Wage Inequality and Trade Globalization in Chile and Mexico.

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[DRAFT FOR DISCUSSION ONLY]

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Abstract

This work uses Input-Output analysis to study the empirical relationship between trade globalization and wage inequality in Chile and Mexico. We compute inter-industry forward and backward linkages, the amount of jobs created due to changes in trade patterns and Theil indexes of inter-industry wage inequality. Our results show that sectors with strong forward and backward linkages decreased in the two countries while the inter-industry wage inequality increased in the period studied. Our computation of jobs generated due to changes in trade structure shows that the job losses were higher than the jobs created in Mexico, these job losses came from the manufacturing sector. For the case of Chile job creation due to trade were higher than job losses and most job creation came from the manufacturing sector. These results indicate that the same dynamic sectors in different countries have different effects on job creation and on wage inequality.

Keywords: wage inequality, trade globalization, classical development theory.

JEL Classification Numbers: C82, C23, D63, O57

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Introduction

The diversity of transmission channels through which globalization can affect income inequality in different regions of the world (e.g. trade, technological change, financial flows, institutions and policy regimes) has generated a diversity of studies and approaches. Latin America is one of the regions where the persistent level of income inequality relative to other parts of the world (see e.g. Lopez and Perry 2008; Deininger and Squire 1996) has attracted the attention of numerous scholars and diversity of studies.

This paper focuses on the trade channel of transmission. We chose the this channel for two reasons; (1) trade is one of the central components of any study on globalization, and for Latin America is the most important component of all the structural reforms that took place in the region since the1970s, (see Figure 1.A in Appendix A), (2) the Input-Output (I-O) analysis used in this work provides clear insight on the empirical connection of trade and job creation (we compute the number of jobs generated due to trade in each sector) and through this channel to wage inequality.

In Latin America the existing literature on trade and inequality is diverse and shows mixed results. For example Dollar and Kraay (2002), Behrman, Birdsall and Szekely (2001) studying a group of Latin American countries found that trade openness reduces income inequality, while on the other hand, Sanchez Paramo and Schady (2003), Spilimbergo et al (1999) and Barro (2000) found that openness increases income inequality. Taylor (2000) and Slaughter (2000) found that trade liberalization coincides with increases in income and wage inequality, in particular in Argentina, Chile, Costa Rica and Mexico, from middle 1970s to 1990s. In our view, the mixed results provided by the existing literature shows that more empirical research is needed to disentangle the diverse connections between greater openness in trade and inequality.

Our work seeks to contribute to this strand of the literature by providing an answer to the following question; how trade globalization affects the number of jobs created due to trade and through this channel how is inter industry wage inequality being affected? In this paper, by trade globalization we mean increases in trade as measured by increases in imports and exports (as % of total imports and exports).

Our hypothesis is that Latin American countries have integrated into the world economy in different ways; for example due to varying export profiles, the degree of timing of liberalization (the countries that first liberalized their markets were those in the southern cone Argentina, Chile, and Uruguay for example) or the strength of the inter-industry linkages. We believe that these different forms of integration have had different effects on inter industry wage inequality in each country. Such hypothesis is based on the observation in the current literature on trade and

inequality that country specific characteristics matters and have to be taken in to account when studying transmission channels.

To answer our research question we first identify the dynamic sectors for our sample of countries. Dynamic sectors are defined as those sectors with the highest exports and imports (vis a vis the rest of the sectors) as a share of total exports and imports respectively. Second, we measure the forward and backward linkages of the dynamic sectors with the rest of the economy using I-O analysis, which allows us to measure and compare the strength of the linkages between the dynamic sectors and the rest of the economy in different countries. Third, we compute the amount of employment generated due to trade in our sample of countries using I-O analysis. Fourth, we compute the Theil index for inter-industry wage inequality.

Our sample of countries is composed of Chile and Mexico. Four reasons explain our choice; 1) they are among the countries considered as "strong" reformers. Using the index of structural reforms from the Economic Commission for Latin America and the Caribbean (ECLAC), Argentina and Chile made the biggest structural reforms from 1970 to 1980, and Mexico and Brazil from 1980 to 1990 among 17 countries of the region (See Figure 2.A in Appendix A), 2) diversity in timing of adoption of structural reforms and variety of political experiences through history, 3) diversity in regional composition, although all countries have regions weakly connected with the dynamic regions, Mexico is recognized as a country where the indigenous population are mainly established in poor regions, not the case of Chile and Argentina for example, 4) reliable I-O tables are available for these countries.

The rest of this work is organized as follows; section two presents the theoretical approach of this study. Section three indentifies the dynamic sectors in our chosen countries. In section four we use I-O tables to calculate the forward and backward linkages between dynamic sectors and the rest of the economy and we compute the Theil index for inter-industry wage inequality. Section five presents our calculations of the employment generated due to trade in different sectors. Section six presents our conclusions.

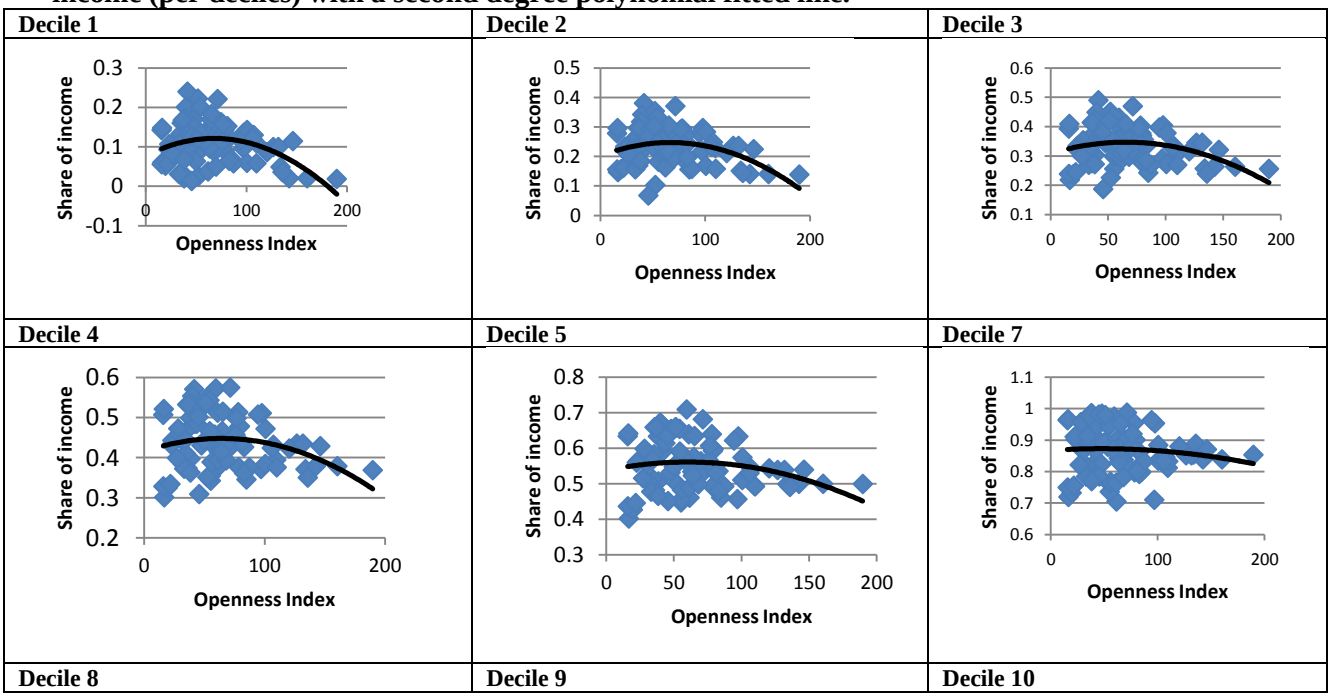
II. A classical development approach

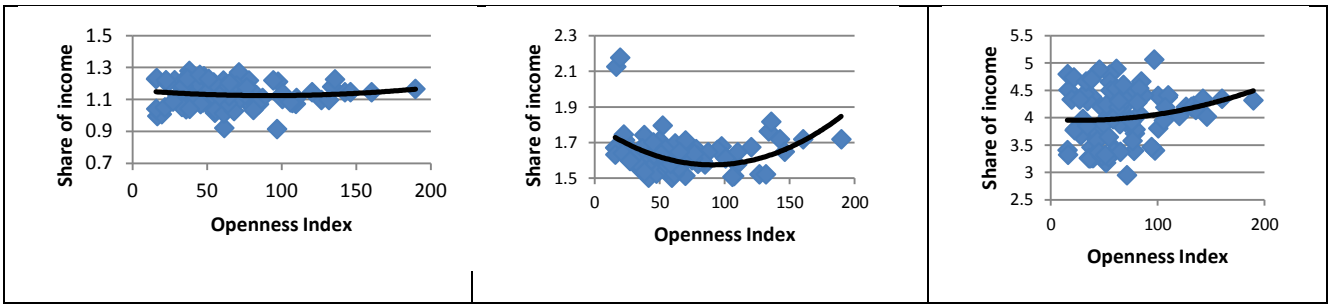
In this section we explain our approach of studying inequality and globalization. The ideas of the so called pioneers of what is known today as development economics, is what we call in this section the classical development tradition. These development theorists shared a set of ideas that made their approach distinctive with respect to the classical economists (Smith, Ricardo, Malthus and Marx) and the neoclassical approach (which took over this field during the 1970s and 1980s). The ideas of the classical development economists emerged in the late 1940s and their central ideas can be summarized as follows; 1) developed and developing countries face different challenges and have different economic structure (e.g developing countries face rigidities,

bottlenecks and obstacles not present in developed countries), 2) distrust of the market mechanism to achieve change in the economic structure, hence government intervention and central planning is required, 3) focus on the study of long term relations among different sectors of the economy, in particular how the composition of output in these sectors changes over time and how these changes affect the whole economy, 4) economically powerful actors are present in their models (institutions, corporations, interest groups, social classes), see (Meier and Baldwin 1957; Shapiro and Taylor 1990 and Gibson 2003) for a detailed reference to early development economists.

