Winners take all (the most): The effects of market concentration on labor share and wage inequality

Sossdorf, Fernando

1 July 2022

Winners take all (the most): The effects of market concentration on labor share and wage inequality

Fernando Sossdorf*

Abstract

The increase in market concentration in the major advanced economies in recent decades has led to an exhaustive analysis of its implications. One of them is that it may explain the fall in labor share. This is explained, according to one theoretical strand, by the emergence of highly efficient superstars firms with low levels of labor share that, due to reallocation effects as they gain very large market share, depress aggregate labor share. In turn, wage inequality between workers with different skills may also increase because superstars firm may demand highly skilled workers. Thus, this paper investigate the effects of market concentration on the labor share and on the highly skilled worker share in the wage bill in the Chilean manufacturing. The results indicate that an increase in concentration is associated with a fall in labor share and a increase in the share of the wage bill that is paid to highly skilled workers. Moreover, those industries with the largest increase in concentration are those with the largest drop in labor share and the largest increase in the highly skilled worker share in the wage bill. However, the small group of large companies that dominate the industries are far from being superstars: they have not become more productive and more innovative and their contribution to aggregate productivity and employment has not increased over time. On the contrary, they charge a higher markup than the rest of firms. The findings shows that increases in market concentration may be detrimental to the economy as dominant firms polarize the labor market, do not contribute to increases in productivity and innovation and exert market power.

JEL classification: D22, D33, J24, L13, L40.

Keywords: Market Concentration, labor share, highly skilled worker, superstar firms.

*Email: fernando.sossdorf@gmail.com. I would like to thank to Evangelos Siokas, Panagiotis Panagiotopoulos, Aimilia Protogerou and participants to the EAEPE Conference 2019 and participants in numerous internal seminars in Chile in September 2019 for helpful discussions. The usual disclaimer applies.

1. Introduction

Apple, Microsoft and Amazon reached a market value close to 900 billion dollars in 2018 according to Forbes magazine. The rapid growth of large global companies leading the economies has led to a growing body of research to explain this phenomena (Manyika et al., 2018). In fact, large companies define the business landscape despite to represent the minority of firms. This is it, they contribute significantly to value-added, research and development, foreign direct investment, and exports in developed and developing countries (Freund and Pierola, 2015; OECD, 2018; Hernández et al., 2018). In almost half of the OECD economies, for instance, the value added generated by large companies represents more than half of the total in the industrial sector. In turn, a small group of big exporting firms explains most of the trade volume of a country.

The importance that a small number of dominant large firms have taken on in the economies has led to a growing interest in the role that these types of firms might play in the rise of concentration in product (Autor et al., 2019) and labor markets (Azar et al., 2017) and in the increase of profits (Council of Economic Advisors, 2016; Grullon et al., 2019) and markups (De Loecker and Eeckhout, 2017). In general, empirical evidence has focused strongly on the United States, and to a lesser extent on some European countries and Japan (Bajgar et al., 2019).

Regarding the increase in profits and market concentration, one theoretical strand proposed by Autor et al. (2019) is the emergence of superstar firms that have become more efficient with respect to the rest of the firms. They propose that such firms arise because technological change has made industries increasingly characterized by a winner take most (all) feature where a small number of dominant firms gain a very large share of the market. In turn, superstar firms achieve this position through lower average costs, higher quality, or greater innovation. A second theoretical strand to explain this phenomenon is that the increase in product market concentration is attributable to a decrease in competition, which has led to the dominant firms to strengthen their position. Under such a scenario, leading firms exert their market power by charging higher prices and placing entry barriers which would be detrimental to the economy (Gutiérrez and Philippon, 2017; Grullon et al., 2019).

In parallel to the increase in market concentration, the fall in the labor share has been a global secular trend (Elsby et al., 2013; Karabarbounis and Neiman, 2013; IMF, 2017). The sustained drop in the income share paid to labor has been a phenomenon that originated in the 1980s affecting advanced countries and much of the emerging economies including large ones such as China, India, Brazil, Turkey, Mexico and South Africa[1](Abraham and Bormans, 2019). This has been driven primordially by the globalization and the technological progress. Technology, on the one hand, has resulted in automation replacing a large number of jobs (Autor and Salomons, 2018; Acemoglu and Restrepo, 2018) and a decrease in the relative price of investment goods which has induced firms to substitute capital for labour (Karabarbounis and Neiman, 2013). On the other hand,

[1]In the BRICS economies only Russia has shown a moderate increase in the labor share in the last decades. It should be noted that although in emerging economies there is a significant portion of self-employment that may affect the measurement of the income share, even when the figures are corrected there is a declining trend.

globalization broadly understood by participation in global value chains, foreign direct investment and trade volumes has led to a shift from production in advanced economies to more capital-intensive goods and an offshoring of labor-intensive goods (Dao et al., 2017; Doan et al., 2017). In emerging economies, the increasing participation in GVCs is observed with the drop in the income share which seems contradictory as these economies are more involved in producing the offshoring labor-intensive goods. The explanation proposed by Elsby et al. (2013) and Doan et al. (2017) is that the expansion of the GVCs coincide with the fall in the relative price of investment which has conducted to offshore those tasks with low substitution between factors as those with high substitutability are automated; in the developing economies, the relative local cost of capital is high due to its scarcity and the tasks performed with high substitution between factors will exhibit a high labor share as firm exploit low relative cost of labor while those tasks of low substitution will have a low labor share. Thus, the increase in the production of tasks of low substitutability caused by offshoring is conducive to a fall in aggregate labour participation in developing economies. For instance, the IMF (2017) points out that technology and global integration explain nearly to 75 percent of the decline in income shares in Germany and Italy, and close to 50 percent in the United States. Other factors that may explain the fall in labor share are regulation of labor and product markets, a rise in intellectual property rights, minimum wage legislation, welfare state policies and changes in the power relations between workers and employers due to a fall in the unionization rate (Dao et al., 2017; Dosi and Virgillito, 2019). But, the empirical literature remains inconclusive about the impact of these determinants on the labor share (Abraham and Bormans, 2019).

The fall in labor share, in turn, translates into two key facts for policymakers. On one side, the sustained fall means that productivity grows more than wages. On the other side, since the rise in corporate profits is directed at those individuals in upper deciles of income distribution, it is not surprising that income inequality is increasing (Song et al., 2018; Dosi and Virgillito, 2019). But, also the wage inequality among workers may be rising as globalization and technology favor more qualified workers (Reenen, 2011; Helpman, 2018).

A new determinant explaining the fall in labor share is the increase in market concentration. Autor et al. (2019) postulate that superstars firms with a dominant market share are depressing income share. In fact, these firms have high fixed and low-marginal costs that translate into low labor share that leading to a decrease in aggregate labor share as superstar firms gain market share. In this regard, Akerman (2018) shows that there is not only a relationship between market concentration and labor share but also between concentration and changes in the relative demand of skilled workers. As dominant firms gain market share they require highly skilled workers conducting to a polarisation in the labour market where highly efficient firms employ the most skilled workers.

However, while empirical evidence for the United States shows that market concentration increases across industries and at the aggregate level, this is not conclusive to assert that dominant firms are highly efficient. Indeed, Gutiérrez and Philippon (2019) show that super stars firms have not become larger, have not become more productive, and the contribution of star firms to aggregate U.S. productivity growth has fallen. This means that the dominant companies are not following the

Schumpeterian hypothesis (Nelson and Winter, 1982b) by which they increase their market share by being more innovative. In turn, Ciarli et al. (2018) argue that the idea of superstars benefiting from the cumulative increasing returns on R&D investment is not a new idea in the innovation literature. Indeed, (Nelson and Winter, 1982a, p. 325) point out: "there are usually winners and losers in industries, and that the high productivity and profitability of winners confer advantages that make further success more likely, while decline breeds further decline. This process creates a tendency for concentration to develop even in an industry initially composed of many equal-sized firms... At the same time, industries with rapid technological change tend to grow more concentrated than those with slower progress... The analysis addresses the pervasive question of whether industry concentration, with its associated monopoly profits and reduced social welfare, is a necessary cost if societies are to obtain the benefits of technological innovation (AT)". In this way, the increase in market concentration departs from the idea of top dominant companies in a context of technological oligopoly that drive innovation and productivity.

Empirical evidence on the evolution of market concentration in developing countries, on the contrary, is limited and confined to country studies rather than comparative studies (Amann and Baer, 2008; OECD, 2010; Solimano, 2012; Mendoza et al., 2013; López-Calvay et al., 2019). Research in these economies, broadly speaking, shows that there is an increasing or stagnating income inequality over time, high market concentration relative to advanced countries, and the predominance of a small group of large firms of relative high productivity that also dominate exports. In fact, Latin America, for example, is the most unequal region in the world despite the fall in income and wage inequality in the 2000s until the slowdown in 2011 (Messina and Silva, 2018) with a persistent difference in labour productivity between large firms and SMEs within and between sectors over time (Economic Commission for Latin America and the Caribbean, 2012) and with indicators of product market regulation that are more restrictive than in OECD countries (OECD, 2019), which may encourage market concentration and may be one of the reasons for low private innovation.

In this sense, this paper analyzes the impact of product market concentration on labor share and on the share of the wage bill that is paid to highly skilled workers in a developing country as is the case of the Chilean manufacturing sector for a panel of firms from 1995 to 2007. In spite of the fact that manufacturing represents 15% of GDP in the period analyzed, the database allows for a detailed analysis of the dynamics of labor share at the firm level and the evolution of market concentration in 113 industries. In turn, the database also has detailed information on the aggregate wages of workers with different skills for each firm, which allows for an analysis of the evolution of the wages that are paid by worker skill. In addition, having a data panel allows to explore if the dominant companies that gain market share are more efficient with respect to the rest of the firms.

