years Chile has one of the highest GDP per capita of Latin America.

All trade reforms make that Chile now is a small and open economy. One of the most important reasons for the economic successes must be this profound policies to open the economy.

¹ Source: <http://data.worldbank.org/country/chile>

² Source: <http://data.worldbank.org/country/chile>

Trade liberalization has been one of the most drastic reforms. Exports rose enormously as a consequence of lowering trade barriers and (later on) signing important trade contracts. More about the processes of trade liberalization and its effects on the economy will be discussed in Section 3.

There are some socio-economic indicators shown in Table 1, coming from the databank of the World Bank. Not only the GDP per capita has increased, most macroeconomic indicators for Chile show a general improvement over the past decades. Indicators for, among others, health and education are positive as well. The literacy rate of the population was almost 100 percent in 2008 and secondary school enrollment (gross) has increased significantly over the past years. Secondary school follows after primary school and is fundamental for future income. Secondary school is more subject-orientated education and is crucial for high skilled labor in a country. Furthermore life expectancy at birth has increased and is nowadays at the same average of the European Union.

As mentioned earlier, privatization was part of the liberalization process of Chile. Merchandise trade is the sum of merchandise exports and imports as a percentage of GDP. It is a good indicator for the private sector and you can see in Table 1 that the merchandise trade grew from 16,8 percent in 1972 to 75,1 percent in 2008.

Indicators for labor and social protection are wages, labor participation and unemployment. These indicators are very important for a country's development and social satisfaction. The labor participation rate of the total population (% of total population of 15 years and older) is between 50 and 60 percent since 1980. For Latin America this percentage is higher (65 percent) but for Europe it is more or less the same since the nineties. This can be explained by the people going to school at the age of fifteen and older. It can also be explained by unemployment. For Chile unemployment was high in the eighties; around 10 percent and almost 20 percent in 1982. Unemployment then decreased significantly (4,4 percent in 1992, one of the lowest percentages ever for Chile), but in the past decade unemployment is higher again. Annual real average wages increased at a stable level over time.

There has been a high current deficit in the eighties, due to the recessions and governmental interference. The current account of Chile was positive between 2004 and 2007 and was negative in 2008. Due to good recovery the current account was positive again in 2009 and even higher than for example in the United States.

We can argue that trade liberalization has had generally major positive effects on the GDP and on poverty. Besides all these economic successes however, there is something that has not improved over the years, namely inequality. Inequality remained notably high for Chile, also after trade liberalization. Income inequality has always been relatively high for Latin America in relation to the rest of the world. The major reforms in the late seventies even show a tendency to greater wage inequality. At that time this may be due to the severe regime of President Allende. However, this cannot be the only explanation for the high inequality in Chile for the past decades. We will take a deeper look at the trends of income inequality in Section 4.

There is another reason why it is remarkable that inequality remained high, if one consider that Chile is a developing country. Well known economic theories like Heckscher-Ohlin and Stolper Samuelson show that wages of the low skilled should increase when a developing country opens up the economy. These theories will be elaborated on in Section 2.

Table 1: Main macro indicators 1970-2008

	1970	1972	1974	1976	1978	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008
GDP growth (annual %)	2.1	-0.8	2.5	3.4	7.5	8.1	-10.3	8.0	5.6	7.3	3.7	12.3	5.7	7.4	3.2	4.5	2.2	6.0	4.6	3.7
Labor participation rate						50,3	49,6	50,7	51,9	53,7	54,1	55,2	56,5	55,4	55,9	54,6	54,1	55,8	55,9	59,5
unemployment rate						10.4	19.6	13.9	8.7	6.3	5.7	4.4	5.9	6.3	6.3	9.2	8.9	8.8	7.7	7.8
Annual real average wages (2000 = 100)						66.2	72.2	64.5	62.8	66.8	69.3	76.0	83.9	91.6	96.3	100	103.7	106.5	110.6	113.5
Merchandise trade (% of GDP)	25.7	16.8	29.8	40.0	38.2	38.1	31.6	37.6	43.0	50.1	51.1	45.4	42.5	47.3	45.6	50.1	52.4	59.9	66.1	75.1
Current account balance (% GDP)				1,5	-7,1	-7,1	-9,5	-11	-6,7	-0,9	-1,5	-2,2	-2,9	-4,1	-4,9	-1,2	-0,9	2,2	4,9	-1,5
Secondary school enrollment (% gross)	46,2	55,3	57,5	56,2	60,0	62,5	63,9	71,9	77,7	82,5	78,2	77,4	n.a.	n.a.	78,1	82,7	85,6	89,1	91,2	90,4
Literacy rate							91.1					94.3					95.7			98.6
Life expectancy	62.0	63.2	64.6	66.1	67.6	69.1	70.3	71.4	72.2	72.9	73.6	74.2	74.7	75.3	76.0	76.8	77.5	78.1	78.4	78.6
Real effective exchange rate (2005 = 100)						171,9	182,6	148,8	104,2	89,7	88,0	97,0	102,5	111,2	117,2	110,7	96,7	96,2	103,6	101,6

Source: World Bank

The purpose of this paper is to study the relation between trade and the individual wage levels in Chile. This allows us to understand whether trade liberalization has increased, or decreased inequality within the country between different types of workers. The focus lies on individual wages and a distinction between wages of low educated persons and high educated persons is made. Moreover the effect of trade liberalization on wages of the total working population is studied. The starting point will be the commonly used trade theory of Heckscher Ohlin and Stolper-Samuelson. For the empirical analysis data of the period 1990 to 2009 is used. With this data we build on to earlier empirical work on the trade effects for Chile. Among others, Beyer et. al. (1999) and Ferreira and Litchfield (1999) have done research regarding the effects of trade liberalization on wage differentials for Chile. However, the data in their studies are restricted to an earlier time period respectively the period 1960-1996 and 1987-1994. Moreover, Beyer et al. (1999) used data from the Greater Santiago household income surveys, which is restricted to the metropolitan area. Besides, Beyer et al. (1999) offer some hypothesis on the positive relation between openness and inequality, but no empirical work is done by the authors. Ferreira and Litchfield used the same survey data as is done in this paper (*Caracterizacion Socioeconomica Nacional (CASEN)*) but only until 1994. The process of trade liberalization for Chile has not stopped since then, but is still in process. The study will focus on the patterns of the link between trade liberalization and income distribution of the past two decades (1990-2009).

In short, this paper is organized as follows. In Section 2 an explanation of the theoretical background is given. In Section 3 we will share light on the process of trade liberalization in Chile. The patterns and trends of wage distribution are discussed in Section 4. The empirical research will be discussed in Section 5. This section contains the methodology, information on data and the results of our research. Section 6 contains the conclusion of this study.

2 Theoretical background

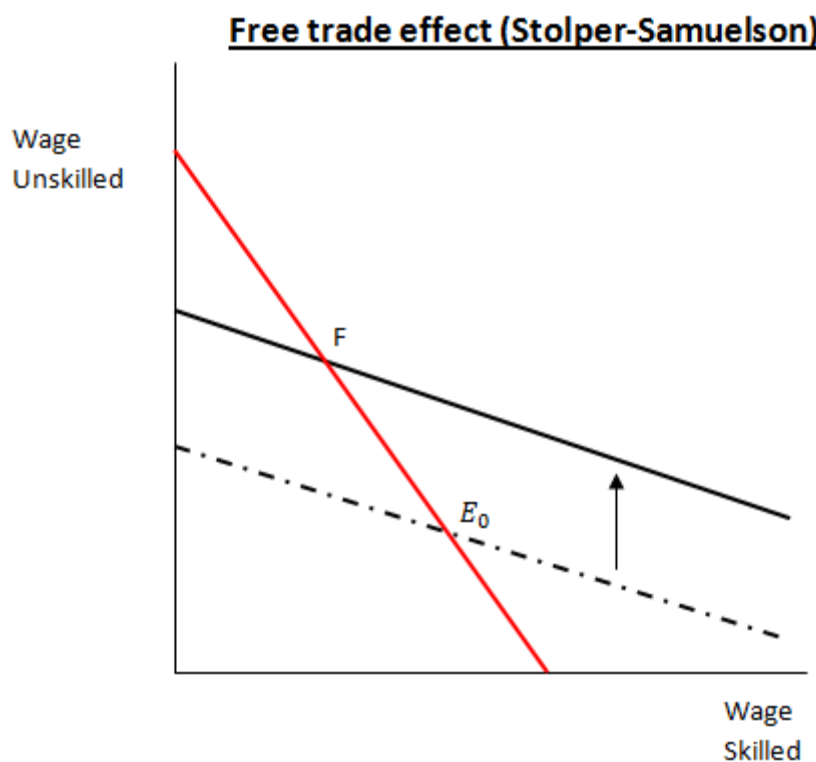
In this section the focus lies on the theoretical relationship between trade liberalization and income distribution. Especially the trade theories of Heckscher-Ohlin and Stolper-Samuelson will be discussed. Furthermore light is shed on some critics and remarks on these theories.