We believe that the following reasons make our work fall in the classical development tradition; First, we take in to account the trade structure of each countries (we identify which sectors become dynamic with trade globalization), taking in to account the frequently made observation that globalization does not affect countries in the same way (Figure 1.B and 2.B in Appendix B, shows that globalization affects differently two groups of Latin American countries for example). We believe that a country by country approach (Figures 1.C - 3.C in appendix C show that the correlation between openness and income inequality varies from country to country) is in line with the observation of the classical development economists that structure and relevant features of countries matter. Even within a country not all members of society benefit in the same way from more trade, as shown in Figure 1 below.

Figure 1. Sample of 18 Latin American countries (1988-2008); openness index versus shares of income (per deciles) with a second degree polynomial fitted line.





Source: Own construction from data obtained from SEDLAC for shares of income and World Bank for exports and imports as a share of GDP to compute the Openness Index.

Figure 1 shows that for a sample of the 18 Latin American countries, when we use the openness index as a globalization indicator a non linear behavior (from the first to the sixth decile) emerges (and the relationship varies at different levels of income distribution). As the country becomes more open (in trade) the shares of income first increase and then decline (for the poorest deciles). The opposite non linear behavior is observed for the richest two deciles, as openness increase first the share of income decline and then increase. A linear behavior is observed in the case of the 7^{th} and 8^{th} deciles.

Second, to make the connection between trade and wage inequality we use Hirschman's (1958) idea that leading industries influence investment decisions in other sectors through inter-industrial linkages. Since one of the central aspects of globalization is the development of export-led sectors which vary from country to country. In our view one possible connection between trade and wage inequality is that the export sectors have weak linkages (we define strong and weak linkages in section IV) with the rest of the sectors and when growth (due to trade) takes place, such growth benefits a very small sector of the population (mostly the owners whom may be at the top of the income distribution), increasing wage inequality. Hence if the dynamic sector does not require inputs from the remaining sectors (e.g. the financial sector is such a sector), inter-industrial linkages will be weak. In this case trade related growth means more inequality. Another scenario is that the forward and backward linkages of the dynamic sectors with the rest of the economy are strong, in this case it is very likely that trade will end up benefiting more people (e.g. via new jobs) than those at the top deciles of the income distribution, hence helping in the reduction of inequality.

Third, we use Lewis's (1954) characterization of developing countries, where a large "subsistence" labor force located in rural and in "informal" urban areas coexist with a "modern" sector of the economy. We believe that Lewis's characterization is relevant for many Latin American economies, since they have large regions with indigenous population (and non indigenous population) that are weakly connected to the modern (industrial) sector where growth due to trade is taking place, e.g. the north-east and north of Brazil, the Andean region of Peru, southern Mexico, are some examples (may not be as relevant for the case of Uruguay, Chile, Argentina and Paraguay).

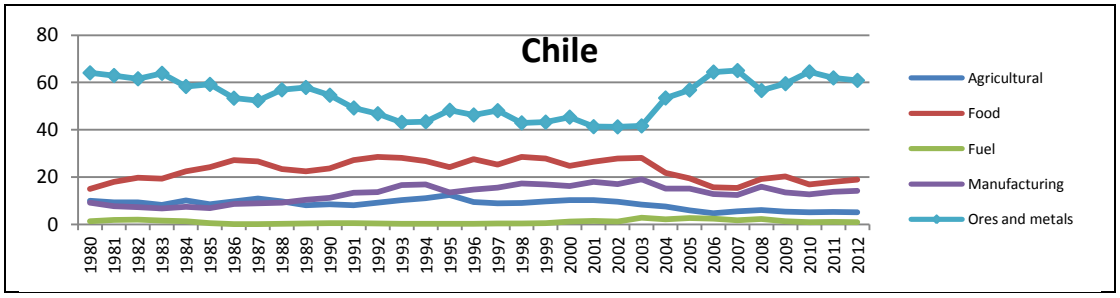
Hence, in the "modern" sector, where trade related growth takes place (not necessarily demanding more skilled labor) profits and wages may benefit only a small part of the population, so the proportion of rich people increases (and hence inequality). Lewis's idea also comes in to play when it is recognized that formal job creation has not been able to absorb the surplus labor from agriculture and informal urban sectors. Ocampo and Bertola (2012) show that informality is still a prevalent feature in Latin America. For example in 2008, 30% and 43.3% of the labor force was informal for Chile and Mexico respectively.

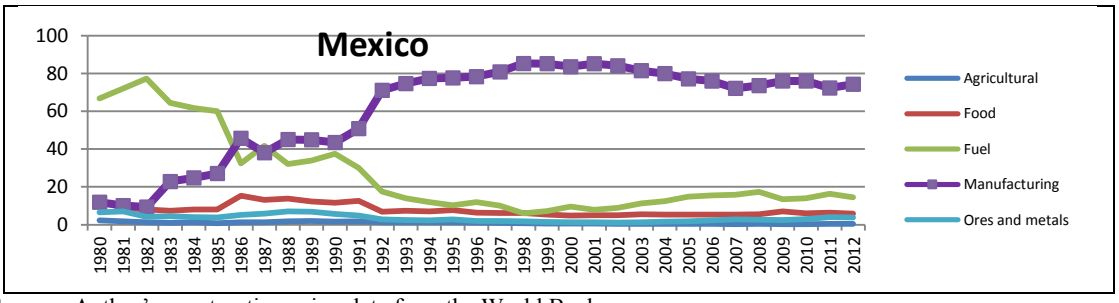
Finally we provide some discussion on the prevailing approach of studying globalization and inequality. The standard theoretical framework uses the Heckscher-Ohlin (H-O) international trade model, which states that countries will engage in trade based on comparative advantage (derived from the relative endowments of factors of production). In particular the skill-biased technical change theory derived from the H-O framework has been frequently used as the theoretical explanation of changes in inequality. Trade will increase the demand for skilled labor in countries with abundant capital (rich countries) and for unskilled labor in countries abundant in labor (poor countries). The implication for income distribution is that in rich countries inequality will increase while in poor countries income inequality is expected to decline. We believe that the classical development theory approach suits better our research question and hence we stick to this theoretical framework.

III. Identifying dynamic sectors.

In this section we study the trade performance of our sample of countries. Figure 2 shows time series of the exports in each country by type of merchandise since 1980 when major trade liberalization initiatives began to be undertaken (see Ocampo and Bertola, 2012). The series are percentages of all exported goods. The classification of commodity groups is based on the Standard International Trade Classification (SITC), hence the country graphs are comparable.

Figure 2. Exports by type of merchandise 1980-2012 (% of all exports)

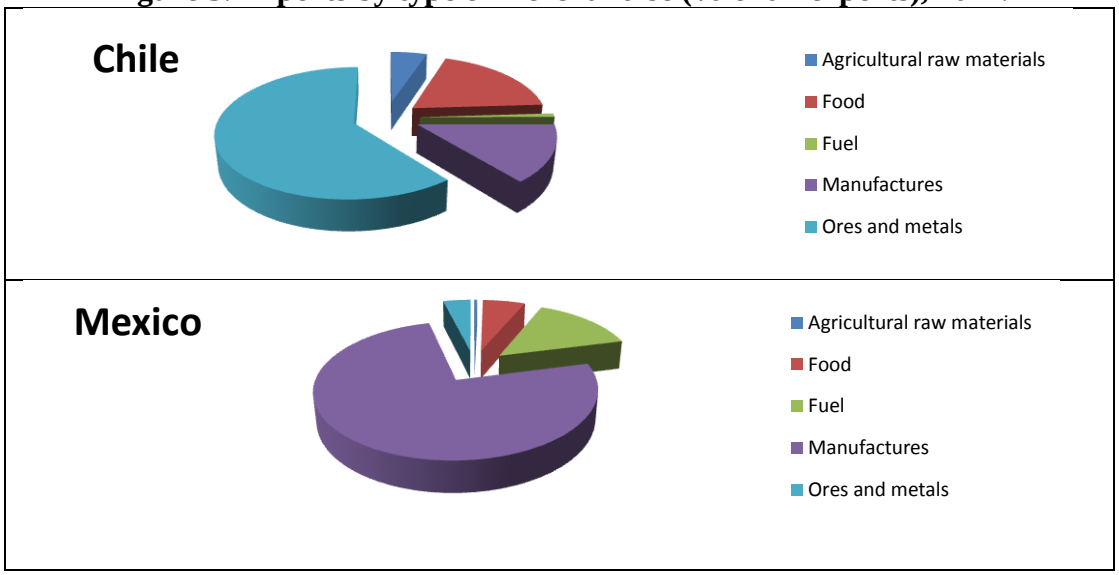




Source: Author's construction using data from the World Bank.