Another important fact to note is that Chile also has a small market that can sustain only a small number of companies producing at the minimum efficiency scale (OECD, 2010). Therefore, a more concentrated industrial structure is expected relative to other economies with large domestic markets, but Solimano (2012) using the Herfindahl-Hirschman Index (HHI) as a measure of market

concentration for six sectors (forestry, banking, pharmacies, pension funds, administration, mining and health insurance) finds that Chile has a high market concentration index in which two to six firms dominate these sectors.

Therefore, this document contributes to empirical literature in three ways: i) examines the evolution of market concentration in a developing economy and explores not only the relationship between changes in market concentration and changes in labor share, but also whether dominant firms that gain market share induces changes in the share of the bill that is paid to highly skilled workers, ii) analyses the contribution of the top dominant firms to employment and productivity, iii) investigates whether changes in market concentration are due to emergence of superstar firms that have become more productive and more innovative.

In this way, the research questions are: i) is there a link between changes in market concentration and changes in labor share?, ii) is there a link between changes in market concentration and changes in the share of highly skilled worker wages in total wage bill?, iii) what are the characteristics of the top dominant firms? Have they become more productive and innovative?, are they superstar firms? .

The results indicate first of all that Chile has had an increase in market concentration across industries and at the aggregate level. Secondly, the rise in market concentration is associated with a drop in labor share. This is robust even to the inclusion of import penetration and to the addition of variables of globalization and technological change. Moreover, those sectors in which concentration has increased the most are those in which labour participation has fallen the most. Thirdly, the rise in market concentration is associated with an increase in the share of highly skilled in wage bill. This means that dominants firms that gain market share increase wage inequality by attracting the most qualified workers. Fourth, there are no superstars as the dominant firms have not become more productive and innovative and in turn there is no relationship between the markups evolution and market concentration. In fact, dominant firms have higher markups than other firms, so they exert market power which, combined with labour market polarization, can be detrimental to the economy.

The rest of the paper is organized as follows. Section 2 describes the data used in the paper along with the construction of variables of concentration, labor share and skills. Section 3 presents the empirical model to be estimated. Section 4 shows the main empirical results. Section 5 provides concluding remarks.

2. Data and Variables

2.1. Sources

Five data sources are used in the analyses. The first two databases come from ENIA described in the Appendix of data construction. First, Form F1 is used to capture economic and accounting information about the firm. The data are based on the International Standard Industrial Classification of All Economic Activities (ISIC) Rev 3 at four digits. Second, form F3 is used to identify the

specific goods that firms produce and export at seven digits. The third database comes from COMTRADE, which provides information on imports (HS6) by origin. To generate a concordance between products reported by imports (HS6) and those reported by ISIC rev 3, tables from World Integrated Trade Solution (WITS) are used. A fourth source comes from the Trade in Value-Added (TiVA) database from OECD. To complement this information, data from Chilean Customs, the Central Bank of Chile and the Global Trade Analysis Project (GTAP 10) are used. Finally, data from LA-KLEM and ECLAC are also incorporated into the analysis.

Each firm in ENIA has an identifier generating a panel data that spans from 1995 to 2007. Data-cleaning procedure is also applied to the dataset. Firms with missing information, zero or negative values on sales, employment, wages and value added are dropped.

2.2. Product-market concentration

Market concentration is based on quantifying the industrial structure of a specific sector using the market share of firms. Although this definition is very broad, it presents the three main problems involved in defining concentration: unit of measurement, geographic space or sector reference and how to measure concentration using the market share of firms (OECD, 2018). On the one hand, the market share of firms can be measured through their activity, capacity or income. Gutiérrez and Philippon (2019), for example, in his study on concentration in the United States uses market value of equity to define both the 20 firms that dominate nationally in one year and the 4 firms that dominate each sector in each year; Grullon et al. (2019), meanwhile, measures concentration in the USA using the sales of the companies. Thus, two recent works for the United States measure concentration using two different units of measurement which can lead to different conclusions. On the other hand, measuring concentration at very aggregated levels results in creating sectors that in practice do not compete with each other (Werden and Froeb, 2018). The Council of Economic Advisors (2016), for instance, in its study on the concentration of markets in the United States measured it at two digits, which gave way to the creation of sectors such as retail trade, which was later severely criticized by other studies (Werden and Froeb, 2018). At the same time, the geographical space is another key fact when defining concentration. The same set of companies in a sector can compete in different geographical areas, which has led to distinguish between local concentration and concentration at the country level (Rossi-Hansberg et al., 2018). Finally, market concentration seeks to identify the group of firms that dominate the structure of the sector. Therefore, empirical studies have used from 4 companies to 50 companies to use the market share of each firm in the sector. In this sense, two measures are commonly used: concentration ratio (CR) and the Herfindahl-Hirschman Index (HHI).

Concentration ratio measure the market share of the largest n firm in the market (CR_n):

$$CR_n = \sum_{i=1}^{n} S_i$$

Where S_i is the market share of the $i-th$ company in the observed industry:

$$S_i = \frac{Unit_i}{\sum_{i=1}^{m} Unit_i}$$

With $m > n$ and $Unit$ being the unit of measurement of market share. Thus, the CR4 indicates, for instance, the sum of the market share of the four largest companies in a specific sector. Although in practice there is no criterion to define whether the value obtained from a CR_n in a sector denotes concentration or not, Naldi and Flamini (2014) postulate that in the case of CR4 a value close to 0 indicate perfect competition while values between 0% and 40% indicate monopolistic competition (or effective competition), values between 40% and 60% denote a loose oligopoly and finally values above 60% indicate a tight oligopoly or the presence of a dominant firm. It is important to highlight that four firms in the market can have different market shares and yield the same CR4. For example, four companies in one sector may have a share of 20% each while in another sector firms may have a share of 65%, 5%, 7% and 3% respectively. While the first sector presents a market share distributed among the four firms, the second sector exhibits a top firm that dominates almost all of the sector.

In this sense, a crucial problem with concentration ratio is that it only reports on the weight of one group of firms in the sector. Following the previous example of the two sectors with equal CR4, the first sector may have a fifth firm with a market share of 15% and a sixth with a 5% share while the second sector may contain a large number of firms with low market share. To incorporate the total number of firms in the sector, the Herfindahl-Hirschman Index (HHI) calculates the square of each firms' market share in the market, and adds the resulting numbers:

$$HHI = \sum_{i=1}^{n} S_i^2$$

Where S_i is again the market share of the firm i in the total sector and S_i^2 is its squared value. In the case of a company that dominates the whole market, the HHI is 1 while in the case of n firms with an identical market share, the HHI is $1/n$. The Department of Justice (DOJ) and the Federal Trade Commission in the United States[2], for example, consider markets in which the HHI is between 0.15 and 0.24 to be moderately concentrated, and in the case that the HHI is in excess of 0.25 to be a market highly concentrated.

To take into account the problems described above and the specificities of a small market in Chile in each sector as postulated by Solimano (2012) in which two to six firms dominate the market, HHI and CR4 are used as measures of market concentration. As unit of measure of market share, sales are used. An important point to note is that each firms' sales include the value of exports, so that the construction of domestic markets requires exports to be subtracted from the value sold of each company. For comparison purposes and robustness check, concentration indicators are also calculated using the market share of the three and eight largest firms in each sector. Likewise, the Chilean economy is strongly concentrated in the Metropolitan Region, so the absence of geographical problems rules out the use of local concentration measures. In this sense, concentration is measured

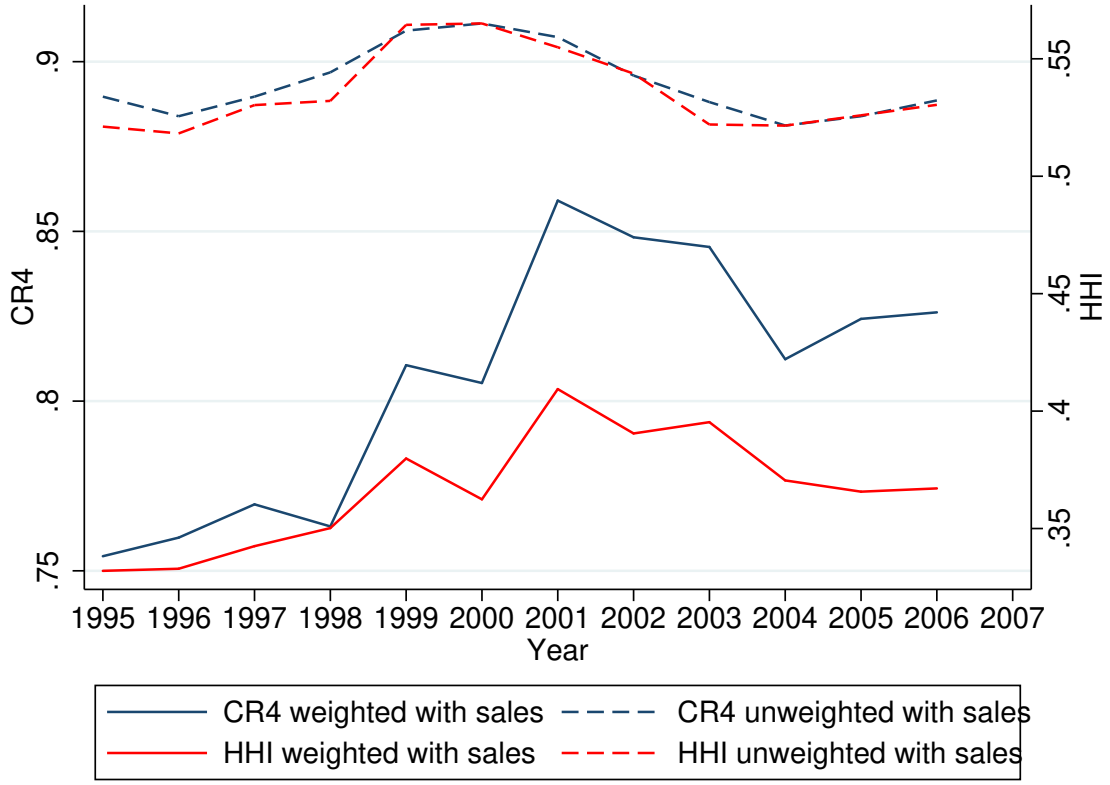
[2]https://www.justice.gov/atr/herfindahl-hirschman-index.

using ISIC rev 3 at the four digits that includes 113 sectors.