A well-known theory about the effects of trade liberalization on inequality is the Heckscher-Ohlin model of international trade. This theory is based on one of the general accepted theories by economists; the theory of comparative advantage. The Heckscher-Ohlin model builds on the theory of Ricardo. Ricardo states that everyone wins from trade and that there is only one factor of production. The outcome of free trade is complete specialization. The Heckscher-Ohlin model is more complex, but gives more subtle and nuanced predictions. They also say that trade will increase economic growth and therefore it is important to reduce barriers like import tariffs to stimulate international trade. Free trade will increase efficiency and aggregate welfare, but not everyone will benefit from it, as Ricardo claims. Heckscher-Ohlin (HO) assumes that there is a net gain, but there are also losers caused by free trade. Their theory explains that countries export that good that is used intensively in production by the relative abundant factor of that country. For instance country A will export the good that uses a relatively more abundant factor in production. Moreover it will import the good that is produced with relatively more of the factor of production that is relatively abundant in country B (Burtless (1995)). Two theories arising from the Heckscher-Ohlin theory are the factor price equalization theorem and the Stolper-Samuelson theorem. These two theories are important, describing the link between trade and inequality. The factor price equalization theorem argues that, under the assumptions of HO, prices of the factors of production will be equalized among trading partners by free trade. This means that a developing country (Chile) benefits from this free trade. The proved theorem of Samuelson shows that real wages of Chilean workers will increase and/or the real wages of the developed country will decrease because the prices of the factors of production will equalize over time.

The Stolper-Samuelson (SS) theorem describes the relation between the relative prices of output goods and relative factor prices. We know from Heckscher-Ohlin that the good is exported that uses production by the relative abundant factor of that country. The trade of these goods increases the demand for those goods and thus for the abundant factor of that good. The increased demand will change the relative goods prices. In the HO setting, Stolper-Samuelson tells us that if the relative price of one good increases, the price of that factor, which is used intensively in the production of that good, will increase as well. The other factor price will decrease. Within the economic theories two common used factor prices are labor (L) and Capital (K). For our theoretical framework however, the factor prices we will use are skilled labor (S) and unskilled labor (U). For a developing country like Chile, it can be assumed that the country is relative labor unskilled abundant. Free trade will increase the domestic price of the export good produced by the relative abundant factor. As a consequence the return of that abundant factor (in this case unskilled labor wages) will increase as well. According to these theories the expectation is that developing countries become less unequal when opening to free trade. A reduction in trade barriers has the same effect, as it stimulates trade.

Graphically an example can be given to illustrate how the SS theorem works. Consider a model with two countries, two sectors and two factors. There is a developing country (in this case Chile) and a developed country. The two factors are skilled and unskilled labor and the sectors are the agricultural and the service sector. In Figure 1 on the vertical axis the wage for unskilled labor is shown and on the horizontal axis the wage for skilled labor. We will assume that the agricultural sector uses the relative labor unskilled workers for production. The service sector is relatively skilled labor abundant. The black line represents the set of all wages for the agricultural sector (unskilled labor). The set of wages which generate zero profit for the service sector (skilled labor) is given by the red line. The starting point is E_0 in autarky for Chile and this is the unique point where both sectors have zero profit. There is an equilibrium between the skilled and the unskilled sector and wages of those sectors. The F point is the point of free trade. When a country opens up the economy, the good that is used intensively in production, by the relative abundant factor of that country (HO theory) will be exported and the price of that good will increase. We can assume that Chile is a relative labor unskilled abundant country so it will increase the production of the agricultural sector. Graphically can be seen that the black dotted line shifts up to the black straight line and the price of the agricultural sector increases. According to Stolper-Samuelson this means that the relative factor prices will increase as well. So when the developing country changes their economy into an open one, according to Stolper-Samuelson inequality decreases because the wages of the unskilled sector increase.

Figure 1



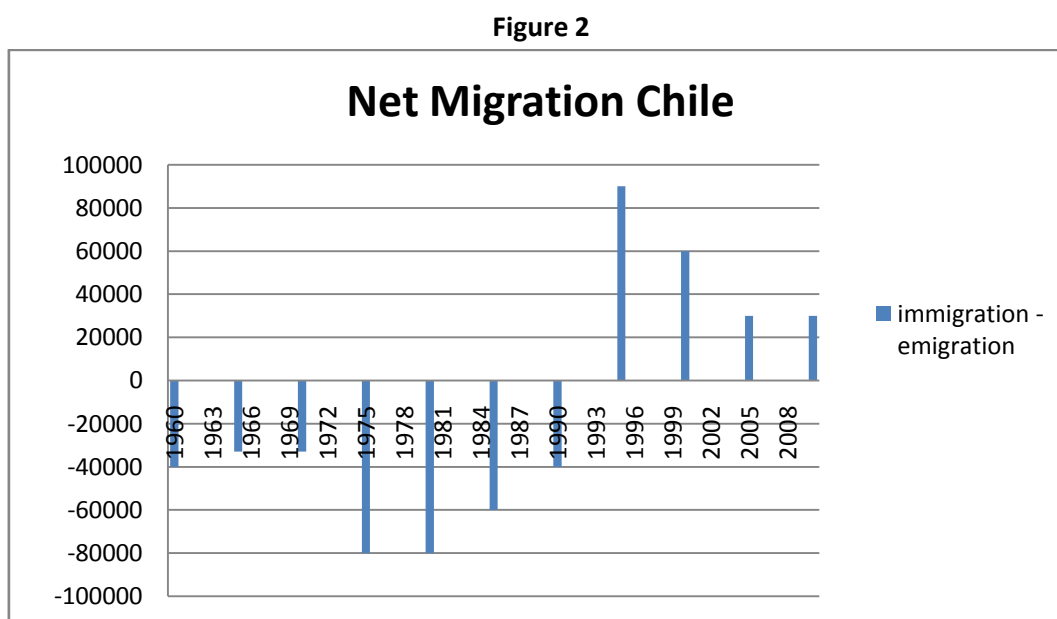
Source: Author (based on Stolper Samuelson)

2.1 Literature on the theoretical framework

The Ricardian comparative advantage theory and the Heckscher-Ohlin-Samuelson model are well-known theories of international trade. However empirical findings do not always confirm these theories. Growth and welfare enhancing effects of international trade are generally accepted but there are mixed results for the effects on inequality. Therefore literature on the theories is discussed in this section. In Section 3 a closer look is taken at the case of trade liberalization for Chile and Latin America.

Davis (1996) remarks that empirical studies show many contrary results to the Heckscher-Ohlin-Samuelson theory; thus that liberalization does not benefit the abundant unskilled labor. His study tries to give a theoretical explanation for this notable contradiction. Examples are given by among others Esquivel and Rodriguez-Lopez (2003), Galiani and Sanguinetti (2003) and Behrman et al (2000). Davis (1996) takes a different and critical assumption to explain the anomaly between the Stolper-Samuelson theorem and some empirical evidence. Stolper-Samuelson compares the relative factor abundance of a developing country with the rest of the world (the global economy). Now, factor abundance matters only relative to a smaller set of countries with similar endowment proportions.³ This means that a country can be relative labor abundant if one takes the global economy as a reference, but it is relative capital abundant if the smaller set of countries is the reference. Such a small set of countries can for example be neighboring countries or a set of countries that have free trade agreements.