Figure 2, shows that Chile's leading export merchandise is ores and metals followed by food, throughout the whole period. For Mexico the leading export merchandise is manufacturing followed by fuel (since 1986).

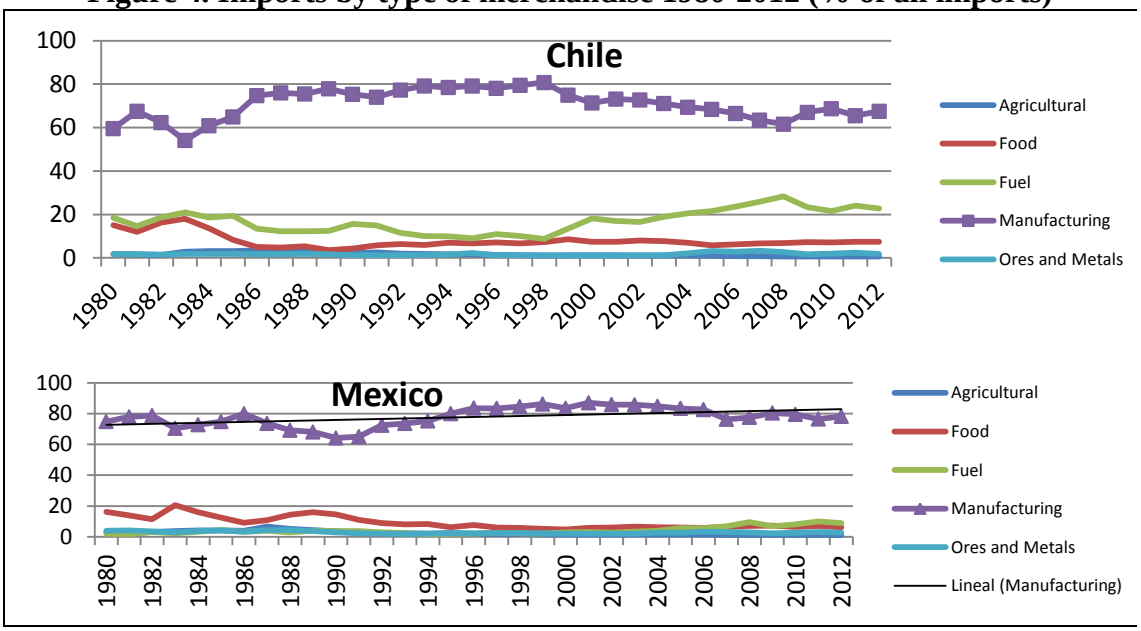
Figure 3. Exports by type of merchandise (% of all exports), 2012.



Source: Author's construction using data from the World Bank.

Figures 2 and 3 confirm that different countries have different dynamic sectors (due to trade) and integration to the world economy occurred differently in different countries. In the year 2012, Mexico's leading export merchandise was manufacturing and for Chile, it was ores and metals. The relevance of these dynamic sectors has remained the same since the mid 1980s for Mexico and since the 1980s for Chile.

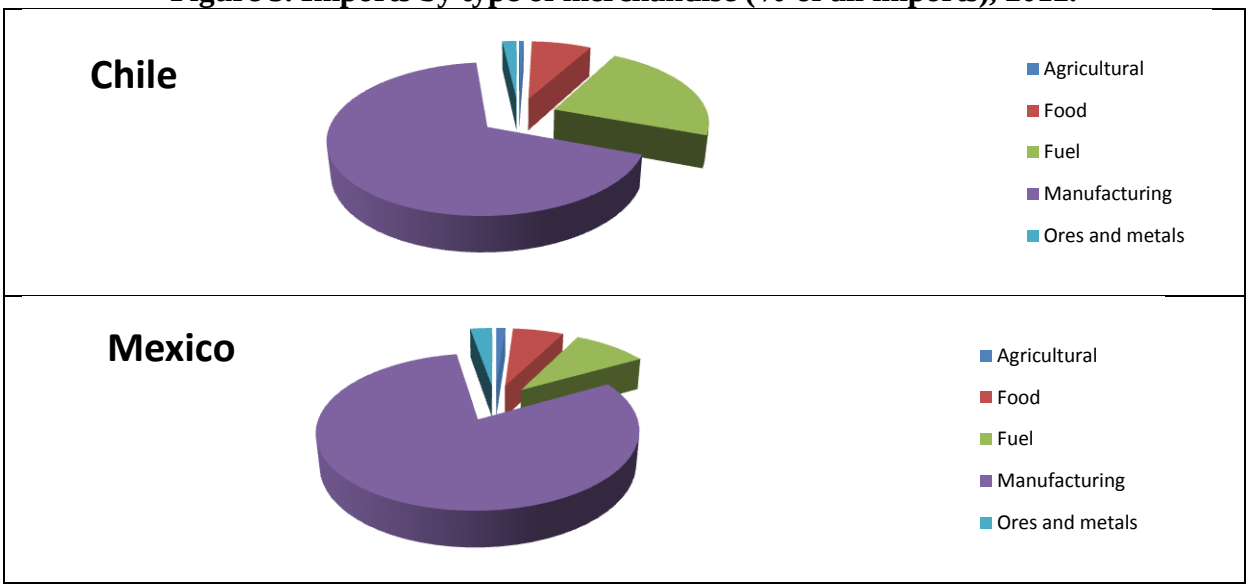
Figure 4. Imports by type of merchandise 1980-2012 (% of all imports)



Source: Author's construction using data from the World Bank.

Figure 4, shows that from 1980 to 2012 in terms of imports the most dynamic sector was manufacturing in both countries. Fuel was the next most dynamic sector in the case of Chile. For Mexico food was the second most dynamic sector until 2007 when fuel took the lead.

Figure 5. Imports by type of merchandise (% of all imports), 2012.



Source: Author's construction using data from the World Bank.

Figures 4 and 5 shows that in the two countries manufacturing and fuel were the most dynamic sectors. The least imported goods were agricultural goods and ores and metals. Figure 4 shows that the structure of imports has remained the same since (manufacturing being the most dynamic) 1980.

Table 1 summarizes the diversity in the structure of trade for our sample of countries. (Table 1.D in Appendix D, includes Argentina and Brazil for comparative purposes). Some general observations are important to make: 1) the exports sector shows more diversity than the imports and 2) the structure of imports and exports (the two leading sectors) remained fairly stable from 1980 to 2012.

Table 1. Summary of dynamic sectors in selected countries (1980-2012).

Country	Dynamic sectors	
	Exports	Imports
Chile	Ores and Metals, Food	Manufacturing, Fuel
Mexico	Manufacturing, Fuel	Manufacturing, Fuel

From this section we learned the relevance of the manufacturing sector and fuel for the case of Mexico and Ores and metals and manufacturing for Chile. In the following section we will be able to see how these dynamic sectors are connected with the rest of the economy using the I-O analysis.

IV. Measuring the strength of the linkages

In this section we use Input-Output analysis to measure the forward and backward linkages between different sectors of the economy. We are particularly interested on the linkages between the dynamic sectors (defined in the previous section as those with the highest exports or imports as a share of total exports or imports respectively) and the remaining sectors in the economy. In this section we follow the notation and approach used in Miller and Blair (2009).

We compute two types of backward linkages, the direct backward linkage which measures how sector j depends on inputs from other industries and is the sum of the elements of the jth column

of the direct input coefficient matrix (matrix A), each element in this matrix is the value of total intermediate inputs required by sector j as a proportion of j's total output. Hence the direct backward linkage for sector j is: $BL(d)_j = \sum_{i=1}^{n} a_{ij}$. The row vector containing the backward linkages of all sectors is given by: $b(d) = \boldsymbol{i}'\boldsymbol{A}$, where $\mathbf{i}$ is a column vector of 1's.

We also compute the total backward linkage, which is obtained as the column sums of the total requirements matrix, $L = [l_{ij}] = (I - A)^{-1}$, also known as the Leontief inverse matrix. For sector j the total backward linkage is; $BL(t)_j = \sum_{i=1}^{n} l_{ij}$. The row vector of total backward linkages is; $b(t) = \boldsymbol{i}'\boldsymbol{L}$, where $\mathbf{i}$ is a column vector of 1's.

We normalize direct backward linkages as follows; $\bar{b}(d) = \frac{\boldsymbol{i'A}}{\boldsymbol{i'Ai}/_n} = \frac{\boldsymbol{ni'A}}{\boldsymbol{i'Ai}}$

And total backward linkages as; $\bar{b}(t) = \frac{\boldsymbol{i'L}}{\boldsymbol{i'Li}/_n} = \frac{\boldsymbol{ni'L}}{\boldsymbol{i'Li}}$, n is the number of sectors.

When $\bar{b}(d)$ and $\bar{b}(t)$ are equal to one, it means that the value of the linkage is equal to the average of all linkages (direct and total respectively). We define strong linkages as those where $\bar{b}(d) > 1$ and $\bar{b}(t) > 1$, and weak linkages where $\bar{b}(d) < 1$ and $\bar{b}(t) < 1$.

We compute two types of forward linkages; the direct forward linkage which measures the effect of sector i in the total production and is the row sum of matrix B (also known as the Ghosh matrix). Each element of matrix B is the value of total intermediate sales by sector as a proportion of the value of i's total output. Hence the direct forward linkage for sector i is computed as; $L(d)_i = \sum_{j=1}^{n} b_{ij}$, the column vector containing the forward linkages of all sectors is given by; $f(d) = \boldsymbol{Bi}$, where $\mathbf{i}$ is a column vector of 1's.