Notwithstanding the above, an even finer disaggregation is possible using form F3. This form only includes the sales of each product at 7 digits for each firm but not the work, salary, capital and value added required in each of these products. As a first approximation of the evolution on market concentration, we use the form 3 at 7 digits as in described in the Figure 1.

The definition of markets in this case are the 1328 products listed in the form 3. A firm in the textile sector (code 1711), for example, that sells five different products competes in five different markets using this form while using the form 1 at 4 digits it competes in one single market. The blue line indicates CR4 while the red line denotes HHI at the aggregate level. The two dotted lines are the unweighted average of both indicators while the continuous lines estimate the weighted average using as weight the percentage of sales of each product in its initial year. The Figure 1 indicates that using the simple average yields a very high concentration using both HHI and CR4 with a clear upward trend from 1995 to 2007. Using the weighted average, HHI and CR4 continue to have high values around 0.35-0.4 and 0.75-0.85, respectively, with an upward trend. That is, there is increase in market concentration regardless of whether using HHI or CR4 defining sectors at 7 digits.

Figure 1. Evolution of market concentration at 7 digits



Note: For each year, the CR4 is calculated for each sector, as well as the HHI index. Then, the weighted average for each year is calculated in which the weights are the percentage of the value added in 1995.

On the other hand, using Form 1 with sectors defined at 4 digits to measure market concentration, as will be done in the rest of the document, it is obtained that both the value of CR4 and the HHI are lower as expected by having more aggregated sectors, but even so, the values obtained are higher in relation to those of the United States and also show a growing trend, as shown in the Table 2. The Table shows the concentration ratio for one firm (CR1), two firms (CR2), three firms (CR3), eight firms (CR8) and twenty firms (CR20). In the case of CR1, the dominant firm in the market, on average, accounts for 25% of total sales each year, reflecting a highly concentrated industrial structure around a single firm. In turn, CR2 shows that two firms in one sector, in general, capture 40% of sales, indicating a high market concentration. As for the HHI index, the value obtained also indicates that there is a moderate concentration, on average, in Chilean manufacturing.

Table 1: Market Concentration at 4 digits, selected years

	1995	2001	2007
CR1	0.257	0.252	0.302
CR2	0.416	0.414	0.437
CR3	0.494	0.510	0.525
CR4	0.552	0.585	0.588
CR8	0.678	0.725	0.708
CR20	0.754	0.812	0.749
HHI	0.148	0.153	0.185

Note: For each year, the CR_n is calculated for each sector, as well as the HHI index. Then, the weighted average for each year is calculated in which the weights are the percentage of the value added in 1995.

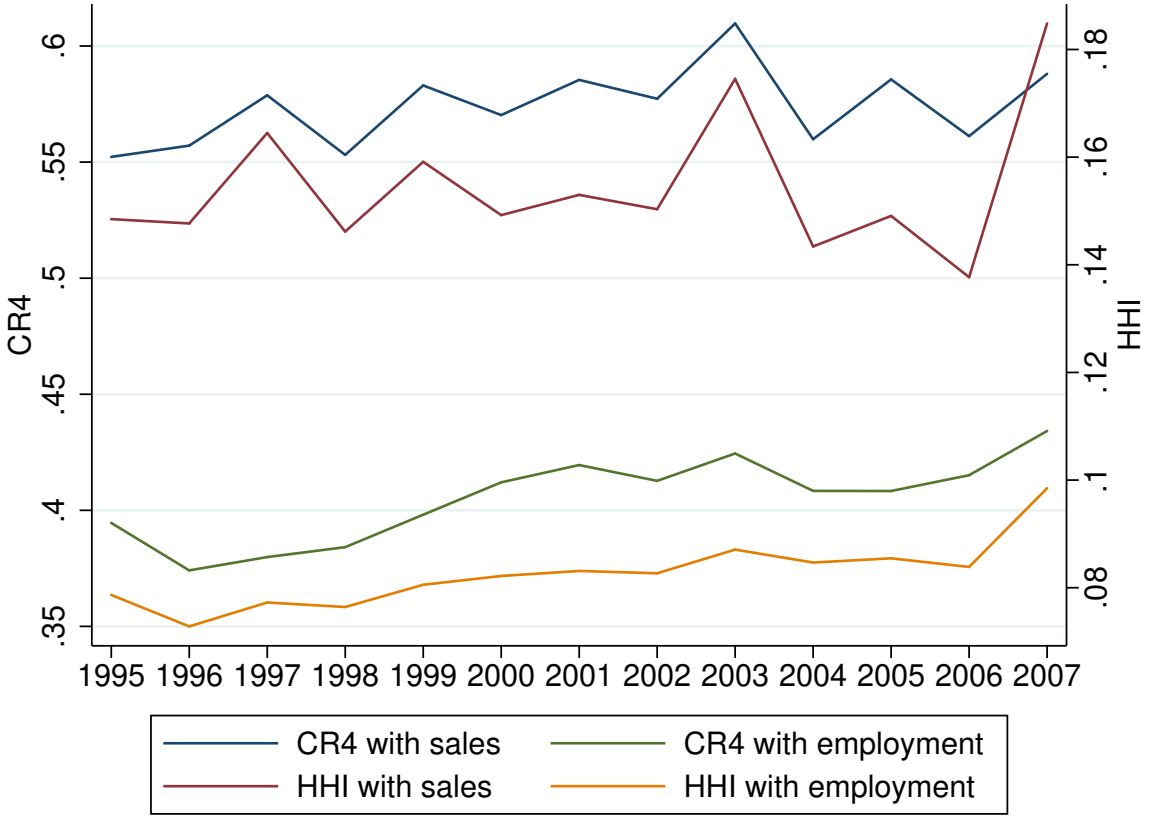
Finally, an alternative way of characterising the evolution of market concentration is to use employment as the unit of measurement. Figure 2 shows CR4 and HHI using sales and employment as an indicator. As in Autor et al. (2019) and Akerman (2018), concentration measures using sales are higher than when using employment. At the same time, for the 4 concentration indicators it has to be said that the trend is increasing even when there is a fall in market concentration since 2002, to increase again in 2007. In summary, regardless of how market concentration is measured, at 4 or 7 digits, and how the unit of measurement is defined, employment or sales, market concentration in Chilean manufacturing shows an increasing trend in the period considered.

2.3. Labor Share

Factor share is related to the percentage of income accrued to workers and to the owners of capital. At the aggregate level, the labor share is calculated as the ratio between workers' income and national income.

At the firm level, an approximation would be to consider workers' wages in the numerator and value added in the denominator. However, workers' remuneration in ENIA also includes non-wage compensation such as bonuses, family allowances, pension and health insurance expenses that must be incorporated in the calculation of the wage bill. The sum of wages and the additional benefit received by the workers is defined as the total compensation of the employees. At the same time,

Figure 2. Evolution of market concentration at 4 digits: sales and employment



Note: For each year, the CR4 is calculated for each sector, as well as the HHI index. Then, the weighted average for each year is calculated in which the weights are the percentage of the value added in 1995.

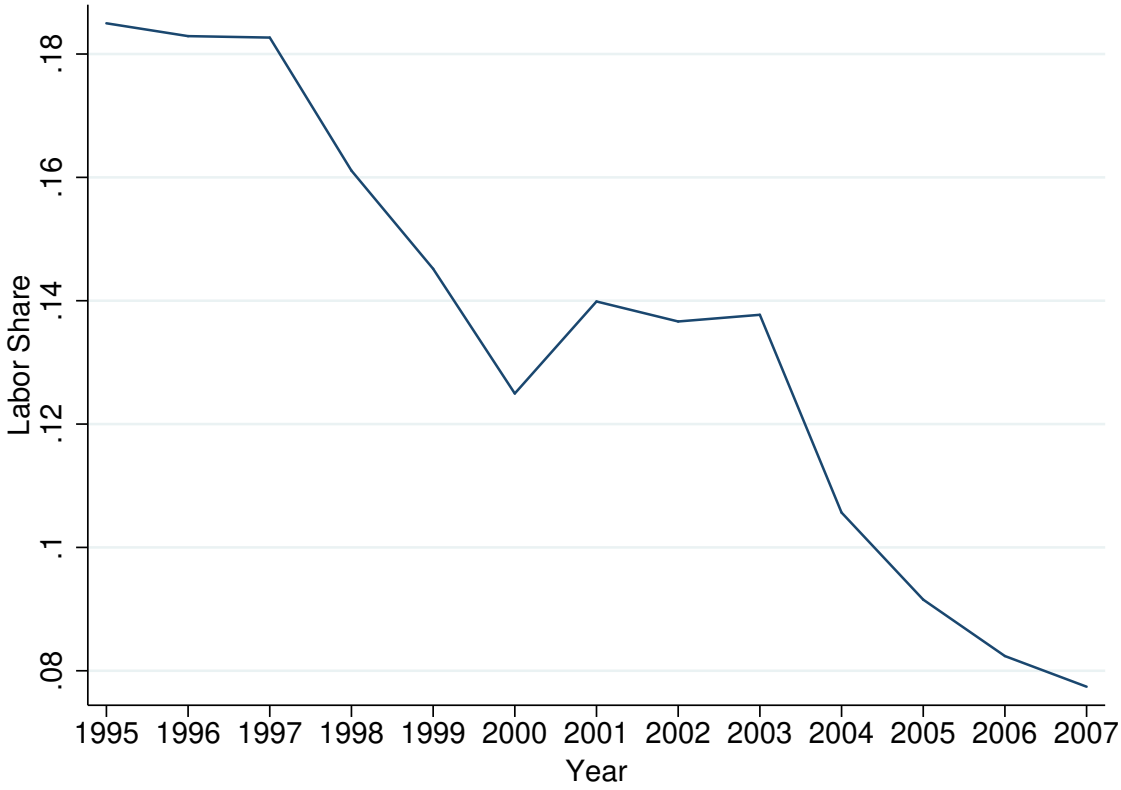
the value added reported by ENIA includes all sources of income and subtracts the value of inputs used. Hence, labor share is defined as the ratio between total compensation of employees (WB) and valued added:

$$LS = \frac{WB}{Value\ Added}$$

Figure 3 shows the evolution of the aggregate labor share in manufacturing from 1995-2007. On the one hand, the low percentage of labor share in manufacturing is in line with the sectorial evidence on labor share provided by Abeles et al. (2017). They found that the wage bill in the Chilean manufacturing was equal to 10% in 2010 being the country with the lowest labor share in the region[3]). On the other hand, the evolution of labor share shows also a decreasing trend throughout the period. Despite a small increase and stabilization around the initial years of the decade of 2000, the income share falls from 1995 to 2007.