According to Davis migration can be an indicator for the Stolper-Samuelson theorem. One can assume that emigration will decrease if wages for the unskilled increase, given the fact that income can be a motivator to migrate. If this is true this means that Stolper-Samuelson effects occurred since the early nineties according to Figure 2.



Source: WDI

³ Davis, D., 1996, "Trade Liberalization and Income Distribution", page 2,3

Adrian Wood (1997) shows that the HO theory supports the trends in East Asia. Openness to trade in the sixties and seventies resulted in less wage inequality in that region. However, this is not true for Latin America, as wage differentials became larger or remained high since the eighties, when processes of trade liberalization began. For Chile it is a plausible explanation that inequality remained high in the late seventies due to the military control at that time. Wood (1997) argues that there is a clear contradiction between East Asia and Latin America but he acknowledges that further research is needed on the countries. Nevertheless, for his research he assumed that there is indeed a difference between the effects of openness on wage inequality in both continents. This allows him to compare both regions and both periods. Differences between both regions are (1) the faster growth in the supply of skilled labor in East Asia, (2) the more regulated nature of labor markets in Latin America and (3) the availability of natural resources (Wood 1997). Latin America has a comparative advantage in primary products, compared to East Asia, because most of the countries are rich in natural resources. However primary production often does not require skilled workers.

A more promising explanation for the different effects on wage inequality is the different period of trade liberalization. There is one important difference between both periods; the influence of Asian countries like China and India on the world economy. Since the mid-80s these countries opened their economies and became very important trade partners to the rest of the world. Before that they were closed economies with no trade. Relative to middle-income countries, low-income Asia was very labor unskilled abundant. Their comparative advantage in low skilled production may have shifted comparative advantages of Latin American countries. Trade liberalization now can have two effects on relative wages. Latin America has a comparative advantage of relative unskilled labor compared to developed countries. However Latin America has a comparative advantage of relative skilled labor compared to low-income Asian countries. Therefore trade liberalization in the late 70s and 80s could also increase wage inequality.

The development of technology is another explanation for the effects on Latin America, because it may have raised the relative demand for skilled labor. The technological progress of the past decades is unfavorable for wages of unskilled workers.

Nissanke and Thorbecke (2006) argue that there can be other links between globalization (as a result of trade liberalization) and poverty and inequality. The aim of their paper is to have a critical view on the literature of the debate on globalization and poverty/inequality. The authors stress that there are four different concepts of inequality. The first three concepts are not relevant for this study. However the fourth concept captures so-called vertical and horizontal inequality. Vertical inequality represents inequality among individuals at different levels of income and horizontal inequality refers to inequality within the same social or income class. The main focus within this research is on vertical inequality and Nissanke and Thorbecke (2006) accentuate that class conflicts could occur. The example they give illustrates that due to trade liberalization food prices could increase in a developing country. As food prices go up, the income of farmers will increase as well, because they sell their products for higher prices. Purchasers of food however will not benefit if they do not work in that sector, because their income stays the same. Empirical literature shows that the 'between countries' inequality is more significant than 'within country' inequality, see Williamson (2002) and Bourguignon and Morrison (2002).

Nissanke and Thorbecke (2006) show stepwise the channels between globalization & trade liberalization and poverty & inequality, the so called *openness-growth-inequality-poverty* chain. The first link is between openness and economic growth. Due to an increase in exports, imports and capital inflows; trade liberalization contributes to a growth of GDP. There is clear empirical evidence that trade increases total productivity, due to a more efficient reallocation of resources. The second link is between inequality and growth, which is interesting for this study. There are several channels showing that high inequality leads to lower economic growth. Five reasons are given for this link; (1) high rent-seeking activities, (2) more social unrest leading to lower investment, (3) ineffective redistribution policies in order to reduce inequality, (4) underinvestment by the poor and (5) negative impact on education. Altogether inequality probably leads to slower economic growth in the future. The third link shows that high inequality has a negative effect on poverty, among others because inequality has negative effect on economic growth. Another important issue in the mentioned channels is the so-called pro-poor growth. The pro-poor growth makes a distinction between absolute and relative growth. There is a relative pro-poor growth if distributional shifts accompanying growth are in favor for the poor compared to the non-poor. We will focus on the relative pro-poor growth because it is more relevant for the inequality issue. Growth is not the only channel for inequality and poverty. Important other links are: changes in relative prices of factors and products and factor mobility (see Heckscher-Ohlin and Stolper Samuelson). Technological progress over time is another factor which can influence the inequality, because it is skill biased. Moreover vulnerability, flow of information, global disinflation and institutions affect income distribution (Nissanke and Thorbecke 2006).

3 Trade liberalization

In this section we will first give a short review of trade liberalization in five stages between 1974 and the nineties for Chile. Then the process of free trade agreements since the nineties will be discussed and the impact of these free trade agreements for the economy of Chile will be shown. Finally we will review several papers about the effects of trade liberalization for among others Latin America.

One of the most important reforms in the past decades for Chile is trade liberalization. Edwards and Lederman (1998) distinguish five different stages of reforms, regarding trade liberalization, between 1974 and the nineties. The first stage between 1974 and 1979 contains important reductions of import tariffs. According to Edwards and Lederman (1998) the average import tariff was 94 percent at the end of 1973. In 1974 this dropped to 67 percent and it dropped to 44 percent in 1975. After that, import tariffs continued to drop gradually to 11 percent in 1991. In this period lowering tariffs was not the only policy. The government also wanted to maintain a competitive real exchange rate. For example, after 1974 a depreciation of the real exchange rate was needed to stimulate exports. See Table 2 for average applied tariff rates of the last two decades. Here, you can see that the tariff reduced to 1.2 percent in 2008, however due to the economic crisis the tariff rate went to almost 6 percent in 2009 (not in the figure).

The second stage (1979-1982) the exchange rate was fixed to the dollar, which resulted in an appreciation of the exchange rate. As a consequence of the appreciation, Chile ran out of reserves and a crisis occurred in 1982. The trend of openness was interrupted during this crisis, due to an overvalued currency. The effects of this crisis were the bankruptcy of a lot of banks and firms, resulting in more unemployment and an enormous decline of GDP, as mentioned earlier (Section 1).

Between 1983 and 1985 (third stage) the country turned to a more severe state control. This was due to the crisis in the previous years and the desire to have more control by the government. The uniform tariff rate was raised from 10 to 35 percent (see Edwards and Lederman (1998)). After 1985 the Chilean economy recovered fast. The process of trade liberalization was resumed and tariffs were lowered again. Among the important economic measures of that fourth stage (1985-1990) was to establish an independent Central Bank.

The last stage, beginning in 1991, focused on new trade strategies like Preferential Trade Agreements (PTAs) and Free Trade Agreements (FTAs).