We also compute the total forward linkage which is the row sums of the G matrix,

$G = [g_{ij}] = (I - B)^{-1}$, also known as the Ghosh inverse matrix. For sector i the total forward linkage is; $L(t)_i = \sum_{j=1}^{n} g_{ij}$. The column vector containing the forward linkages of all sectors is given by; $f(t) = \boldsymbol{Gi}$, where $\mathbf{i}$ is a column vector of 1's.

We normalize direct forward linkages as follows; $\bar{f}(d) = \frac{\boldsymbol{Bi}}{\boldsymbol{i'Bi}/_n} = \frac{\boldsymbol{nBi}}{\boldsymbol{i'Bi}}$

And total forward linkages as; $\bar{f}(t) = \frac{\boldsymbol{Gi}}{\boldsymbol{i'Gi}/_n} = \frac{\boldsymbol{nGi}}{\boldsymbol{i'Gi}}$

We define strong forward linkages as those where $\bar{f}(d) > 1$ and $\bar{f}(t) > 1$ and weak linkages where $\bar{f}(d) < 1$ and $\bar{f}(t) < 1$.

For Mexico, we use domestic I-O tables published by the National Institute of Statistics and Geography (INEGI in Spanish) for 2003 and 2008 calculated at basic prices of the corresponding year (in thousands of Mexican pesos). These tables contain the transaction (flows) table from which matrix A (the technical coefficients matrix) and matrix B (the value of total intermediate sales by sector as a proportion of the value of i's total output) are obtained. The 2008 and 2003 I-O tables are aggregated in 19 and 20 sectors respectively. We use correspondence tables published by the National Institute of Statistics to make the 2003 I-O table compatible with the 2008 I-O aggregated in 19 sectors.

For the case of Chile, we use 1996 and 2008 domestic I-O tables, obtained from the Central Bank of Chile at basic prices of the relevant year (in millions of Chilean pesos). From the

transaction (flows) table we are able to obtain the technical coefficients matrix (matrix A) and matrix B. The 1996 and 2008 I-O tables are aggregated in 74 and 111 sectors respectively. Since Mexico uses the North American Industrial Classification System (NAICS) and Chile the International Standard Industrial Classification (ISIC) we use correspondence tables published by the National Institute of Statistics of Mexico to make the 1996 and 2008 tables compatible with the 19 sectors I-O tables of Mexico. Table 2 and 3 show the results of our calculations for the case of Mexico in 2003 and 2008. Appendix E shows the results for Chile in 1996 and 2008.

Table 2. Forward and backward linkages, Mexico (2003)*

Sectors	Backward linkages				Forward linkages			
	b(d)	b(d)_bar	b(t)	b(t)_bar	f(d)	f(d)_bar	f(t)	f(t)_bar
Agriculture, farming, forestry and fishing	0.38	1.16	1.74	1.08	0.62	1.57	2.39	1.35
Mining	0.20	0.62	1.37	0.85	0.57	1.42	2.21	1.26
Generation, transmission and distribution of electric	0.60	1.83	2.23	1.39	0.64	1.61	2.22	1.26
Construction	0.51	1.54	2.03	1.26	0.08	0.21	1.11	0.63
Manufacturing Industry	0.68	2.06	2.37	1.47	0.60	1.52	2.19	1.24
Commerce	0.26	0.78	1.45	0.90	0.36	0.91	1.70	0.97
Transportation, post office, storage	0.35	1.06	1.65	1.03	0.28	0.69	1.52	0.86
Media	0.39	1.18	1.68	1.04	0.46	1.15	1.81	1.03
Financial and insurance services	0.40	1.23	1.63	1.01	0.64	1.60	2.18	1.24
Real state and rental services	0.09	0.28	1.16	0.72	0.24	0.61	1.43	0.81
Professional, scientific and technichal services	0.29	0.87	1.51	0.94	0.72	1.80	2.33	1.32
Corporations	0.46	1.41	1.74	1.08	1.00	2.51	3.03	1.72
support for businesses and waste management services	0.23	0.69	1.42	0.88	0.89	2.24	2.59	1.47
Educational services	0.10	0.31	1.17	0.73	0.01	0.04	1.02	0.58
Health and social asistance services	0.24	0.73	1.46	0.91	0.00	0.00	1.00	0.57
culture, sports and recreational services	0.30	0.90	1.52	0.95	0.04	0.09	1.04	0.59
Temporary accomodation services and food services	0.27	0.82	1.49	0.93	0.13	0.32	1.23	0.70
Other services except governmental	0.25	0.77	1.49	0.93	0.27	0.68	1.47	0.83
Legislative and governmental activities	0.25	0.75	1.43	0.89	0.01	0.03	1.02	0.58

Source: Author's construction from I-O tables in 2003

*In green are highlighted the sectors with strong forward and backward linkages according to our criteria.

Table 3. Forward and backward linkages, Mexico (2008)*

Sectors	Backward linkages				Forward linkages			
	b(d)	b(d)_bar	b(t)	b(t)_bar	f(d)	f(d)_bar	f(t)	f(t)_bar
Agriculture, farming, forestry and fishing	0.30	1.15	1.44	1.05	0.55	1.57	1.82	1.21
Mining	0.12	0.46	1.17	0.86	0.51	1.45	1.73	1.15
Generation, transmission and distribution of electric energy	0.40	1.53	1.60	1.17	0.64	1.84	1.90	1.26
Construction	0.39	1.49	1.57	1.15	0.08	0.22	1.09	0.72
Manufacturing Industry	0.41	1.58	1.57	1.15	0.31	0.90	1.44	0.96
Commerce	0.20	0.77	1.27	0.93	0.33	0.96	1.47	0.98
Transportation, post office, storage	0.39	1.52	1.58	1.16	0.21	0.60	1.29	0.86
Media	0.26	1.01	1.36	0.99	0.35	1.02	1.50	1.00
Financial and insurance services	0.33	1.27	1.45	1.06	0.35	1.01	1.49	0.99
Real state and rental services	0.08	0.32	1.11	0.82	0.16	0.46	1.23	0.82
Professional, scientific and technichal services	0.24	0.92	1.32	0.96	0.83	2.36	2.21	1.47
Corporations	0.21	0.81	1.27	0.93	0.96	2.74	2.49	1.65
support for businesses and waste management services	0.15	0.58	1.21	0.88	0.93	2.67	2.36	1.57
Educational services	0.11	0.43	1.16	0.85	0.00	0.01	1.01	0.67
Health and social asistance services	0.28	1.08	1.40	1.02	0.00	0.00	1.00	0.67
culture, sports and recreational services	0.24	0.93	1.33	0.97	0.04	0.10	1.05	0.70
Temporary accomodation services and food services	0.30	1.16	1.43	1.05	0.17	0.48	1.22	0.81
Other services except governmental	0.23	0.88	1.31	0.96	0.21	0.61	1.29	0.86
Legislative and governmental activities	0.29	1.13	1.42	1.04	0.00	0.00	1.00	0.67

Source: Author's construction from I-O tables in 2008

*In green are highlighted the sectors with strong forward and backward linkages according to our criteria.

According to Table 2 and 3, from 2003 to 2008 the sectors with strong backward linkages increased from 8 to 10 and sectors with strong forward linkages decreased from 9 to 8. In 2003 there were 6 sectors with both strong forward and backward linkages while in 2008 there were only 3 sectors (Agriculture, forestry and fishing; generation, transmission and distribution of electric energy and financial and insurance services). The dynamic sector due to trade (manufacturing), lost strength of forward linkages from 2003 to 2008 (in 2003 it was one of the 6 sectors with both strong forward and backward linkages).

For Chile, from 1996 to 2008 the sectors with strong backward linkages decreased from 12 to 9 and with strong forward linkages increased from 10 to 11. Sectors with both strong forward and backward linkages decreased from 8 in 1996 to 6 in 2008. In 2008 these sectors are; 1) agriculture, 2) generation of electricity, gas and water, 3) manufacturing, 4) media, 5) corporations and 6) recreational services. The dynamic sector, mining, had strong backward linkages in 1996. By 2008 nor strong forward and backward linkages were present in this sector.

To assess the effects of these inter-industry changes on inequality, we compute the Theil index of inter-industry wage income inequality. To make this calculation, we require the employed population by sector as well as average annual wages per sector. From I-O tables, we use the

vector of total employee compensation, which we divide by the average annual wages per sector to obtain the amount of employed workers per sector in the relevant year.

Average annual wages per sector are obtained from laborsta-ILO, which provides information on monthly wages in 159 occupations (and 48 sectors). Using the sector specification concordance form, provided by the National Institute of statistics of Mexico, we aggregate the 48 sectors in the 19 sectors compatible with the I-O tables.

Table 4 shows the contribution of each sector to inter-industry wage income inequality for Mexico and Chile. The first observation is that in both countries, the total Theil index increased, from 0.14 in 2003 to 0.21 in 2008 for Mexico and from 0.06 in 1996 to 0.14 in 2008 for Chile. Second, the sectors with negative contributions to the Theil index are the ones were incomes are lower than the average of all sectors. In both countries the manufacturing sector has a negative contribution. For Chile, the dynamic sector (mining) shows a positive contribution to the Theil index. Table 1.F. in Appendix F shows a bar graph of the contribution of each sector for both countries in corresponding years.