[3]Latin America includes Argentina, Brazil, Chile, Colombia, Costa Rica, Guatemala, Honduras and Mexico.

Figure 3. Labor Share



Note: The figure shows the aggregate labor share in manufacturing from 1995-2007. For each year, the labor share is calculated in which the weights are the percentage of the value added in 1995.

2.4. Skills

The skills of a worker are generally measured using educational data, the years of experience of each worker employed at the firm, distinction between production and non-production workers, and the tasks demanded by the firm (Anderson et al., 2001; Álvarez and López, 2009; Brambilla et al., 2019).

In the case of Chilean manufacturing, ENIA contains information on the tasks performed by the workers but not on their education or years of experience employed in the firm. Given the lack of years of schooling in the data, Correa et al. (2019) using ENIA calculates that, on average, 23% of total hours worked corresponds to skilled labor, which corresponds almost identically to the average number of workers who complete a university education in Chile. In view of this, to distinguish between the skills of the workers, the tasks required by each firm will be used.

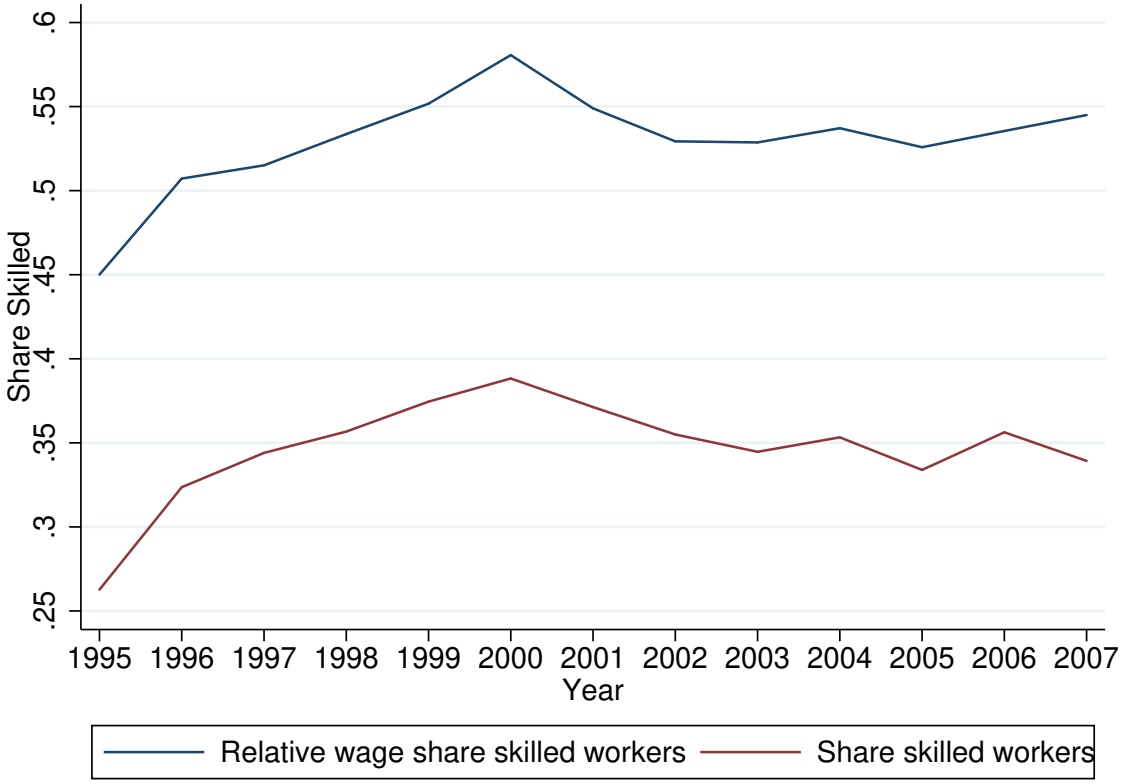
In this sense, ENIA classifies workers for each firm at detailed categories: managers, engineers, administrative personnel, non-specialized personnel, maintenance workers, clerks, and personal service workers. Based on this, a worker classification by skills is as follows:

- High skilled workers: managers, engineers, administrative personnel.

- Low skilled workers: non-specialized personnel, maintenance workers, clerks, and personal service workers.
- Highly-skilled workers: managers and engineers.

Figure 4 shows the aggregate share of skilled worker wage in wage bill and the percentage of skilled workers over total employment. Both variables show a growing trend in the period under consideration, even though the peak was in 2000, then dropped slightly and remained at values around 0.55 for the skilled share in the wage bill and 0.34 for the percentage of skilled workers. The difference between the share of the wage that is paid to skilled workers and the share of skilled workers reflects the wage premium paid to these workers.

Figure 4. Evolution of relative demand and wage of skilled Workers



Note: The figure shows the aggregate share of the wage bill paid to skilled workers and the aggregate relative demand share of skilled workers in manufacturing from 1995-2007. For each year, both shares are calculated as weighted average in which weights are the percentage of the value added in 1995.

3. Methodology

3.1. Baseline specification

3.1.1. Market concentration and labor share

The methodology employed consists in estimating for each industry at the 4-digit ISIC Revision 3 level, the annual change in labor share against the annual change in product market concentration using OLS:

$$\Delta Labor\ Share_{i,t} = c + \gamma \cdot \Delta\ Market\ Concentration_{i,t} + c_i + \eta_t + \varepsilon_{i,t} \quad (1)$$

$\Delta Labor\ Share_{i,t}$ is the change in the labor share in the industry i in t. $\Delta\ Market\ Concentration_{i,t}$ is the change in market concentration in industry i in t. The error term is composed of a industry unobserved heterogeneity (c_i) and an idiosyncratic error ($\varepsilon_{i,t}$). The equation estimated include also year and industry fixed effects and the errors are clustered at the industry level.

3.1.2. Market concentration and skilled share in the wage bill

In order to estimate the impact of market concentration on the share of the wage bill that is paid to skilled workers, 1 is modified in the following way:

$$\Delta Wages_{i,t} = c + \gamma \cdot \Delta\ Market\ Concentration_{i,t} + c_i + \eta_t + \varepsilon_{i,t} \quad (2)$$

$\Delta Wages_{i,t}$ is the change in the wage bill share of skilled workers in industry i in t. $\Delta\ Market\ Concentration_{i,t}$ is the change in market concentration in industry i in t. The error term is composed of a industry unobserved heterogeneity (c_i) and an idiosyncratic error ($\varepsilon_{i,t}$). The equation estimated include also year and industry fixed effects and the errors are clustered at the industry level.

A modification to 2 is to include only the share of highly skilled in wage bill. In that case, the equation to estimate is as follows:

$$\Delta High\ Wages_{i,t} = c + \gamma \cdot \Delta\ Market\ Concentration_{i,t} + c_i + \eta_t + \varepsilon_{i,t} \quad (3)$$

$\Delta High\ Wages_{i,t}$ is the change in the wage bill share of highly skilled workers in industry i in t.

3.1.3. Enlarging the domestic market: imports

A problem with the equations described above is that each sector is defined by the sum of the consolidated sales of each firm. This means that I do not considering imports aimed at each sector, which enlarges the size of each industry. In view of this, I consider imports from 20 countries: Argentina, Brazil, Canada, China, Colombia, Germany, Ecuador, Spain, France, India, Italy, Japan, Mexico, Netherlands, Peru, South Korea, Spain, United Kingdom, United States and Venezuela. This group of countries accounts for 85% of imports, on average, in manufacturing in 1995-2007.

The import of each country is considered as one firm more in each sector. Thus, the equation to estimate is:

$$\Delta X_{i,t} = c + \gamma \cdot \Delta\ Market\ Conc_{i,t} + c_i + \eta_t + \varepsilon_{i,t} \tag{4}$$

Where $\Delta X_{i,t}$ corresponds to a change in the labor share or to the change in share of the wage bill that is paid to (highly) skilled workers in industry i in t.