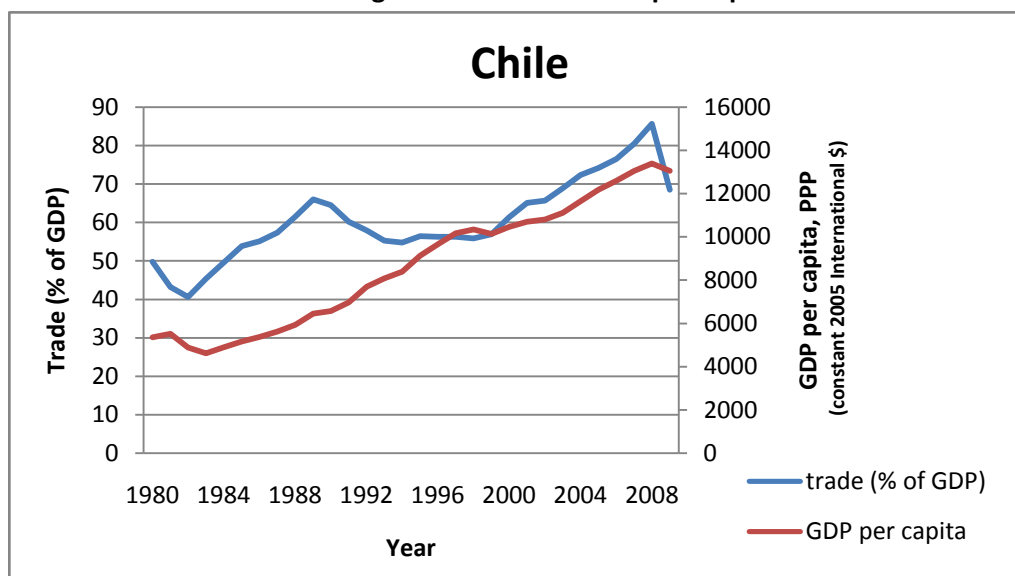
Table 2: average tariff rates

	1992	1994	1996	1998	2000	2002	2004	2006	2008
Tariff rate (applied weighted mean)	11.0	10.9	n.a.	10.9	9	6.96	3.76	2.18	1.02

The importance of trade liberalization for economic growth and the link between both can be seen in Figure 3. On the left axis trade as a percentage of GDP is shown. This percentage is a good indicator for trade liberalization. On the right axis GDP per capita is shown and both variables show an increasing trend. Both indicators have more or less the same patterns. More evidence of the positive effects of trade liberalization on economic growth for Chile but also for the rest of the world is given by Sachs and Warner (1995) and Edwards (1993). They show that trade liberalization will

increase aggregate income. There is a large amount of other research that proves this theory, so it is a common accepted effect of trade liberalization. Worldwide there is strong evidence, that countries that opened their economies have experienced accelerated growth between 1970 and 1989 (Sachs and Warner (1995)).⁴

Figure 3: Trade and GDP per Capita



Source: World development indicators

3.1 Free Trade Agreements

In the nineties a new stage of trade liberalization began for Chile. Since 1991 Chile negotiated with several countries and regions for preferential trade agreements and many trade contracts were signed since then (Chumacero et al. (2004)). These trade agreements and other contracts aimed to stimulate trade, have played an important role for the Chilean economy. It also contributed to the highly open economy as we know it nowadays. Two important trading partners of Chile are the European Union (effective since 2003⁵) and the United States (effective since 2004⁴). In total, Chile signed FTAs with 19 countries between 1996 and 2009.

Chumacero et al. (2004) take a closer look at the agreements with the EU and the US and study the economic effects for the Chilean economy. The authors quantify the potential effects of the FTAs and distinguish short and long term effects. They set up a dynamic general equilibrium model for a small economy and adjusted the model to the main features of Chile's trade agreements. Different scenarios show an increase of GDP, aggregate consumption and welfare due to the FTA's in the long term. The increases however are not very large, due to the fact that Chile already had a relative open economy before the agreements were effective. Nevertheless benefits from FTA's with the US and the EU should not be underestimated.

In Table 3 the imports and exports as a percentage of GDP and the real exchange rate are shown. The share of import and export has increased a lot since 1970. In 2008 both were above 40

⁴ Their study is limited to 1989, so that does not mean that growth has stopped since then.

⁵ SICE; Foreign Trade Information System: http://www.sice.oas.org/agreements_e.asp

percent of GDP, while this was about 14 percent in 1970. Data on real exchange rates⁶ are available since 1980. At that moment it was very high but it decreased over time and is stable nowadays.

Table 3

Year	Import volume		Exports volume		Real exchange rate (index: 2005)
	Imports % GDP	Rate of change	Exports % GDP	Rate of change	
1970	14.02	0.95	14.61	2.06	
1980	26.98	23.48	22.82	14.19	171.91
1990	30.55	5.81	33.99	8.62	88.05
1991	27.77	6.95	32.40	12.43	91.78
1992	28.17	21.81	29.81	13.93	97.04
1993	28.62	14.18	26.62	3.53	99.02
1994	26.57	10.12	28.24	11.63	102.46
1995	27.10	24.98	29.30	10.98	108.60
1996	28.97	11.83	27.28	11.78	111.23
1997	29.20	13.18	27.08	11.20	119.37
1998	29.57	6.72	26.30	5.23	117.17
1999	27.33	-9.53	29.60	7.32	111.63
2000	29.73	10.05	31.60	5.08	110.73
2001	31.77	4.09	33.31	7.23	100.04
2002	31.62	2.25	34.04	1.60	96.72
2003	32.41	9.74	36.52	6.46	90.84
2004	31.58	18.41	40.76	13.30	96.21
2005	32.81	17.18	41.33	4.32	100.00
2006	30.71	10.61	45.77	5.09	103.61
2007	33.24	14.51	47.25	7.57	100.59
2008	40.89	12.20	44.78	3.11	101.65
2009	30.36	-14.28	38.14	-5.60	100.25

Source: World Bank

3.2 Literature on trade liberalization

Chile is not the only developing country suffering an increase of wage inequality, as the rest of Latin America has shown the same trend the past decades. There has been a large amount of research the past decades, trying to explain the changes of relative wages over time for different groups of the population. The amount of data for countries worldwide has increased over time and fluctuations of wage inequality are the main reasons for this quantity of research. The raising inequality worldwide is mainly explained by the increased demand of relative skilled workers.

⁶ A measure of the value of a currency against a weighted average of several foreign currencies (World Bank)

Like Chile, Costa Rica and Mexico lowered their trade tariffs significantly to stimulate trade. Colombia is an example of increasing trade by devaluating the exchange rate considerably, which resulted in an almost doubling of exports (Robbins 1996). Robbins shows that relative wages have not lowered before the nineties for Chile, Columbia and Costa Rica. On top of that, he shows that studies found that minimum wages did not affect relative wages for those countries. Possible explanations are the technological change worldwide and for the specific case of Chile the abundance of natural resources. Robbins (1996) offers alternative theories to the H-O and SS theories. For Chile he finds a shift of skill intensive employment within industries (which is contrary to the H-O theorem). This suggests capital deepening and/or technological progress in that period.

Green et al. (2001), Galiani and Sanguinetti (2003), and Esquivel and Rodriguez-Lopez (2003) did empirical research on trade and wage inequality for Brazil, Argentina and Mexico respectively. There are a lot of differences between these countries and Chile, but it is interesting and relevant to see what the effects on these countries of the same region are. Most of the Latin American countries namely, were similar in the sense that they were developing countries and opened their economies in the same period. Green et al. (2001) find little effects of trade on the inequality in Brazil. They do find a significant and substantial rise in the returns to college education over the years (from 1992 onwards). This trend could be explained by a change of skill-biased technology, following Robbins (1996). For Argentina Galiani and Sanguinetti (2003) show that during the nineties there was an important increase of the college wage premium and in the decade before it decreased. The authors find evidence that due to trade liberalization, there is a growth of the college-wage premium. Nonetheless, this effect does not seem to be one of the main reasons for the increase of income inequality in the nineties. Esquivel and Rodriguez-Lopez (2003) discuss trade and wage inequality before and after Mexico entered the NAFTA (North American Free Trade Agreement). A Result of their empirical study is that technology was responsible for the increase in wage inequality before Mexico entered the NAFTA. However, in absence of technological trade, the authors show that there would have been a reduction of wage inequality, as predicted by Stolper-Samuelson.