Table 4. Inter-industry wage inequality (total and contribution by sector)*

Sectors	Theil Index			
	Mexico		Chile	
	2003	2008	1996	2008
Agriculture, farming, forestry and fishing	-0.0100	-0.0054	-0.0350	-0.0244
Mining	-0.0063	-0.0048	0.0268	0.0268
Generation, transmission and distribution of electric energy	0.0144	0.0099	-0.0004	-0.0002
Construction	0.0018	0.0203	-0.0403	-0.0323
Manufacturing Industry	-0.0151	-0.0138	-0.0311	-0.0252
Commerce	-0.0086	-0.0024	-0.0025	-0.0035
Transportation, post office, storage	0.0453	0.0123	-0.0074	-0.0103
Media	-0.0040	0.0021	0.0000	0.0000
Financial and insurance services	0.0126	0.0157	0.0135	0.0122
Real state and rental services	0.0000	0.0000	0.0002	0.0006
Professional, scientific and technichal services	0.0080	0.0007	0.0168	0.0354
Corporations	0.0000	0.0000	0.0000	0.0000
support for businesses and waste management services	-0.0253	-0.0010	-0.0063	-0.0040
Educational services	0.0721	0.0927	0.0552	0.0704
Health and social asistance services	0.0302	0.0376	0.0525	0.0772
culture, sports and recreational services	0.0000	0.0000	0.0000	0.0000
Temporary accomodation services and food services	-0.0089	-0.0041	-0.0069	-0.0081
Other services except governmental	-0.0062	-0.0105	-0.0088	-0.0089
Legislative and governmental activities	0.0468	0.0702	0.0368	0.0409
Total	**0.1468**	**0.2194**	**0.0632**	**0.1464**

Source: Author's construction from I-O tables in corresponding years and countries

Summarizing, for the case of Mexico, the dynamic sector due to trade lost strength in forward linkages and from 2003 to 2008 three sectors with both strong forward and backward linkages were lost. The implication on inter-industry income inequality (assuming that no other factors affected the distribution of inter-industry income in this period) is an increase in inter-industry wage inequality.

For Chile, in 1996 manufacturing is one of the sectors with both strong forward and backward linkages while mining showed only strong backward linkages. By 2008 manufacturing industry remains a sector with strong forward and backward linkages and mining has neither strong forward or backward linkages. From 1996 to 2008 Chile lost strength in linkages by moving from 8 sectors with both linkages strong to 6 sectors. Under the assumption that no other factors interfered in the distribution of inter-industry income in this period, the consequence of these sectorial changes was an increase in the inter-industry wage inequality.

Although the decline in the strength of linkages in both countries lead to an increase in the inter-industry wage inequality, the dynamic sectors in both countries contribute in different ways to the Theil Index, Mexico's dynamic sector makes a negative contribution and Chile's a positive contribution. In both cases manufacturing shows a negative contribution to the Theil Index, indicating that wages in this sector were below the average wages of all sectors.

V. Trade and employment

In this section we use I-O analysis to assess the effects of changes in trade patterns on job creation. We follow the methodology used in Kucera and Milberg (2003) and Jiang (2011) who have calculated the amount of employment generated due to changes in patterns of trade for ten OECD countries from 1978 to 1995 and for China from 2003 to 2007 respectively. We estimate the effect of changes in the trade structure in 19 sectors for Chile and Mexico. The labor content in trade expansion is given by;

$$L = \hat{E}[(I - A)^{-1}T],$$

where A is the input coefficient matrix, each element in matrix A is the value of total intermediate inputs required by sector j as a proportion of j's total output. I is the identity matrix and $(I - A)^{-1}$ is the Leontief inverse matrix, each element of this matrix shows the input requirement by sector j if there were a unit increase in final demand of the output of the jth sector. $\hat{E}$ is the diagonal labor coefficient matrix, which shows the employment per unit output. L shows the employment generated due to changes in patterns of trade. T is the trade expansion vector and for the case of Mexico is computed as;

$$T = (X^{2008} - M^{2008}) - (X^{2003} - M^{2003})(D^{2008}/D^{2003}),$$

Where X and M are export and import values, D is the vector of domestic demand obtained as the addition of domestic production and imports. Hence T is the net exports resulting from changes in the structure of trade from 2003 to 2008. Matrix $(I - A)^{-1}T$, is a column vector showing the additional production required in each sector given the change in the pattern of trade. The multiplication with the $\hat{E}$ matrix gives the change in employment in each sector due to changes in trade patterns.

We use I-O tables from the National Institute of Statistics and Geography (INEGI in Spanish) for 2003 and 2008 calculated at basic prices of the corresponding year (in thousands of Mexican pesos). These tables contain the transaction (flows) table, aggregated in 19 sectors, from which matrix A (the technical coefficients matrix), vector of imports, exports and domestic outputs are derived.

We use GDP deflator published by the National Institute of Statistics and Geography to obtain the real 2008 exports, imports and domestic outputs in 2003 basic prices. This allows us to compute T, the trade expansion vector. Before obtaining L we need to compute $\hat{E}$, the labor coefficient vector (employment per unit of output). Since the employment data available is not consistent with the 19-sector I-O tables we use the sector specification concordance form published by the National Institute of Statistics of Mexico. We also use the concordance form to aggregate the data from laborsta-ILO on wages in 159 occupations (and 48 sectors). From the laborsta-ILO data we compute the average annual wages per sector in the corresponding years, W_{03} for Mexico.

$EW_{03}^{-1}Q_{03}^{-1}$,

Where Q_{03}^{-1} is the vector of total output obtained from the 2003 national I-O tables (for Mexico), in thousands of Mexican pesos. Hence the labor coefficients are the numbers of workers required to produce 1000 pesos worth of output for each sector in 2003. $\hat{E}$ is the diagonal matrix containing the labor coefficients. This matrix allows us to calculate the employment change vector L. Table 5 shows our results for the case of Mexico and Chile.

Table 5. Change in employment due to changes in trade patterns (Mexico 2003-2008 and Chile 1996-2008)*

Sectors	Employment (in 1000)	
	Mexico	Chile
Agriculture, farming, forestry and fishing	12.895	-29.326
Mining	479.396	744.514
Generation, transmission and distribution of electric energy	-21.865	-110.437
Construction	-171.646	-178.121
Manufacturing Industry	-425.573	642.541
Commerce	43.574	84.760
Transportation, post office, storage	-15.842	-27.344
Media	-95.900	0.000
Financial and insurance services	54.364	-6.977
Real state and rental services	0.000	9.678
Professional, scientific and technichal services	37.565	8.596
Corporations	0.000	0.000
support for businesses and waste management services	-14.048	288.298
Educational services	-4.297	-3.364
Health and social asistance services	1.802	-1.318
culture, sports and recreational services	0.000	0.000
Temporary accomodation services and food services	-23.706	183.628
Other services except governmental	-8.665	21.626
Legislative and governmental activities	-74.747	-39.164
Total employment gains	629.596	1983.640
Total employment losses	-856.289	-396.051

Source: Author's construction from I-O tables in corresponding years and countries
*Highlighted are the sectors that lost employment in the period studied

Table 5 shows that for the case of Mexico 10 out of 19 sectors lost employment. The sector that created more employment was mining (479,396). The total employment losses amount to 856, 289. The total employment gained amounts to 629,596. Hence between 2003 and 2008 Mexico's changes in trade pattern generated more job losses than gains.

For Chile 8 out of 19 sectors experienced job losses. The sector that lost more jobs was construction (178,121). The total amount of jobs destroyed (396,051) were less than the ones created (1,983,640), showing that between 1996-2008 Chile's changes in trade pattern lead to more employment gains than losses.

Table 5 also shows that although the dynamic sectors in both countries (mining and manufacturing for Chile and Mexico respectively) lost strength between the period studied. The effect of changes in trade patterns on job creation is different. In the case of Mexico the manufacturing sector is among those with the biggest job losses while for Chile the mining sector was the sectors where most of the jobs were created.

Since manufacturing is a dynamic sector for both countries from the import side, some observations are in order. For Mexico the manufacturing industry is one of the sectors that lost the most employment due to trade while for Chile it was one of the sectors where most of the employment was created. The loss of strength of the same dynamic sectors in different countries has different effects on job creation.

Diverse results are also observed between the contribution to Theil Index and job creation due to trade. Those sectors with negative contribution to the theil index (e.g the manufacturing sector in both countries) have different effects on job creation. In Mexico most jobs were lost in this sector and in Chile this sector is among those with more jobs created.

VII. Conclusions

We have identified the dynamic sectors due to trade in Chile and Mexico and how these sectors are connected with the rest of the economy. Using I-O analysis we computed the strength of forward and backward linkages in both countries. We found that at the country level the strength of the linkages decreased as measured by the decrease in both linkages (forward and backward) in the two countries (from 8 to 6 in Chile and from 6 to 3 in Mexico) and the decrease in the strength of linkages of the dynamic sectors (manufacturing in Mexico and mining in Chile).

Our computation of the inter-industry Theil index, a measure of the evolution of wage inequality, shows that from 2003 to 2008 inter-industry wage inequality increased in Mexico and Chile. Hence, the reduction in the strength of the linkages can be associated with increase in inter-industry wage inequality. This finding supports the hypothesis that the relationship between the dynamic sector and the rest of the economy matters for inter-industry wage inequality.