3.1.4. Adding globalization and technological progress

In the previous equations an association has been established between labor share (skilled share in wage bill) and market concentration. However, globalisation and technological progress are two of the main determinants of labor share. For the first variable, the participation index in global value chains (GVCs) has been commonly used, while for the second variable the relative price of the investment (PI) has been employed. Thus, the equation to estimate now is:

$$\Delta X_{i,t} = c + \gamma \cdot \Delta\ Market\ Conc_{i,t} + \beta \cdot \Delta\ PI_{i,t} c_i + \alpha \cdot \Delta\ GVCs_{i,t} + c_i + \eta_t + \varepsilon_{i,t} \tag{5}$$

Where $\Delta X_{i,t}$ is the change in the labor share or the change in (highly) skilled worker wage in total wage bill in industry i in t. $\Delta PI_{i,t}$ is the change in the relative price of investment and $\Delta GVCs_{i,t}$ is the change in the participation in global value chains in industry i in t. As for the relative price of investment, we follow Schwellnus et al. (2018) to calculate this variable at sectoral level. Data on investment price and value added deflator are obtained from LA-KLEMS database and from the Central Bank, ECLAC and INE. The investment price deflator is divided by the value added deflator in the corresponding industry. Meanwhile, data on global value chains are obtained from TiVA database and from data of Chilean customs and Central Bank. For each sector, the participation index in the global value chains (Koopman et al., 2010) is calculated. It consists of calculating the forward linkages (FL) and the backward linkages (BL) and then adding both variables. BL refers to the foreign value added in gross exports while FL is the domestic value-added embodied in intermediate exports that are further re-exported to third countries as share of gross exports (Raei et al., 2019). Due to the limited availability of data at the sectoral level for GVCs and for the relative price of the investment, equation 6 is estimated at 2 digits.

The evolution of the relative price of investment is shown in the Figure 7 in Appendix Figures. Following Karabarbounis and Neiman (2013), the capital deflator is divided by the value added deflator. Figure 7 shows the result of this ratio for the aggregate economy (blue line) and for manufacturing (red line). Although the IMF (2017) has pointed out that for some emerging economies the price of capital did not decline (and even increased), in the case of Chile it shows a strong fall for both the economy as a whole and for manufacturing. This should lead companies to substitute labor for capital, reducing the labor share. As for the skilled share in the wage bill, Correa et al. (2019) indicate that there is a strong skill-capital complementarity in Chile so theoretically it would be expected that a drop in the relative price of capital increases the relative demand of skilled

workers leading to a rise in the relative wage of workers of high qualification. In turn, the evolution of the participation in GVCs is shown in Figure 8. The red and blue (dotted) lines show the evolution of forward linkages and backward linkages for the economy (manufacturing). In line with OECD (2010), Chile is well integrated in GVCs and its position is upstream. That is, its participation in terms of providing inputs for export processing in foreign countries is higher than the foreign inputs processed in domestic exports. The low value in forward linkages is explained by the fact that both general and manufacturing exports are based on primary products, intermediate products and natural resources that require few imported inputs. Figure 8 also shows that the forward linkages over gross exports have had a fall while the backward linkages over gross exports have had a slight increase. The expected effect of changes in the participation in GVCs in changes in labor share and in changes in skilled share in the wage bill has not a clear direction. On one hand, an increase in the supply of foreign inputs in machinery and electrical equipment, for example, may require highly skilled workers for processing which may increase both the relative demand for these workers as their relative wages. On the other hand, another possible scenario is that the participation in GVCs increases due to an increase in domestic inputs for processing in foreign exports and that these inputs are, for example, basic products such as copper that is later transformed into sophisticated products using copper. Under this context, the firms will require a higher number of unskilled workers.

3.2. Characterizing the top dominant firms

Once the possible association between the labor share (highly skilled worker share in the wage bill) and the market concentration has been considered, it is worth investigating the characteristics of the dominant firms in the market. That is, if large firms have a lower labor share as shown in Figure 9 in the Appendix Figures, this would be pushing the aggregate labor share downward whenever dominant firms gain market share. However, this does not provide information on whether these dominant firms are superstars in the sense of Autor et al. (2019). In order to have information on the characteristics of the top firms that dominate the market, different regressions are estimated where the dependent variable is the annual growth in market concentration and the explanatory variable is the annual growth in a key indicator such as labor productivity, capital intensity, and the purchase of foreign license and technical assistance:

$$Growth\ Market\ Conc_{i,t} = c + \gamma \cdot Growth\ Indicator_{i,t} + \eta_t + \varepsilon_{i,t} \tag{6}$$

Where $Growth\ Market\ Conc_{i,t}$ corresponds to the annual growth in market concentration and $Growth\ Indicator_{i,t}$ is the annual growth either in labor productivity, capital intensity or purchase of foreign licenses.

3.3. Computing markups

Preliminary evidence of an increase in market concentration measured through concentration ratios and HHI provides only partial information on the increase in market power. Indeed, complementary information such as whether firms are applying, on average, a higher price over marginal cost helps to enrich the analysis.

The price over the marginal cost that each firm applies is the markup. On the one hand, the price that each firm applies can be obtained in the micro data while on the other hand, obtaining the marginal cost of each firm is only possible trough an estimation. In this sense, the proliferation of firm-level databases with detailed information on the inputs employed by the firm has allowed the calculation of markups through the estimation of production functions under the assumption that at least one input is fully flexible and that the firm minimizes costs for each product produced. Loecker and Warzynski (2012), for example, develops this methodology to estimate the markup in Slovenians firms. This is called the production function approach. A second approach is developed by Antràs et al. (2017). They state that the markup for a firm is the ratio of sales to variable costs under the assumption of a production function with returns to scale. Following Autor et al. (2019), this is the accounting approach. For its simplicity and not require the estimation of a production function, the calculation of markups are made using the accounting approach:

$$\mu = \frac{Sales}{Variables\ Costs}$$

4. Results

4.1. Baseline specification

Table 2 shows the regression of the estimation of the annual change in the measure of concentration in the annual change in the labor share. Although CR4 and HHI will be used as market concentration indicators, CR3 and CR8 are added to the regression to validate that the choice of indicator is not arbitrary. Thus, each row in Table 2 shows how the change in a measure of market concentration affects the change in the labor share. For each regression using a specific indicator of market concentration, the model is estimated initially without dummies. Then, the estimation is made adding year fixed effects and the final model includes year and sectorial dummies. For the 4 market concentration indicators, an increase in market concentration reduces the labor share. Thus, regardless of whether we measure concentration using the 3, 4 or 8 top firms or the HHI index, I get coefficients of negative sign and statistically significant. In addition, the sectors with the greatest increases in market concentration are the sectors with the greatest drop in labor share. In terms of magnitude, the full model indicates that one standard deviation increase in market concentration using CR4 results in a fall of 19% of a standard deviation in the rate of change of labor share, while using HHI one obtains that one standard deviation increase in market concentration results in a fall of 13% of a standard deviation in the rate of change of labor share.

Table 2: Market concentration and labor share

	(1) Δ Labor Share			(2) Δ Labor Share			(3) Δ Labor Share			(4) Δ Labor Share		
Δ CR4	-0.153**	-0.163**	-0.170**									
	(0.0580)	(0.0534)	(0.0562)									
Δ CR3				-0.139**	-0.148**	-0.154**						
				(0.0551)	(0.0504)	(0.0530)						
Δ CR8							-0.160**	-0.169**	-0.181**			
							(0.0686)	(0.0639)	(0.0683)			
Δ HHI										-0.136**	-0.143**	-0.153**
										(0.0634)	(0.0578)	(0.0604)
Dummy Year	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y
Dummy Industry	N	N	Y	N	N	Y	N	N	Y	N	N	Y
Observations	1282	1282	1282	1282	1282	1282	1107	1107	1107	1284	1284	1284

Standard errors in parentheses. Each regression is weighted in which the weights are the percentage of the value added in 1995.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$

Table 3 estimates how changes in market concentration affects the skilled worker wage in total wage bill. For both CR4 and HHI index, the result indicates that an increase in concentration is associated with an increase in the skilled worker share in wage bill. But, for each of the six regressions, the coefficient is not statistically significant meaning that the statistical relationship between the two variables is discarded.

However, the results in Table 3 may hide the dynamics that occur with highly skilled workers. That is, changes in market concentration induced by dominant firms that gain market share may lead to an increase in the relative demand for highly skilled workers that, in turn, provokes a rise in their relative wages.

Table 3: Market concentration and skilled worker share in wage bill

	(1) Δ Wages			(2) Δ Wages		
Δ CR4	0.0454	0.0687	0.0834			
	(0.0769)	(0.0658)	(0.0688)			
Δ HHI				0.0667	0.0742	0.0827
				(0.0864)	(0.0726)	(0.0779)
Dummy Year	N	Y	Y	N	Y	Y
Dummy Industry	N	N	Y	N	N	Y
Obs¿23ervations	1282	1282	1282	1284	1284	1284

Standard errors in parentheses.

Each regression is weighted. Weights are the percentage of the value added in 1995.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$

In fact, an increase in market concentration may induce a rise in the share of the wage bill that is paid to highly skilled workers as in shown in Table 4 . The results shows how changes in market concentration affects the change in highly skilled worker share in wage bill. The coefficient in the six regressions is positive and statistically significant for both CR4 and HHI index. This means that an increase in market concentration is associated with a rise in highly skilled workers share in total wages. Thus, when top dominant firms gain market share increase the relative demand for highly skilled workers which in turn rises the share of these workers in the wage bill. Certainly, the final result is a change on the workers' wage distribution that leads to an increase on wage inequality since the workers with higher qualification benefits from the increase in market concentration. In terms of magnitude, the full model indicates that one standard deviation increase in market concentration using CR4 or HHI results in a rise of 7% of a standard deviation in the rate of change of highly skilled worker share in wage bill.

Previous estimates have been made on the assumption that there is a domestic market without imports. Given that Chile is a small open economy with a great trade exposure, it is clear that this condition cannot be sustained. Moreover, market concentration indicators will be higher in comparison to the case in which the imports are included so the previous results may be misleading. In this regard, Table 5 and Table 6 show how changes in market concentration are associated

Table 4: Market concentration and highly skilled worker share in wage bill

	(1) Δ High Wages			(2) Δ High Wages		
Δ CR4	0.103**	0.109*	0.129*			
	(0.0345)	(0.0626)	(0.0679)			
Δ HHI				0.0795*	0.148**	0.160**
				(0.0412)	(0.0638)	(0.0674)
Dummy Year	N	Y	Y	N	Y	Y
Dummy Industry	N	N	Y	N	N	Y
Observations	1280	1280	1280	1284	1284	1284

Standard errors in parentheses.