In his paper about trade and growth in developing countries, Edwards (1993) starts with a short summary of trends in trade since the 1950s. Until the 1970s there was a general view that protectionism was the best policy for the growth of developing countries. From the 1960s onwards there were more and more academics who investigated the effects of a more open oriented economy. With evidence of many different empirical researches, an increased number of academics were convinced that developing countries should open their trade sectors for more economical success. In the early 1990s exports were one of the main drivers for economic growth in Chile. For his study, Edwards (1993) focuses on detailed multi-country studies of liberalization and on cross-country regression analyses. Edwards shows that Romer's (1989) model of endogenous growth was a new theory compared to the neoclassical models where growth was exogenous on the long run. Romer's model shows that more free trade will result in a higher equilibrium growth. Another model by Edwards (1992) shows that due to openness, a small country can absorb technology of developed countries and will thus grow faster. It is important, also for our study, to use a reliable indicator for trade openness. Romer (1989) has captured openness by using exports and imports share. The disadvantage is among others that exports and imports ratios are dependent on the economy's structure (like the size of a country).

4 Wage distribution in Chile

This section covers trends in wage distribution in Chile of the last couple of decades. Using data from among others, household surveys we will show several indicators for inequality. The focus of this section is looking for relations between education, income levels and distributive changes.

Behrman et al. (2000) did research on the remarkable fact that inequality remained very high for Latin America despite the economic successes. They use a high quality data set (1980-1998) on wage differentials by schooling level for eighteen Latin American countries. One of the findings is that, especially in nineties, the wage gap between workers with higher education and those with secondary and primary education widened. The authors also find that reforms in general increase wage differentials but the effect becomes smaller over time. We will indeed see (Table 4) the effect has decreased and even reversed for Chile. On the long run reforms, and thus trade liberalization, might have positive effects on wage differentials.

For a reliable view of income distributions of the past 30 years we will use these individual income statistics and show the trends of income distributions using quintiles. For Table 4 data is used from the so-called CASEN surveys. Those surveys are conducted by the Chilean Ministry of Planning (MIDEPLAN).

In Table 4 the income quintiles are given for several years. Each quintile represents 20 percent of the population. The first quintile represents the lowest 20 percent (of income) of the population and the fifth quintile the highest 20 percent. Table 4 specifically shows the income distribution according to the educational attainment of each individual. The evolution of income distribution is among others dependent on educational attainment of the population (Galiani and Sanguinetti 2003). We define two skill groups: skilled and unskilled workers. The unskilled workers are individuals who spent up to nine years of school. This means they have finished preprimary and primary school. Skilled workers are individuals who spent more than nine years at school and this group contains individuals who finished secondary school, high school or university. It must be noticed that differences in-between the high educated group can be large because earnings between persons who attained secondary school and university may differ significantly. However, for the empirical research a distinction between two educational groups will give sufficient reliable and robust results. Not surprisingly, the skilled or high educated group earns much more than the unskilled or low educated group. Income for both educational groups have experienced continues growth. However, the differences between both groups have become smaller over the years. Especially for the last decade, the income of the low educated increased fairly. Finally, if you look at the total average income over time this increased for every new year. This increase is not surprising because the Chilean economy grew enormously in the same period.

Table 4: Income in pesos

group	1990	1992	1994	1996	1998	2000	2003	2006	2009
Low educated	49,580	66,273	76,341	103,159	114,935	118,311	129,142	152,857	203,351
High educated	118,332	172,204	232,866	238,953	286,226	269,336	277,985	285,576	342,409
difference	2,39	2,60	3,05	2,32	2,49	2,28	2,15	1,87	1,68
Total average income	74938	110706	134487	172569	194678	207718	227074	243986	304094

Most indicators we use, show an improvement of income distributions for Chile. Beyer et al. (1999) and Ferreira and Litchfield (1999) showed contrary developments for the period 1960-1996. In that period the distribution tended to get more unequal, so that means that the trend changed over time.

5 Empirical Research

In this section the empirical research is discussed. First in Section 5.1 we will say something about the methodology and the equation being used. Then in Section 5.2 the data we used is discussed and a distinction between individual and trade data is made. Moreover we analyze all the variables that are used for the research. Finally in Section 5.3 we discuss our results.

5.1 Methodology

To see what the effect of trade liberalization on wage differences is, the following equation is estimated:

$$W_{ijt} = \alpha + \beta\rho_{jt} + \delta x_{ijt} + \varphi_t + agri_j + \varepsilon_{ijt} \quad (1)$$

Here, W_{ijt} represents the wages of individuals of Chile and α is a constant. Wages are measured for an individual i working in industry j at time t . ρ_{jt} is sector-specific and represents the measure for trade at time t . Depending on the specification chosen, this variable captures: imports, exports or trade openness ((imports + exports)/GDP). In this research we are especially interested in the sign of its coefficient β , because β shows the effect trade has on the wages of individuals living in Chile. The variable x_{ijt} contains a set of control variables like rural, gender and years of schooling (experience). More on these control variables is described in Section 5.2. φ_t Represents yearly fixed effects. Standard errors are clustered at the regional level. The sector dummy is indicated by $agri_j$, and takes the value 1 in case the individual is employed in agriculture. Finally, ε_{ijt} is the error term for individual i working in sector j during period t .

5.2 Data

In this section the data sources and the calculations of the variables for our research are presented. Both individual and trade data are addressed.

5.2.1 Individual data

For the empirical research we will focus on data of the last two decades. Household surveys for nine years are used containing extensive micro data sets; the so-called *Caracterizacion Socioeconomica Nacional* (CASEN) surveys. The available household surveys include the years 1990, 1992, 1994, 1996, 1998, 2000, 2003, 2006 and 2009. These surveys are the most relevant and most complete household surveys in Chile available. Moreover the CASEN surveys represent households of the entire nation. For our research this survey provides better and more reliable results, than for example *the Greater Santiago household survey*, since the CASEN survey includes all regions of the country and not only Santiago. The CASEN surveys are conducted by the Chilean Ministry of Planning (MIDEPLAN), through the Department of Economics of the Universidad de Chile (Ferreira and Litchfield 1999). The objectives of the survey are to obtain socio-economic statistics over the years and to control the effectiveness of the social programs and expenditures of the Chilean government. The survey provides a good insight in among others demographics, income and wage, educational attainment, health issues and employment. Furthermore, for our study it is important that the survey distinguishes the different regions. We made a selection of variables of every year and appended all surveys to one complete dataset.

In this paper we want to focus on the working population. We consider people between 16 and 65 years old to be the wage earning population, both part and full time workers. This implies people younger than 16 and older than 65 are not included in our sample. Furthermore, the sample we use is limited to workers who declare a positive salary. By restricting the research to the wage earners only, the effects on wage trends and wage inequality will be more robust. Both men and women are included in our sample. Our total sample, before adjusting for age and working population is 1.774.950 observations; the final sample used in our research consists of 273.789 observations.

A dummy variable for the regions of Chile is included as well. However, it must be noticed that in 2006 two new regions were created for Chile. For the CASEN household survey of 2009 this new classification of regions is being used. For the sake of reliability the two new regions are added to the regions they were part of before 2006, thereby making use of the old classification with 13 regions (see appendix).

In order to investigate the effects of trade on different skill groups it is important to make a distinction between those groups. The CASEN surveys provide a lot of information about years of schooling and educational levels. Over time the education system has changed for Chile and categories for educational levels thus have changed for some years in our panel. Therefore it is more reliable to distinguish groups based on their skill, using years of schooling. A person is considered to be high skilled when (s)he has had ten years of education or more, referring to completing the secondary school. All other people are considered to be low educated or low skilled. The number of observations for the low skilled group is 182,389 and for the high skilled group this is 91,400. This adds up to a total sample of 273.789 persons. In this paper the effects for low skilled, high skilled groups and for the total group is studied. This way, effects of trade can be explained by the Heckscher-Ohlin theory for different skill groups.

Having explained the background of the dataset, attention is now turned to the variables used for the empirical research.

Dependent variable

- **The labor income (wages) of the Chilean population.** Labor income means that only income from labor and employment is considered (and not for example cash benefits). In this study wages per person are used. Furthermore we make use of the logarithm of wages in order to obtain a better scale of the regressions.