The study of the amount of jobs generated due to changes in trade structure shows that from 2003 to 2008 the jobs losses were higher that the jobs created for Mexico. Most of the job loss came from the dynamic sector (manufacturing). For the case of Chile the opposite was true, from 1996 to 2008 job creation due to trade were higher than job losses. Mining and manufacturing are the sectors were most jobs were created. Although in both countries the strength of the linkages in the dynamic sectors declined, the effect of changes in trade patterns on job creation is different.

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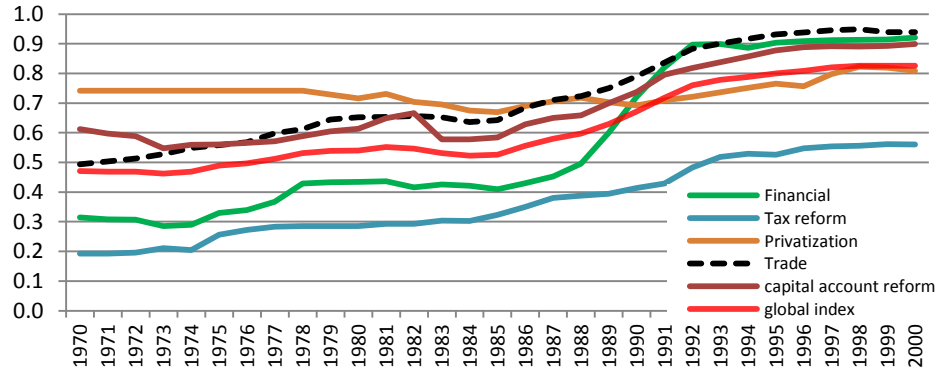
Appendix A

Figure1.A. Index of structural reforms, 17 countries

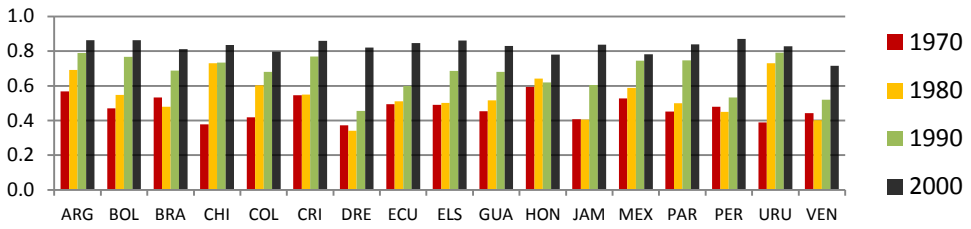


Source: Author's calculation based on data from ECLAC

Figure 1.A captures the intensity of the structural reforms; tax reform and privatization were the less intense while financial, trade and capital account were the most significant. One explanation of why privatization and tax reforms experience less change has to do with political reasons, these reforms are more difficult to approve and the differences among countries in this regard is big.

The global index shows two broad periods, one short (1993-2000) and one long (1970-93), where the index grew together with its components. The long period corresponds to the first tide of reforms in the middle 1970's, soon abandoned, in almost all countries which adopted it (Argentina, Chile, Colombia, Uruguay). After the 1990 the reforms where more generalized in the region. The most important changes happened in finance and trade. An example of structural reforms plus stabilization policies was the "real plan" in Brazil in 1994. Since 1993 changes were at a slower pace relative to the previous period. The global index also shows that by 1997 big reforms stopped, Lora (2001).

Figure 2.A. Global Index of structural reforms, 17 countries



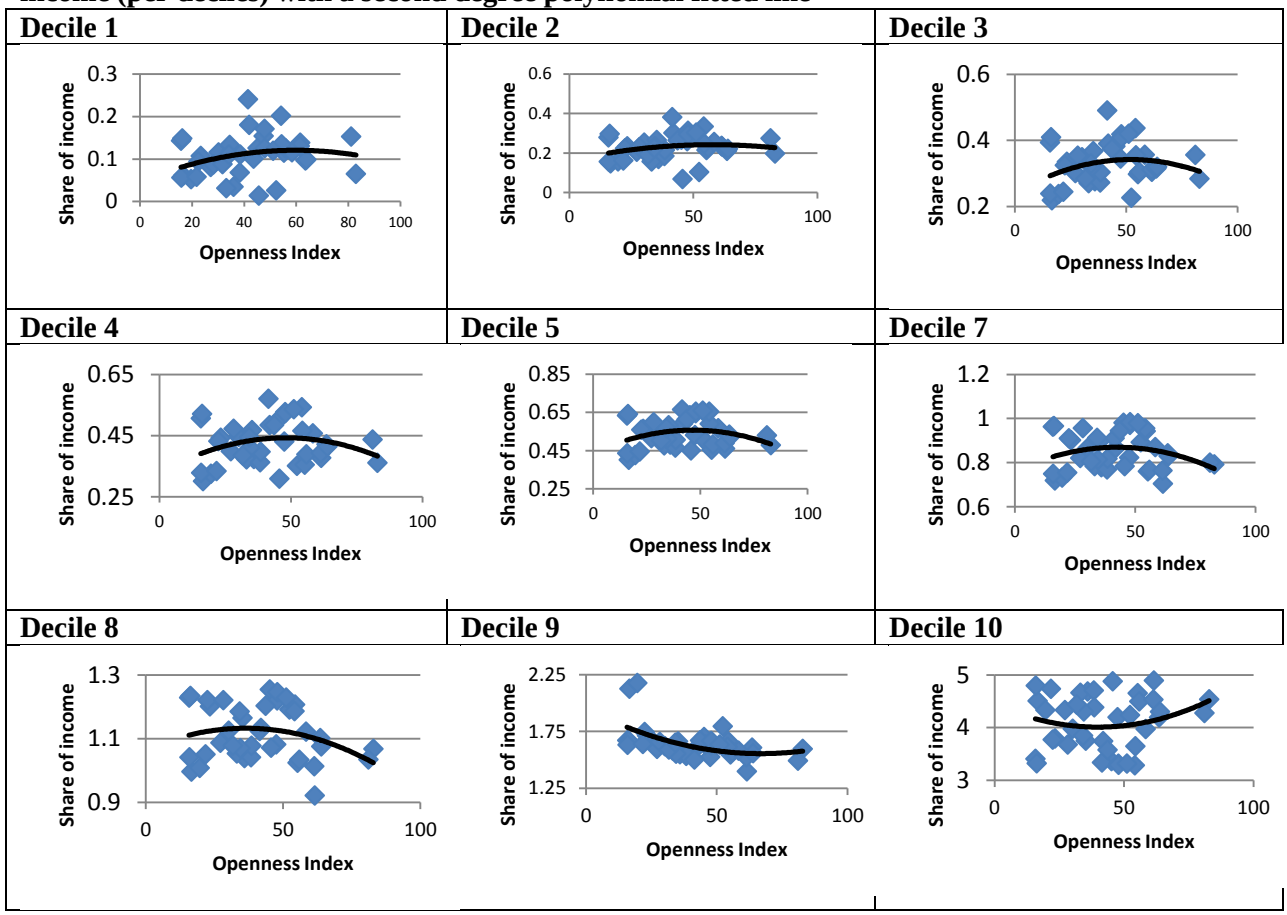
Source: Author's calculation based on data from ECLAC

According to Figure 2.A, in 1970 the countries with the highest index of structural reform were Argentina, Honduras, Costa Rica and Brazil. In 1980 Argentina, Uruguay and Chile are the

reformers. In 1990 Argentina, Uruguay, Bolivia, Paraguay, Mexico and Costa Rica had the highest index. By the year 2000 all the countries were close to 0.8 except Venezuela.
Argentina, Uruguay and Chile made the biggest jump in structural reform from 1970 to 1980. Paraguay, Mexico, Costa Rica, Bolivia and Brazil experienced a big increase in reforms from 1980 to 1990. Dominican Republic, Ecuador, Jamaica, Peru experienced the biggest increase from 1990 to 2000.