Each regression is weighted. Weights are the percentage of the value added in 1995.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$

with changes in labor share and in the highly skilled worker share in the wage bill, respectively. In both Tables, the results are maintained and even more, the coefficients increase in magnitude and statistical significance with respect to the initial case in which imports are not considered. So, the inclusion of imports that reduce the market concentration indicators makes stronger the relationship between rises in the market concentration and drop in labor share and between an increase in the industrial structure and a rise in the share of the wage bill that is paid to highly skilled workers.

Table 5: Market concentration and labor share: adding imports

	(1) Δ Labor Share			(2) Δ Labor Share		
Δ CR4	-0.178**	-0.199**	-0.206**			
	(0.0686)	(0.0617)	(0.0675)			
Δ HHI				-0.225**	-0.244**	-0.267**
				(0.107)	(0.0985)	(0.114)
Dummy Year	N	Y	Y	N	Y	Y
Dummy Industry	N	N	Y	N	N	Y
Observations	1149	1149	1149	1151	1151	1151

Standard errors in parentheses.

Each regression is weighted. Weights are the percentage of the value added in 1995.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$

On the other hand, the regressions for labor share and the share of highly skilled workers in the wage bill have only included dummies for each year and sectorial dummies as additional controls. In this sense, Table 7 and Table 8 incorporate the participation index in global value chains and the relative price of investment to both regressions. Due to data limitation, the estimation for both regressions are made at two digits. This higher level of aggregation entails a significant drop in the observations available. Even considering this problem, the coefficient associated with the change in market concentration for both the labor share and the share in the wage bill of highly skilled workers maintain the sign and statistical significance with respect to the estimation made at 4 digits.

Table 6: Market concentration and highly skilled worker share in wage bill: adding imports

	(1) Δ High Wages			(2) Δ High Wages		
Δ CR4	0.0846**	0.123**	0.130**			
	(0.0418)	(0.0476)	(0.0562)			
Δ HHI				0.0717	0.135**	0.137**
				(0.0585)	(0.0563)	(0.0654)
Dummy Year	N	Y	Y	N	Y	Y
Dummy Industry	N	N	Y	N	N	Y
Observations	1148	1149	1149	1151	1151	1151

Standard errors in parentheses.

Each regression is weighted. Weights are the percentage of the value added in 1995.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$

In effect, the magnitude of the coefficient is similar to the model estimated without controlling by globalization and technology. As for the indicator of trade integration, a greater involvement in global value chains leads to a fall both in the labor share as in the highly skilled worker share in the wage bill although the coefficient is only statistically significant for this latter variable. Thus, the hypothesis of low substitutability between labor and capital in emerging countries that leads to a increase in capital share when advanced economies offshore labor-intensive goods seems to fit with the evidence. In addition, the negative impact in the highly skilled worker share in the wage bill indicates that an increase in the participation in GVCs requires low-skilled workers to perform the tasks demanded. Regarding the relative price of investment, reductions in the price lead to a drop of the labor share as firms substitute capital for labor. On the contrary, a fall in the relative price of investment induces to an increase in the share of wage bill that is paid to highly skilled workers. This means that exists complementarities between capital and skilled labor in which the decrease observed in the relative price of investment increases the relative demand for highly skilled workers leading to a rise in the relative wage share of these workers.

4.2. Characterizing the top dominant firms

The results so far indicate that there is a negative association between market concentration and the labor share. Even more, the sectors with the highest increase in market concentration are the sectors where the labor share has fallen most. As far as the highly skilled worker share in the wage bill is concerned, there is a positive association with market concentration. This is a new channel that explain changes in wage inequality among workers. However, the evidence provided only indicates changes in market concentration, labor share and relative wage share so it is not possible to assert that the companies that dominate the markets are superstars firms as postulated by Autor et al. (2019).

In order to characterize the firms that dominate the market, Figure 5 shows the annual

Table 7: Market concentration and labor share: adding GVCs and price of capital

	(1) Δ Labor Share			(2) Δ Labor Share		
Δ CR4	-0.120	-0.154**	-0.152**			
	(0.0842)	(0.0672)	(0.0702)			
Δ HHI				-0.0636**	-0.0636**	-0.0736**
				(0.0265)	(0.0265)	(0.0289)
Δ GVCs	-0.0602	- 0.00398	-0.00416	-0.0221	-0.0221	-0.0348
	(0.0718)	(0.0829)	(0.0893)	(0.0737)	(0.0737)	(0.0804)
Δ Price Capital	0.0660**	0.0395	0.0368	0.0359	0.0359	0.0247
	(0.0240)	(0.0275)	(0.0384)	(0.0221)	(0.0221)	(0.0279)
Dummy Year	N	Y	Y	N	Y	Y
Dummy Industry	N	N	Y	N	N	Y
Observations	235	235	235	235	235	235

Standard errors in parentheses.

Each regression is weighted. Weights are the percentage of the value added in 1995.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$

Table 8: Market concentration and highly skilled worker share in the wage bill: adding GVCs and price of capital

	(1) Δ High Skill Wages			(2) Δ High Skill Wages		
Δ CR4	0.221*	0.193*	0.185 *			
	(0.119)	(0.105)	(0.104)			
Δ HHI				0.658**	0.495*	0.541*
				(0.174)	(0.238)	(0.269)
Δ GVCs	-0.210	-0.260**	-0.181**	-0.286**	-0.277**	-0.189**
	(0.137)	(0.098)	(0.074)	(0.013)	(0.119)	(0.089)
Δ Price of Capital	-0.362***	-0.156***	-0.202**	-0.372***	-0.167***	-0.217**
	(0.0395)	(0.0397)	(0.0615)	(0.0293)	(0.0405)	(0.0664)
Dummy Year	N	Y	Y	N	Y	Y
Dummy Industry	N	N	Y	N	N	Y
Observations	235	235	235	235	235	235

Standard errors in parentheses.

Each regression is weighted. Weights are the percentage of the value added in 1995.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$

contribution to employment and labor productivity of this type of enterprises. Although four firms contribute, on average, with a little more than 35% of total employment, the contribution to labor productivity is highly unstable and without a clear trend. Furthermore, Figure 10 in Appendix Figures shows that top 4 dominant firms, on average, have a labor productivity that does not

increase over time. As for the capacity of innovation, ENIA does not have information in R&D expenditure but, in turn, provides data on purchases of foreign technical licences. Figure 10 shows that the evolution of the acquisition of foreign technology for the top 4 firms does not increase over time either. Thus, the dominant companies have not become more productive and more innovative or using the terminology of Autor et al. (2019), the dominant companies are not superstars.

To corroborate this assertion, a multivariate analysis is estimated in Table 9. Each row in Table 9 is a regression between the growth in a indicator of market concentration and an indicator of firm dynamism: labor productivity growth, growth in licence and foreign technical assistance per worker, and growth in capital per worker. The increase in concentration cannot be associated with an increase in productivity, nor can it be associated with an increase in foreign licenses purchased by the small group of firms that drive market concentration. Indeed, the only variable with a significant and positive coefficient is capital per worker. In those sectors that saw an increase in their capital intensity, there is a rise in the concentration of their industrial structure. Figure 11 in Appendix Figures illustrates the idea of these regressions for the case of labor productivity using its value in 1995 and 2007. The size of each bubble is proportional to a CR4 ranking (CR4 of each sector divided by the annual average weighted CR4) in 1995, i.e, a larger bubble size indicates a more concentrated sector in 1995. If the superstar firm theory is applied, the most concentrated sectors in 1995 would be expected to have the highest increase in labour productivity from 1995 to 2007. But, Figure 11 shows that this is not happening: there are sectors highly concentrated that barely see a growth of labor productivity.

Table 9: Characterizing the growth in market concentration

	(1) Δ CR4			(2) Δ HHI		
Growth Licenses per Worker	-0.00368	-0.00324	-0.00333	-0.00373	-0.00358	-0.00335
	(0.00328)	(0.00265)	(0.00281)	(0.00393)	(0.00419)	(0.00444)
Growth Labor Productivity	0.00243	0.00146	0.00102	0.00411	0.00281	0.00270
	(0.00432)	(0.00345)	(0.00360)	(0.00464)	(0.00386)	(0.00409)
Growth Capital per Worker	0.0788**	0.0981**	0.103**	0.103	0.116*	0.124*
	(0.0317)	(0.0440)	(0.0492)	(0.0622)	(0.0693)	(0.0747)
Dummy Year	N	Y	Y	N	Y	Y
Dummy Industry	N	N	Y	N	N	Y
Observations	1280	1280	1280	1284	1284	1284

Standard errors in parentheses.