Control variables

- **Experience.** In this paper experience is expressed in years of schooling. In search of the effects on income distribution we use a Mincerian wage equation. This equation is widely used in empirical economics. Mincer (1974) links individual income to the individual's years of schooling. He argues that the logarithm of earnings is linearly related to an individual's years of schooling. This is the case when an additional year of schooling is related to a proportional increase of income. The variable 'experience' we use in this study shows the experience built up at school. Commonly accepted is that experience is equal to $(age - school - 6)$. The advantage of this assumption is that it is applicable for every educational system. This means that 'experience' is more or less the same for every country and stays relatively constant over time, even when schooling systems change over time.

- **Experience squared.** We also use experience squared which is expected to be negative. The quadratic function of 'experience' captures the decline over time of the on-the-job training investments in a human capital model. Variables like age and years of schooling are not included in the regression because they are already captured in the variable experience.
- **Rural.** This variable makes a distinction between the urban area and the rural area. One can expect that the urban area has a higher average income than the rural area. After computing the average income per area, it is indeed the case that income is on average higher in the urban than in the rural area (respectively 227432 and 152926 pesos).
- **Gender.** In this research the total working population; both men and women are included.
- **Agriculture.** This dummy variable takes the value 1 in case an individual works in the agricultural sector. Including this dummy allows us to see the different effects of the sectors manufacturing and agriculture on individual wages. We expect the agriculture dummy to have a negative effect on wage differentials for Chilean workers. The agricultural sector is relative intensive in unskilled labor, so this is in line with the HOS model.

5.2.2 Trade data

The data for trade is compiled from the World Development Indicators (World Bank) and has been integrated with the data of the CASEN surveys. The WDI trade data is at a yearly sector level.

Main Explanatory variables

To improve the robustness of the research several regressions with different measures of trade are used. There are four different regression including imports and exports (1), imports (2) and exports (3) separately and total trade (imports + exports) (4). We also use two different measurements for the main explanatory variables to see whether the outcomes are more or less the same. This entails the use of ratios and levels of trade. For all trade variables a logarithm is used in order to have a better scale of the regressions.

- **Imports and exports.** The variable imports consists of imports of goods and services (current US\$). However within this variable we distinguish agricultural raw materials imports (% of merchandise imports) and manufactures imports (% of merchandise imports). The same holds for exports. Agricultural raw materials include crude materials except fuel.⁷

Following the theoretical framework, we know that a country will export the particular good, which is used intensively in production, by the relative abundant factor of that country. This has effect on the price of the good and on the price of the factor. International trade will have different price effects for different sectors. By specifying whether imports and exports are manufacturing or agricultural based, we can see these different sector effects on the prices.

The sample consists of a total of 143,897 people working in the agricultural sector and 129,892 people working in the manufacturing sector. We expect imports and exports to have positive effects on wages. Following the theoretical framework, imports and exports are expected to be positively linked with wages; we thus expect a positive effect on the dependent variable. These variables are defined as a ratio over GDP.

⁷ For more information see: <http://data.worldbank.org/>

The ratio is constructed as follows:

$$\text{ratio all imports: } \frac{\text{imports}_j}{\text{GDP}_{total}} \quad (2)$$

$$\text{ratio all exports: } \frac{\text{exports}_j}{\text{GDP}_{total}} \quad (3)$$

Imports and exports are sector specific and j is either agricultural or manufacturing imports or exports.

- **Trade openness.** This variable is the summation of imports and exports and is constructed as follows:

$$\text{trade openness: } \frac{\text{Exports}_j + \text{Imports}_j}{\text{GDP}_{total}} \quad (4)$$

Trade openness may not only reflect an increase in volume of trade, but also changes in the productive structure and new technologies affecting imports and exports of among others capital goods. These changes may influence wage differentials between skilled and unskilled persons. Trade openness is sector specific and j is either agricultural or manufacturing trade. For trade openness the same positive effect is expected on wages as for imports and exports.

5.3 Results

In this section the results are shown. Four different specifications for trade are distinguished:

Specification 1: imports and exports

$$W_{ijt} = \alpha + \beta_1 \text{imports}_{jt} + \beta_2 \text{exports}_{jt} + \delta x_{ijt} + \varphi_t + \text{agri}_j + \varepsilon_{ijt}$$

Specification 2: exports

$$W_{ijt} = \alpha + \beta \text{exports}_{jt} + \delta x_{ijt} + \varphi_t + \text{agri}_j + \varepsilon_{ijt}$$

Specification 3: imports

$$W_{ijt} = \alpha + \beta \text{imports}_{jt} + \delta x_{ijt} + \varphi_t + \text{agri}_j + \varepsilon_{ijt}$$

Specification 4: trade openness

$$W_{ijt} = \alpha + \beta \text{trade openness}_{jt} + \delta x_{ijt} + \varphi_t + \text{agri}_j + \varepsilon_{ijt}$$

Each specification is run on three different samples. For each specification we investigate the effects of the respective trade variable for the total sample (1), the low skilled persons (2) and the high skilled persons (3). These samples are shown in 3 columns. This way we can see the different impact on income for different skill groups and argue if the Heckscher-Ohlin theory is valid for the Chilean economy. According to the HO theory we should see a positive relation between trade and income for the low educated population. This positive effect is expected to be smaller for the high educated population. Following this, we should see a decline of income inequality and a pro-poor growth.

In table 5 the results are shown for the effects of both imports and exports on income. This is our first specification.

Table 5: Results with imports and exports

Estimation	(1)	(2)	(3)
	All	low educated	high educated
Ln ratio all imports	0.158* (0.077)	0.229*** (0.063)	0.143 (0.089)
Ln ratio all exports	-0.055 (0.047)	-0.064 (0.046)	0.100 (0.075)
Gender	-0.313*** (0.015)	-0.351*** (0.020)	-0.337*** (0.021)
Rural	-0.193*** (0.032)	-0.113*** (0.026)	-0.133*** (0.023)
Experience	0.019*** (0.002)	0.020*** (0.001)	0.038*** (0.002)
Experience squared	-0.000*** (0.000)	-0.000*** (0.000)	-0.001*** (0.000)
Agriculture	-0.101 (0.269)	-0.399* (0.204)	-0.296 (0.301)
Observations	273789	182389	91400
R^2	0.319	0.353	0.268

Standard errors in parentheses

All regressions contain time fixed effects.

* p<0.1, ** p<0.05, *** p<0.01

For the total sample (1) imports have a positive and significant effect on wages. The coefficient of imports is 0.158 for the total sample. This means that an increase of 10% in imports leads to an increase of 1,6% in wages for the total sample. Exports have a negative coefficient on wages of all workers but the effect is not significant. The coefficient of agriculture is negative as expected, however this is only significant for the low educated (sample 2).

Like for the total population (sample (1)), imports also have a positive and significant effect on wages for the low educated (sample (2)). Exports have a negative coefficient on wages of low educated persons, but this last one is not significant. The coefficient for all imports is 0.229. The effect of imports on wages is thus higher for low educated persons than for the total sample. These results suggest a pro-poor growth compared to the aggregated sample. In the last row, we see that imports and exports have positive coefficients for high educated persons. Those coefficients are however, not significant.

Furthermore research shows that the coefficients of gender, rural, experience and experience squared are highly significant and have the sign that we expected. This is true for all regressions that are reported in this study. The variable rural has a negative and significant effect on wages for all columns, as was expected. Experience has positive effect on income and is significant. This is not very surprising, because one can expect that a higher level of experience leads to higher wages. We see that the effect of experience on wages is higher for high educated persons than for low skilled persons. An explanation for this can be that high educated persons benefit more from

this education in their work experience and get higher wages compared to low educated persons. Experience squared has a negative coefficient as expected.

In Table 6 the correlation between imports and exports is shown. The ratios of imports and exports are highly correlated (0,91), which could explain that exports appear to have no significant impact on individual wages because their effect is captured by imports when both variables are included in the same time.