Appendix B

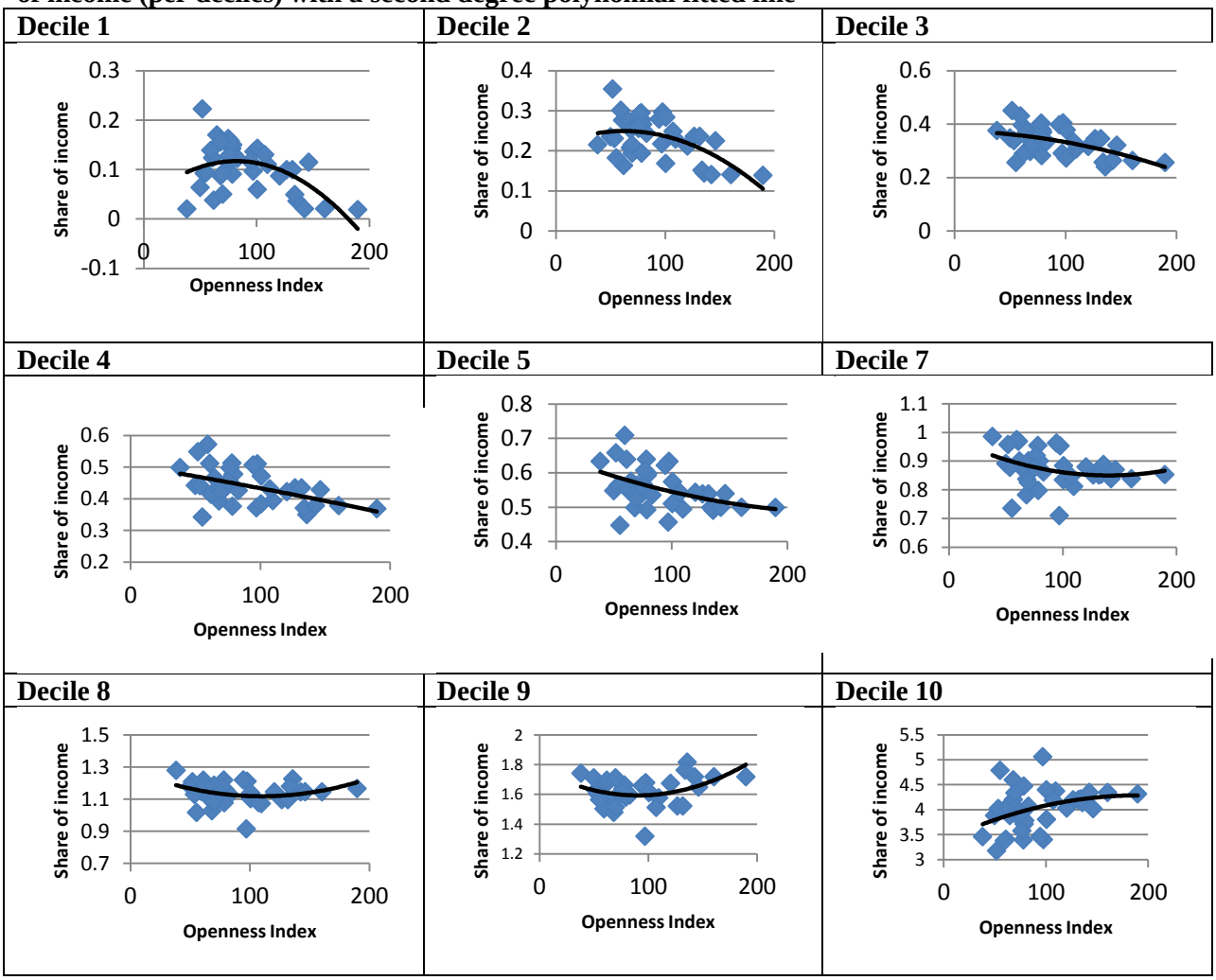
Figure 1.B. Sample of "Big" Latin American countries (1988-2008); openness index versus shares of income (per deciles) with a second degree polynomial fitted line*



Source: Author's calculation based on data from SEDLAC and World Bank.
*Countries in this subsample; Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Peru, Venezuela.

Figure 1.B. shows that for the sample of "big" countries, when we use the openness index as a globalization indicator a non linear behavior up to the eight decile emerges. As the country becomes more open (in trade) the shares of income first increase and then decline. The opposite non linear behavior is observed for the richest two deciles, as openness increase first the share of income decline and then increase (or remain constant as in the 9th decile).

Figure 2.B. Sample of "Small" Latin American countries (1988-2008); openness index versus shares of income (per deciles) with a second degree polynomial fitted line*

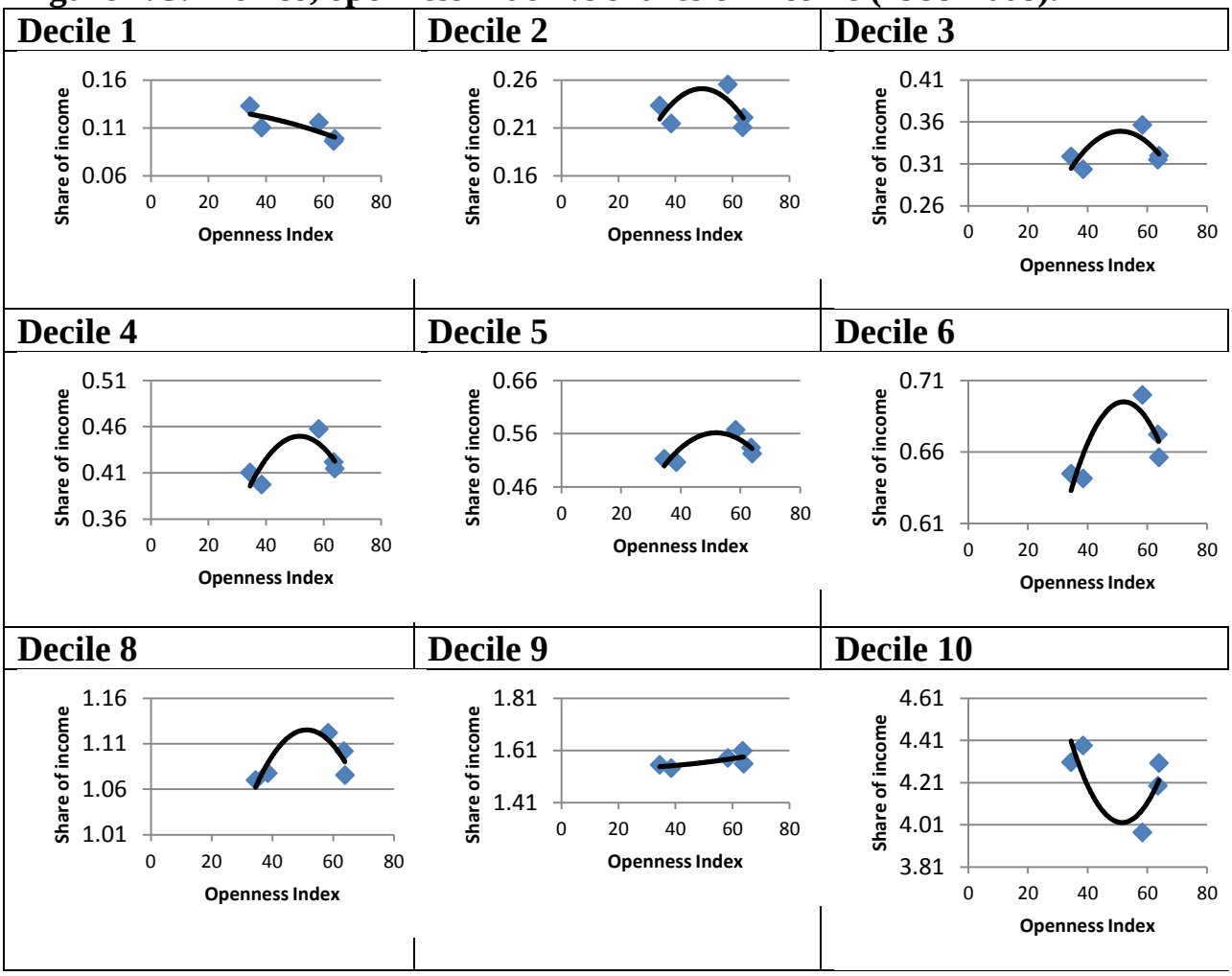


Source: Author's calculation based on data from SEDLAC and World Bank.
*Countries in this subsample; Belize, Costa Rica, Dominican Republic, Ecuador, El Salvador, Honduras, Nicaragua, Panama.

Figure 2.B. shows that for the sample of "small" countries, when we use the openness index as a globalization indicator a marked (strong compared with the sample of "big" countries) non linear behavior for the two poorest deciles emerges. From the 3rd to the 7th decile a more linear inverse relationship (as the economy becomes more open, the shares of income decline) seems to emerge. From the 8th to the 9th decile a non linear relationship appears, at low levels of openness the shares of income declines and as openness increase the shares of income increase. The 10th decile shows a liner relationship, where the shares of income increase together with the openness index.