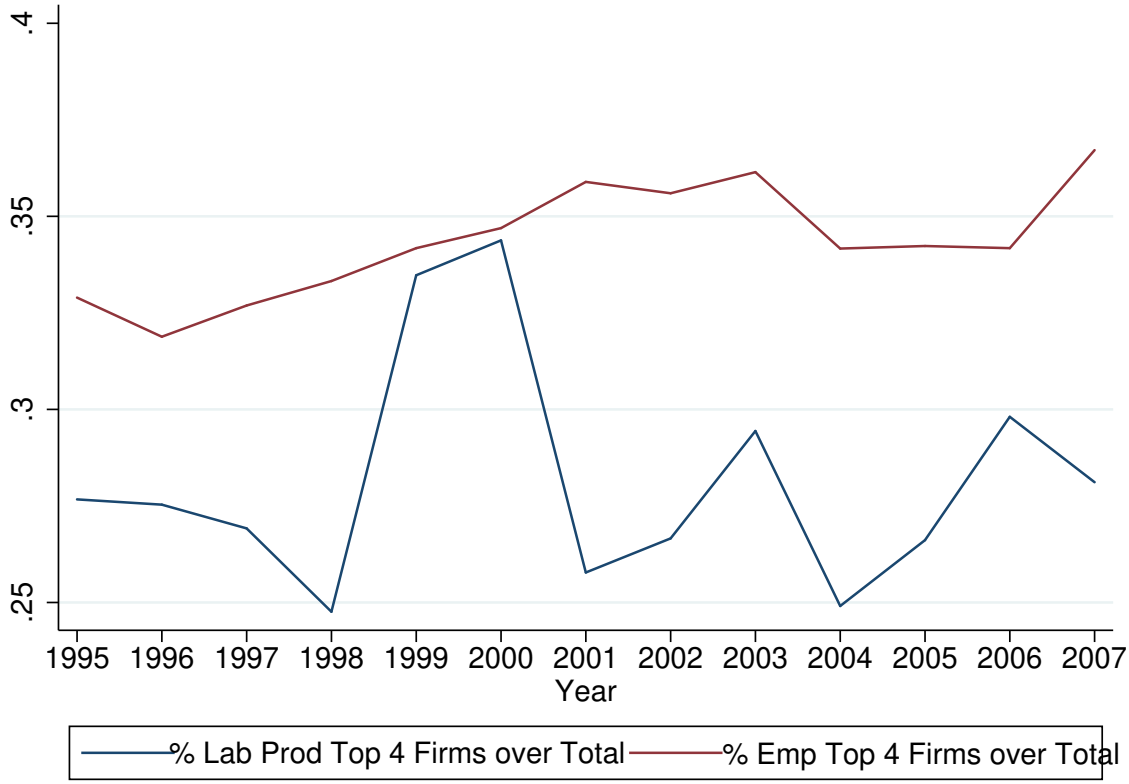
Each regression is weighted. Weights are the percentage of the value added in 1995.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$

4.3. Computing markups

While previous results indicate that there is an increase in market concentration using CR4 and HHI, the analysis of the increase in market power of firms can be enriched by calculating markups

Figure 5. Contribution to the employment and labor productivity of top firms



Note: The figure shows the aggregate contribution to the employment and labor productivity of top 4 firms.

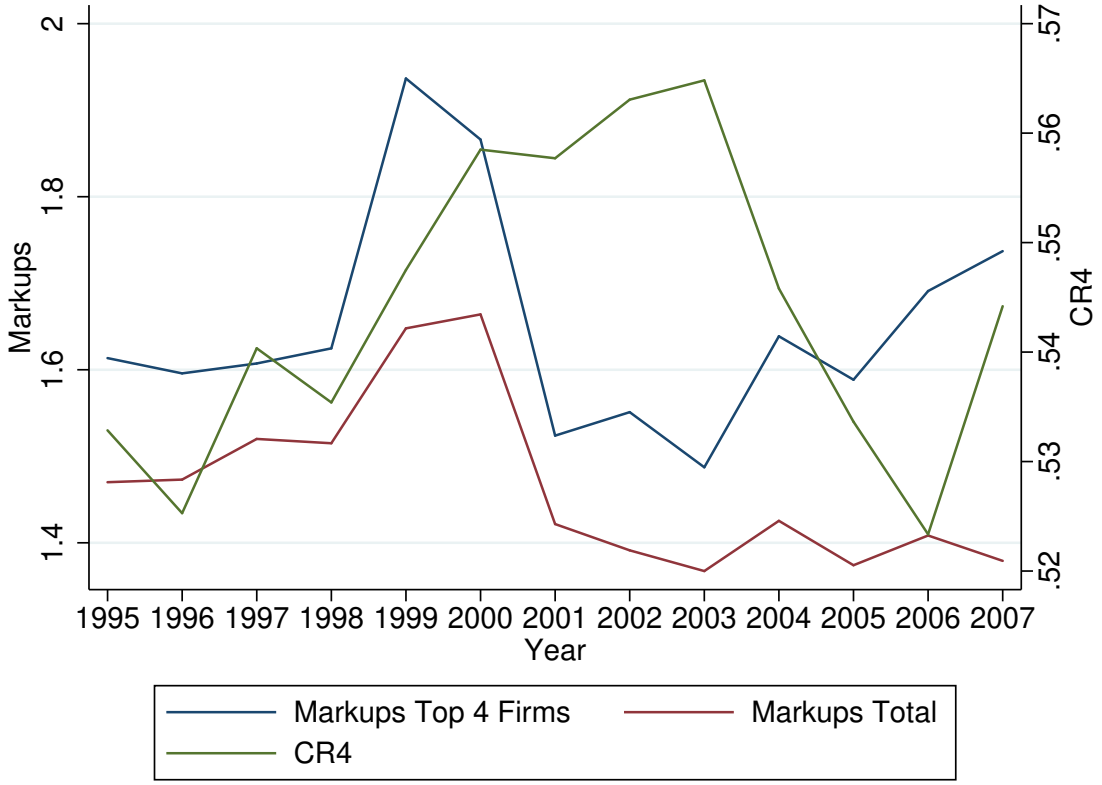
for this type of firms.

In this sense, Figure 6 shows the evolution over time of markups for the economy as a whole as for the four dominant firms. On the one hand, there is a synchronized movement until the year 2000 between the increase in concentration and the increase in markups. Then, there is a fall in the markups but without a correlate in market concentration. On the other hand, the four dominant companies have higher markups than the manufacturing firms as a whole. De Loecker and Eeckhout (2017) argue that in the case of the United States the increase in the average markup is due to the firms at the top of the markup distribution, i.e, firms with highest markups already. In the case of Chile, there is a similar scenario in which the 4 dominant companies, on average, gain market share and by having markups higher than the rest of firms increase the average markup of the economy.

To relate the evolution of markups with changes in market concentration, we follow McAdam et al. (2019) which graphs the relationship between both variables. In this regard, Figure 12 shows the markup in 1995 for the economy in the horizontal axis and the markup in 2007 for the economy in the vertical axis. Again, the size of the bubbles indicates the concentration of the sector with respect to the average concentration. A larger size corresponds to those sectors most concentrated in 1995. In turn, the red line corresponds to a 45-degree line. The first result is that markups are stable. Sectors with high (low) markups in 1995 maintain their position in 2007. On the other hand,

there is no correlation between the evolution of markups and changes in concentration in Chilean manufacturing as in found in McAdam et al. (2019) for European countries. In high concentrated sectors in 1995 there is a very small increase in markups while in others there is a strong increase in markups. Thus, there is a high heterogeneity in the sectors where dominant firms operate: there are dominant firms in their sectors with limited markups while others can load high markups.

Figure 6. Markups top firms



5. Concluding Remarks

Large firms dominate the sectors in which they compete. They contribute significantly to value added, exports, foreign direct investment and research and development expenditures despite represent the minority of firms.

The increase role that a small group of large firms has taken in has gone along with a rise in market concentration and an increase in profits and markups. In fact, sectors are increasingly characterized by a winner-takes-all (most) effect in which a few dominant firms gain a very large market share.

The rise in market concentration in the major advanced economies in recent decades has led to an exhaustive analysis of its implications. One of them is that may explain the fall in labor share that has been a global secular trend since the 1980s.

In fact, according to one theoretical strand this is explained by the emergence of highly efficient superstars firms. The emergence of these kind of firms could relate to the globalization that allows the sale of products in integrated world markets, to the role of intangible capital in fostering scale advantages and to the proliferation of goods, such as those intensive in information, which have high fixed costs and low marginal costs. Given that these firms have a low labor share relative to the rest of firms, when they gain a very large market share they, due to a reallocation effect, depress aggregate labor share.

The fall in labor share means that productivity grows more than wages, with a consequent increase in inequality between the factors of production given that the increase in return to profits goes to top income distribution. At the same time, wage inequality among workers with different skills may also increase due to superstar 7 companies may require highly skilled workers. Under this scenario, superstar firms leads to a polarization of the labor market.

Thus, this study investigates whether changes in market concentration are associated, on one hand, with changes in labor share and, on the other hand, with changes in highly skilled worker share in the wage bill in an emerging country like Chile. The results indicate that an increase in concentration is associated with a fall in labor irrespective of the market concentration indicator utilized. Moreover, those sectors with the largest increase in concentration are those with the largest drop in labor share. In addition, when import penetration is incorporated into the calculation of market concentration indicators, the coefficient associated with the impact of market concentration on labor share increases in magnitude and statistical significance. At the same time, globalization and technology measured by measured by global value chains and relative price, respectively, have been widely cited as determinants of the fall in labor share. By incorporating both variables into the analysis, the result is maintained: increases in market concentration are associated with declines in labor share.

As for the impact of market concentration on the highly skilled worker share in the wage bill, the results indicate a positive association. That is, increases in market concentration induce a rise in the share of the wage bill that is paid to these workers. The finding implies that market concentration leads to an increase in wage inequality among workers. This is a new channel of increase in the wage premium that had not been previously explored in the literature. The result is robust to the inclusion of imports to correct market concentration indicators or to the inclusion of technology and globalization variables.

Notwithstanding the above, the contribution of the top four dominant firms to productivity and employment is irregular. Indeed, they have a very unstable and not growing contribution to labour productivity despite contributing a significant proportion of employment. In turn, dominant firms have not become more productive or more innovative. This means that the dominant firms are not superstar firms. As for markups, dominant firms apply a higher markup than the rest of the firms, which increases the average markup of the economy as market concentration increases. However, there is no relationship between the evolution of markups and the increase in concentration. In fact, there is a high heterogeneity between sectors in which there are dominant companies that apply low

markups while in others they apply high markups.