Table 6: Correlation

	Ratio of imports
Ratio of exports	0,91

In the two tables shown below (Table 7 and Table 8) the results are given for both exports and imports separately (specification 2 and 3). The purpose of this separation is to see if exports have different impact on income for Chile than imports. When included separately into the wage equation, both trade indicators have a positive effect on income. However, Table 7 shows that the ratio for all exports is only significant for the high educated with a significance level of 5%. Furthermore Table 7 shows positive coefficients for the agricultural dummy. This is surprising but could be explained by a high correlation between this dummy and 'rural' variable.

Table 7: Results exports

Estimation	(1) All	(2) low educated	(3) high educated
Ln ratio all exports	0.047 (0.058)	0.088 (0.052)	0.186** (0.071)
Gender	-0.313*** (0.015)	-0.351*** (0.020)	-0.338*** (0.022)
Rural	-0.193*** (0.032)	-0.113*** (0.027)	-0.134*** (0.023)
Experience	0.019*** (0.002)	0.020*** (0.001)	0.038*** (0.002)
Experience squared	-0.000*** (0.000)	-0.000*** (0.000)	-0.001*** (0.000)
Agriculture	0.363*** (0.054)	0.278*** (0.044)	0.117* (0.063)
Observations	273789	182389	91400
R^2	0.318	0.353	0.268

Standard errors in parentheses

All regressions contain time fixed effects.

* p<0.1, ** p<0.05, *** p<0.01

For the results in Table 8, that contains only imports, the ratio of imports is significant and positive for all samples (low educated, high educated and all workers). The effect of imports is very

significant for the low educated and the coefficient of imports is higher for the low educated compared to the high educated. This is in line with the Heckscher-Ohlin theory. This higher coefficient namely means that inequality decreases, because wages increase more for low educated workers due to imports. The increase of 10 percent of imports leads to an increase of 2 percent in wages for low educated persons. For high educated persons this increase is 1,8 percent. The difference is not very large, but it is significant. The coefficients of the control variables are approximately similar to Table 5. Furthermore, like in Table 5 negative coefficients for the agriculture dummy are the result, which we expected.

Table 8: Results imports

Estimation	(1) All	(2) low educated	(3) high educated
Ln ratio all imports	0.134* (0.073)	0.200*** (0.060)	0.182** (0.079)
Gender	-0.313*** (0.015)	-0.351*** (0.020)	-0.337*** (0.021)
Rural	-0.193*** (0.032)	-0.113*** (0.026)	-0.133*** (0.023)
Experience	0.019*** (0.002)	0.020*** (0.001)	0.038*** (0.002)
Experience squared	-0.000*** (0.000)	-0.000*** (0.000)	-0.001*** (0.000)
Agriculture	-0.032 (0.260)	-0.315 (0.201)	-0.408 (0.278)
Observations	273789	182389	91400
R^2	0.319	0.353	0.268

Standard errors in parentheses

All regressions contain time fixed effects.

* p<0.1, ** p<0.05, *** p<0.01

The last regression includes imports summed up with exports divided by GDP, also known as trade openness. The results of specification 4, trade openness, can be seen in Table 9. Trade openness indicates how much a country trades with other countries or economies. Trade openness has a positive and significant effect on income for the low educated and the total population. The coefficient for the high educated is also positive but not significant. The coefficient effect of trade openness on individual wages is higher for the whole population than for the low educated only. Moreover the coefficient for the low educated is higher than for the high educated. This means that low educated persons benefit more from trade openness than high educated persons. These results are in line with the Heckscher-Ohlin theory. For Table 9 there is evidence for the pro-poor growth theory, because low educated persons benefit more from trade openness than high educated persons.

Table 9: Results trade openness

Estimation	(1)	(2)	(3)
	All	low educated	high educated
Ln Trade Openness	2.287*** (0.732)	1.794** (0.612)	0.663 (0.953)
Gender	-0.348*** (0.011)	-0.432*** (0.014)	-0.332*** (0.013)
Rural	-0.206*** (0.022)	-0.118*** (0.018)	-0.092*** (0.015)
Experience	0.024*** (0.002)	0.024*** (0.001)	0.040*** (0.001)
Experience squared	-0.000*** (0.000)	-0.000*** (0.000)	-0.001*** (0.000)
Agriculture	-0.176 (0.157)	-0.192 (0.135)	0.086 (0.198)
Observations	273789	182389	91400
R^2	0.318	0.353	0.268

Standard errors in parentheses

All regressions contain time fixed effects.

* p<0.1, ** p<0.05, *** p<0.01

Regressions for all trade variables are also conducted with variables in levels instead of ratios. Results, significance levels and signs are not significantly different.

Summarizing we find some different impacts of trade specifications on wage differentials. For all specifications we do find positive coefficients for the main explanatory variables; the trade measurements. Only in table 5 (specification 1), exports have negative effects on wages for low educated persons and the total sample, but we can assume that this is caused by the high correlation of exports with imports. In Table 5, 8 and 9 we find that the coefficients of imports are positive and higher for the low educated persons than for high educated persons. In Table 8 import results are significant for all columns. This means that our empirical evidence of imports is in line with the Heckscher-Ohlin and Stolper-Samuelson theory. Between 1990 and 2009 the trend of wage differentials can empirically be explained by the impact of imports on wages. As Nissanke and Thorbecke (2006) argue, there is, for imports, a relation between trade openness and economic growth. This empirical research finds that trade openness also has positive effects on income. This is true for wages of the total population and by making a distinction between low and high educated population, we show that the effect is larger for the low educated than for high educated population. This is true for specification 3 and 4. This means that we find a so-called relative pro-poor growth, because the distributional shifts of income are in favor of the relative poor population. For exports (Table 7) only a significant impact of trade for high educated workers is found. The agricultural dummy has a negative coefficient which was expected following the Heckscher-Ohlin theory. In Table 7 however, the coefficient is positive which could be explained by the high correlation with the rural variable.

6 Conclusion

Chile initiated enormous economic reforms since the early seventies. Free markets started to play an important role, many companies were privatized and tariff barriers were reduced. Trade liberalization continued and since 1991 Chile made free trade agreements with several countries. This all resulted in an enormous economic growth and increase of GDP (also per capita). Although poverty was also reduced, it is remarkable that inequality remained notably high. In this paper the effects of trade liberalization on the individual wages from 1990 until 2009 is studied. These effects are researched within the context of the Heckscher-Ohlin and Stolper-Samuelson theory. According to Heckscher-Ohlin, a country exports the good which uses the relatively abundant factor intensively in production. Stolper-Samuelson adds that if the relative price of a good increases, the price of that factor (used intensively in the production of that good) will increase as well. The price of the other factor will decrease. This means that if Chile is relative labor unskilled abundant, wage inequality will decrease because the wages of labor unskilled persons will increase.

However some empirical studies show contrary results to the Heckscher-Ohlin-Samuelson theory, like Davis (1996) and Wood (1997). With all the important reforms in trade liberalization, like the free trade agreements since the nineties, it is interesting to see if the Heckscher-Ohlin-Samuelson theory holds for Chile between 1991 and 2009. Statistically we find that income differences between the poor and the rich have narrowed over this time period.

Empirically, a distinction between low and high educated persons is made, to test the effects of trade on these different skill groups. Moreover, the effects of trade on individual wages are tested for the entire sample. Four specifications for trade are used, namely imports and exports (1), exports (2) and imports (3) separately and trade openness (4). For imports (3) and trade openness (4), the results are in line with the Heckscher-Ohlin model. Wages of the low educated increase more than wages of the high educated persons, thus wage inequality decreases. Nissanke and Thorbecke (2006) call this pro-poor growth, because the growth is in favor for the poor compared to the non-poor. For the other specifications of trade contrary results are found. Specification (1) shows pro-poor growth impact for imports but not for exports. The contrary impact of exports in specification (1) is caused by the high correlation between imports and exports. Specification (2) shows significant positive effects for high educated persons. This coefficient is higher than the coefficient for low educated persons and the total sample. Except for specification (2) the agricultural dummy has a negative coefficient, which is in line with the Heckscher-Ohlin model.