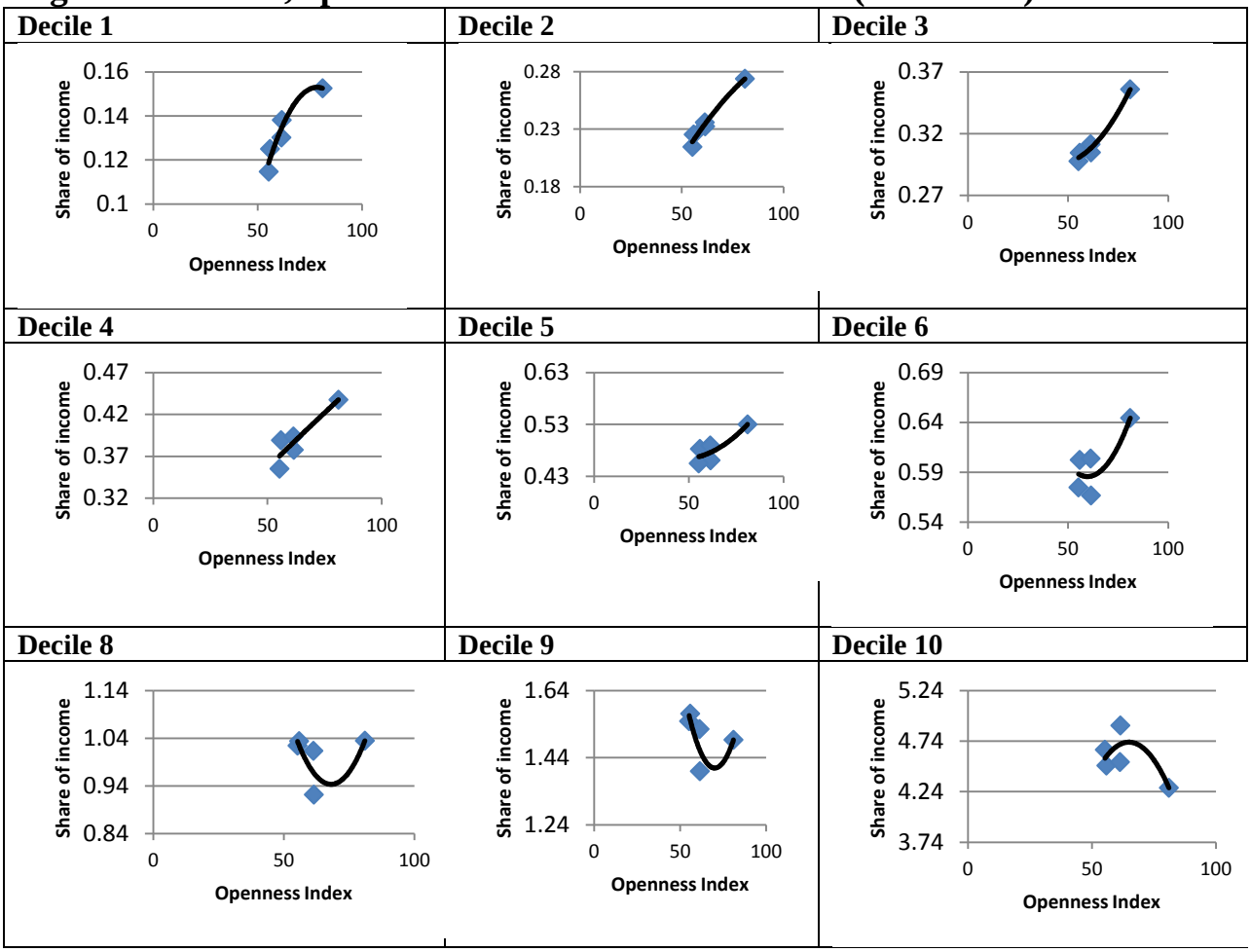
Appendix C

Figure 1.C. Mexico, openness index vs shares of income (1988-2008).



Source: Author's calculation based on data from SEDLAC and World Bank.

Figure 2.C. Chile, openness index vs shares of income (1988-2008).



Source: Author's calculation based on data from SEDLAC and World Bank.

Appendix D

Figure 1.D. Summary of dynamic sectors in selected countries.

Country	Dynamic sectors	
	Exports	**Imports**
Chile	Ores and Metals, Food	Manufacturing, Fuel
Mexico	Manufacturing, Fuel	Manufacturing, Fuel
Argentina	Food, Manufacturing	Manufacturing, Fuel
Brazil	Manufacturing, Food	Manufacturing, Fuel

Appendix E

Table 1.E. Forward and backward linkages, Chile (1996)*

Sectors	Backward linkages				Forward linkages			
	b(d)	b(d)_bar	b(t)	b(t)_bar	f(d)	f(d)_bar	f(t)	f(t)_bar
Agriculture, farming, forestry and fishing	0.45	1.26	1.77	1.12	0.50	1.18	1.78	1.03
Mining	0.40	1.12	1.64	1.04	0.19	0.46	1.29	0.74
Generation, transmission and distribution of electric energy	0.48	1.36	1.83	1.16	0.76	1.81	2.46	1.42
Construction	0.38	1.07	1.60	1.02	0.10	0.23	1.14	0.66
Manufacturing Industry	0.37	1.05	1.60	1.01	0.57	1.35	1.88	1.08
Commerce	0.44	1.24	1.68	1.07	0.32	0.75	1.50	0.87
Transportation, post office, storage	0.37	1.04	1.60	1.02	0.47	1.12	1.75	1.01
Media	0.43	1.21	1.68	1.07	0.55	1.30	2.01	1.16
Financial and insurance services	0.33	0.92	1.49	0.95	0.22	0.52	1.35	0.78
Real state and rental services	0.13	0.37	1.21	0.77	0.97	2.30	2.57	1.49
Professional, scientific and technichal services	0.40	1.14	1.64	1.04	0.75	1.77	2.34	1.35
Corporations	0.43	1.21	1.68	1.07	0.55	1.30	2.01	1.16
support for businesses and waste management services	0.28	0.79	1.44	0.92	0.93	2.19	2.55	1.47
Educational services	0.15	0.42	1.24	0.79	0.02	0.06	1.03	0.60
Health and social asistance services	0.13	0.36	1.20	0.76	0.01	0.03	1.01	0.59
culture, sports and recreational services	0.39	1.11	1.63	1.04	0.54	1.28	2.30	1.33
Temporary accomodation services and food services	0.57	1.62	2.00	1.27	0.28	0.67	1.44	0.83
Other services except governmental	0.30	0.84	1.47	0.93	0.28	0.67	1.44	0.83
Legislative and governmental activities	0.31	0.88	1.50	0.96	0.00	0.01	1.01	0.58

Source: Author's construction from I-O tables in 1996

*In blue are highlighted the sectors with strong forward and backward linkages according to our criteria.

Table 2.E. Forward and backward linkages, Chile (2008)*

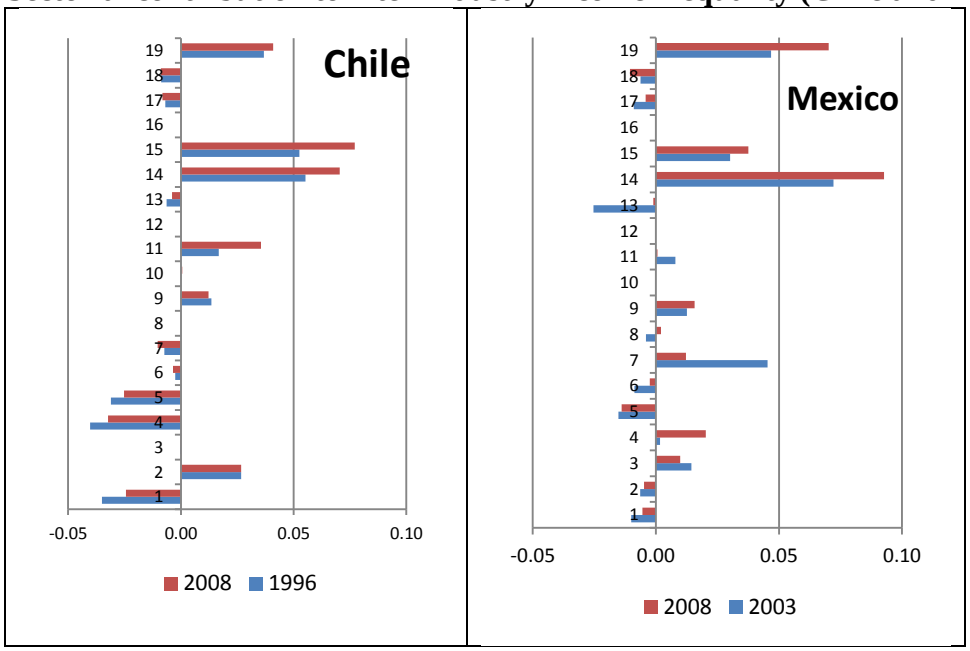
Sectors	Backward linkages				Forward linkages			
	b(d)	b(d)_bar	b(t)	b(t)_bar	f(d)	f(d)_bar	f(t)	f(t)_bar
Agriculture, farming, forestry and fishing	0.51	1.34	1.94	1.17	0.74	1.71	2.14	1.21
Mining	0.33	0.88	1.56	0.94	0.19	0.44	1.29	0.73
Generation, transmission and distribution of electric energy	0.56	1.46	2.10	1.27	0.81	1.86	2.71	1.54
Construction	0.43	1.13	1.72	1.03	0.12	0.29	1.18	0.67
Manufacturing Industry	0.42	1.10	1.71	1.03	0.54	1.23	1.87	1.06
Commerce	0.49	1.29	1.79	1.08	0.40	0.93	1.68	0.95
Transportation, post office, storage	0.34	0.88	1.55	0.94	0.46	1.05	1.78	1.01
Media	0.61	1.59	2.12	1.28	0.52	1.21	1.98	1.12
Financial and insurance services	0.27	0.70	1.41	0.85	0.52	1.20	1.93	1.09
Real state and rental services	0.29	0.77	1.47	0.88	0.86	1.98	2.44	1.39
Professional, scientific and technichal services	0.27	0.72	1.42	0.86	0.78	1.79	2.37	1.34
Corporations	0.55	1.43	2.01	1.21	0.57	1.31	2.13	1.21
support for businesses and waste management services	0.34	0.88	1.54	0.93	0.87	1.99	2.54	1.44
Educational services	0.17	0.45	1.29	0.78	0.02	0.04	1.03	0.58
Health and social asistance services	0.32	0.83	1.53	0.92	0.08	0.18	1.10	0.62
culture, sports and recreational services	0.49	1.28	1.81	1.09	0.48	1.11	1.84	1.05
Temporary accomodation services and food services	0.52	1.36	1.94	1.17	0.18	0.41	1.29	0.73
Other services except governmental	0.13	0.34	1.21	0.73	0.08	0.19	1.15	0.65
Legislative and governmental activities	0.23	0.60	1.39	0.84	0.04	0.09	1.06	0.60

Source: Author's construction from I-O tables in 2008

*In blue are highlighted the sectors with strong forward and backward linkages according to our criteria.

Appendix F

Table 1.F. Sectorial contribution to inter-industry income inequality (Chile and Mexico)



Source: Author's calculation based on data from national I-O tables in corresponding years and countries