For further research on this topic, it is interesting to see what the effects of technological change are on individual wages. Moreover, Chile has many natural resources, so more research can be done on the effect of this abundance of natural resources on trade and on individual wages.

7 References

Atkinson, A. B., 1970, "On the Measurement of Inequality", *Journal of Economic Theory*, 2(1970), 244-263

Behrman, J., N. Birdsall and M. Szekely, 2000, "Economic Reform and Wage Differentials in Latin America", IADB Working Paper 435, Washington, DC: Inter-American Development Bank

Beyer, H., P. Rojas and R. Vergara, 1999, "Trade Liberalization and Wage Inequality", *Journal of Development Economics*, vol 59:1, pp. 103-123

Bourguignon, F., and C. Morrison, 2002, "Inequality among world citizens, 1820-1992", *American Economic review*, 92(4), 727-744

Burtless, G., 1995, "International Trade and the Rise in Earnings Inequality: *Journal of economic literature*, 33(2), pp. 800-816

Chumacero, R., R. Fuentes, and K. Schmidt-Hebbel, 2004, "Chile's Free Trade Agreements: How big is the deal?", Banco Central de Chile, Documentos de Trabajo, No. 264

Cowell, Frank A., 2000, "Measurement of inequality", In: Atkinson, A.B., Bourguignon, F. (Eds.), *Handbook of Income Distribution*, vol. 1. Elsevier, North Holland

Davis, D., 1996, "Trade Liberalization and Income Distribution", NBER Working Paper 5693

Edwards, S., 1992, "Trade Orientation, Distortions, and Growth in Developing Countries", *Journal of developing economy*, 29(1), pp 31-57

Edwards, S., 1993, "Openness, Trade Liberalization, and Growth in Developing Countries", *Journal of economic literature*, 31 (3) (September 1993), pp. 1358-1393

Edwards, S., and D. Lederman, 2002, "The Political Economy of Unilateral Trade Liberalization: The Case of Chile", in *Going Alone – The Case for Relaxed Reciprocity in Freeing Trade*. J. Bhagwati, ed. Cambridge MA: MIT Press

Esquivel, G., and J. Rodriguez-Lopez, 2003, "Technology, trade, and wage inequality in Mexico before and after NAFTA", *Journal of Development Economics*, 72, 543-565

Ferreira, F., and J. Litchfield, 1999, "Calm after the storms: income distribution and welfare in Chile, 1987-1994", *The World Bank Economic Review* 13 (3), 509-538

Galiani, S., and P. Sanguinetti, 2003, "The impact of trade liberalization on wage inequality: evidence from Argentina", *Journal of Development Economics*, 72, 497-513

Green, F., A. Dickerson, and J.S. Arbache, 2001, "A picture of wage inequality and the allocation of labor through a period of trade liberalization: the case of Brazil", *World Development*, 29: 1923-1939

Leamer, E. E., 1996, "In Search of Stolper-Samuelson Effects on U.S. Wages", NBER Working Paper no. 5427

Mincer, J., 1974, "Schooling, Experience and Earnings, New York: Columbia University Press (for NBER)

Montenegro, C., 2001, "Wage Distribution in Chile: Does Gender Matter? A Quantile Regression Approach", Working Paper Series no. 20, World Bank

Nissanke, M., and E. Thorbecke, 2006, "Channels and Policy Debate in the Globalization-Inequality-Poverty Nexus", Elsevier, *World Development* Vol. 34, No. 8, 1338-1360

Nopo, H., 2006, "The Gender Wage Gap in Chile 1992-2003 from a Matching Comparisons Perspective", IDB Working Paper no. 468

Romer, P., 1989, "What Determines the Rate of Growth and Technological Change?", World Banking Working Paper #279

Sachs J. D., and A. Warner, 1995, "Economic Reform and the Process of Global Integration", *Brookings papers on Economic Activity*, 1, 1-95

Samuelson, P. A., 1948, "International Trade and the Equalization of Factor Prices", *Economic Journal*, LVIII (1948), 163-84

Stolper, W., and P. Samuelson, 1941, "Protection and Real Wages", *Review of Economic Studies*, November, IX, 58-73

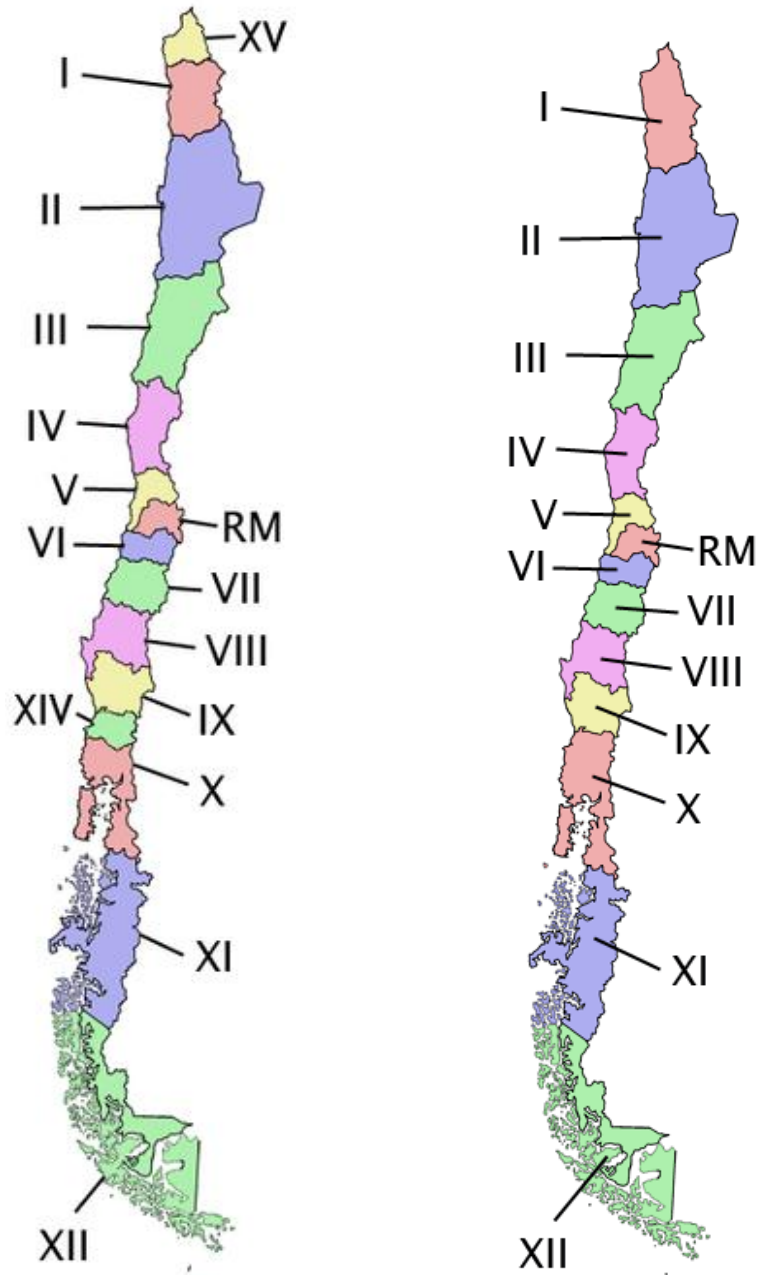
Williamson, J.G., 2002, "Winners and losers over two centuries of globalization", WIDER Annual Lecture 6. Helsinki: UNU-WIDER

Winters, A., N. McCulloch, and A. McKay, 2004, "Trade liberalization and Poverty: The evidence so far", *Journal of Economic Literature*, 62, 72-115

Wood, A. 1997, "Openness and wage inequality in developing countries: the Latin American challenge to East Asian conventional wisdom", *World Bank Economic Review*, Vol. 11 no. 1, p 33-57

8 Appendix

Figure 4: Regions of Chile



RM = Santiago

Region XV was added to region I and region XIV was added to region X.

Source: wikipedia