In sum, the increase in market concentration is associated with a fall in labour participation and an increase in highly skilled worker share in the wage bill. This indicate that dominant firms lead to a scenario that could be detrimental to the economy: on the one hand, they polarize the labor market by increasing wage inequality and on the other hand, they do not become more productive and innovative but rather they charge, on average, greater markups than the rest of the firms which raises the average markup by increasing market power. Public policy in this regard should look not only at the increase in market concentration per se but also at its undesirable effects such as an increase in wage inequality and a rise in market power that can lead to a fall in the welfare of the economy.

References

Abeles, M., A. Arakaki, and S. Villafañe (2017). Distribución funcional del ingreso en América Latina desde una perspectiva sectorial. Serie Estudios y Perspectivas 53, CEPAL.

Abraham, F. and Y. Bormans (2019). The impact of superstar firms on the labor share evidence from a small, open economy: Belgium. Working Paper 81, Vives Research Center for Regional Economics.

Acemoglu, D. and P. Restrepo (2018). Artificial intelligence, automation and work. Working Paper 24196, National Bureau of Economic Research.

Akerman, A. (2018). The relative skill demand of superstar firms and aggregate implications. Research Papers in Economics 2018:2, Stockholm University, Department of Economics.

Álvarez, R. and R. A. López (2009). Skill upgrading and the real exchange rate. *The World Economy 32*(8), 1165–1179.

Amann, E. and W. Baer (2008). Neo-liberalism and market concentration in Brazil: The emergence of a contradiction? *The Quarterly Review of Economics and Finance 48*(2), 252 – 262.

Anderson, M. A., R. Robertson, S. L. S. Smith, M. A. Anderson, R. Robertson, and S. L. S. Smith (2001). Measuring Skill Intensity: Production Worker vs. Education Data in the NAFTA Countries.

Antràs, P., T. C. Fort, and F. Tintelnot (2017). The margins of global sourcing: Theory and evidence from us firms. *American Economic Review 107*(9).

Autor, D., D. Dorn, L. F. Katz, C. Patterson, and J. Van Reenen (2019). The Fall of the Labor Share and the Rise of Superstar Firms. Working paper.

Autor, D. and A. Salomons (2018). Is Automation Labor-Displacing? Productivity Growth, Employment, and the Labor Share. NBER Working Papers 24871, National Bureau of Economic Research, Inc.

Azar, J., I. Marinescu, and M. I. Steinbaum (2017). Labor market concentration. Working Paper 24147, National Bureau of Economic Research.

Bajgar, M., G. Berlingieri, S. Calligaris, C. Criscuolo, and J. Timmis (2019). Industry Concentration in Europe and North America. OECD Productivity Working Papers 18, OECD Publishing, Paris.

Brambilla, I., D. Lederman, and G. Porto (2019). Exporting firms and the demand for skilled tasks. *Canadian Journal of Economics/Revue canadienne d'économique 52*(2), 763–783.

Ciarli, T., A. Marzucchi, E. Salgado, and M. Savona (2018). The Effect of R&D Growth on Employment and Self-Employment in Local Labour Markets. SPRU Working Paper Series 2018-08, SPRU - Science Policy Research Unit, University of Sussex Business School.

Correa, J. A., M. Lorca, and F. Parro (2019). Capital-Skill Complementarity: Does Capital Composition Matter? *The Scandinavian Journal of Economics 121*(1), 89–116.

Council of Economic Advisors (2016). Benefits of Competition and Indicators of Market Power. Technical report, CEA Issue Brief.

Dao, M. C., M. Das, Z. Koczan, and W. Lian (2017). Why Is Labor Receiving a Smaller Share of Global Income? Theory and Empirical Evidence. IMF Working Papers 17/169, International Monetary Fund.

De Loecker, J. and J. Eeckhout (2017). The rise of market power and the macroeconomic implications. Working Paper 23687, National Bureau of Economic Research.

Doan, H., T. Thanh, and G. Wan (2017). Globalization and the Labor Share in National Income. ADBI Working Papers 639, Asian Development Bank Institute.

Dosi, G. and M. E. Virgillito (2019). Whither the evolution of the contemporary social fabric? new technologies and old socio-economic trends. *International Labour Review*.

Economic Commission for Latin America and the Caribbean (2012). *Structural change for equality: an integrated approach to development*. Santiago: ECLAC.

Elsby, M., B. Hobijn, and A. Sahin (2013). The Decline of the U.S. Labor Share. *Brookings Papers on Economic Activity 44*(2), 1–63.

Freund, C. and M. D. Pierola (2015). Export superstars. *The Review of Economics and Statistics 97*(5), 1023–1032.

Grullon, G., Y. Larkin, and R. Michaely (2019). Are US Industries Becoming More Concentrated? *Review of Finance 23*(4), 697–743.

Gutiérrez, G. and T. Philippon (2017). Declining competition and investment in the u.s. Working Paper 23583, National Bureau of Economic Research.

Gutiérrez, G. and T. Philippon (2019). Fading Stars. NBER Working Papers, National Bureau of Economic Research, Inc.

Helpman, E. (2018). Globalization and Wage Inequality. NBER Working Papers 22944, National Bureau of Economic Research, Inc.

Hernández, H., N. Grassano, A. Tübke, G. P. Potters, L., and A. Vezzani (2018). The 2018 EU Industrial R&D Investment Scoreboard. Publications Office of the European Union, Luxembourg, European Comission.

IMF (2017). Understanding the Downward Trend in Labor Income Shares. In IMF (Ed.), *World Economic Outlook April*, Chapter 3, pp. 121–172. Washington: IMF.

Karabarbounis, L. and B. Neiman (2013). The Global Decline of the Labor Share. *The Quarterly Journal of Economics 129*(1), 61–103.

Koopman, R., W. Powers, Z. Wang, and S.-J. Wei (2010). Give credit where credit is due: Tracing value added in global production chains. NBER Working Papers 16426, National Bureau of Economic Research, Inc.

Loecker, J. D. and F. Warzynski (2012). Markups and firm-level export status. *The American Economic Review 102*(6), 2437–2471.

López-Calvay, L., C. Rodriguez, and O. Barriga (2019). Market Concentration, Trade Exposure, and Productivity in Developing Countries : Evidence from Mexico. Working Paper 136518, Washington, D.C. : World Bank Group.

Manyika, J., R. Sree, J. Bughin, J. Woetzel, M. Birshan, and Z. M. Nagpal (2018). Superstars: the dynamics of firms, sector and cities leading the global economy. Discussion paper, McKinsey Global Institute. McKinsey & Company.

McAdam, P., F. Petroulakis, I. Vansteenkiste, M. C. Cavalleri, A. Eliet, and A. Soares (2019). Concentration, market power and dynamism in the euro area. Working Paper Series 2253, European Central Bank.

Mendoza, R. U., A. Barcenas, and P. Mahurkar (2013). Balancing Industrial Concentration and Competition for Economic Development in Asia: Insights from South Korea, China, India, Indonesia and the Philippines. *Journal of Reviews on Global Economics 2*, 248–277.

Messina, J. and J. Silva (2018). *Wage Inequality in Latin America: Understanding the Past to Prepare for the Future. Latin American Development*. World Bank: Washington, DC.

Naldi, M. and M. Flamini (2014). The CR4 Index and the Interval Estimation of the Herfindahl-Hirschman Index: An Empirical Comparison. *SSRN Electronic Journal*.

Nelson, R. R. and S. G. Winter (1982a). *An Evolutionary Theory of Economic Change*. Harvard University Press: Cambridge, MA.

Nelson, R. R. and S. G. Winter (1982b). The schumpeterian tradeoff revisited. *The American Economic Review 72*(1), 114–132.

OECD (2010). *OECD Economic Surveys: Chile 2010*. OECD Publishing.

OECD (2018). Market Concentration Issues paper by the Secretariat. Mimeo, Directorate for Financial and Enterprise Affairs.

OECD (2019). *Boosting Productivity and Inclusive Growth in Latin America*. OECD Publishing.

Raei, F., A. Ignatenko, and B. Mircheva (2019). Global Value Chains: What are the Benefits and Why Do Countries Participate? Working Paper 19/18, IMF.

Reenen, J. V. (2011). Wage inequality, technology and trade: 21st century evidence. *Labour Economics 18*(6), 730 – 741.

Rossi-Hansberg, E., P.-D. Sarte, and N. Trachter (2018). Diverging trends in national and local concentration. Working Paper 25066, National Bureau of Economic Research.

Schwellnus, C., M. Pak, P.-A. Pionnier, and E. Crivellaro (2018). Labour share developments over the past two decades. OECD Economics Department Working Papers 1503, OECD Publishing, Paris.

Solimano, A. (2012). *Chile and the Neoliberal Trap: The Post-Pinochet Era*. Cambridge University Press.

Song, J., D. J. Price, F. Guvenen, N. Bloom, and T. von Wachter (2018). Firming Up Inequality*. *The Quarterly Journal of Economics 134*(1), 1–50.

Werden, G. and L. Froeb (2018). Don't panic: A guide to claims of increasing concentration. *SSRN Electronic Journal*.

Appendix: Data Construction

The data utilized in the paper come from the annual national manufacturing census (ENIA) conducted since 1979 by the National Institute of Statistics of Chile (INE). The dataset is representative of the universe of Chilean manufacturing plants that employ at least ten workers. The ENIA survey includes all those newly created and continuing manufacturing plants over the ten employees threshold. Each plant has a unique identification number where a significant percentage of them are actually single-plant firms[4]

Data from Chilean manufacturing plants have been widely used in previous studies. However, all this literature has used the ENIA survey that focuses on plants characteristics that come from "Formulario Número 1" (Form 1, from now on F1). This form captures economic and accounting information about the firm such as:

i) Plant identification: the unique number of identification, the region where the plant is located, number of days in operation, output classification at a four-digit level according to the International Standard Industrial revision 2 and 3.
ii) Employment and salaries: the total number of employees, wages, days worked.
iii) Energy, raw materials and others: total costs of raw materials, electricity consumed, imported material.
iv) Sales, investment, exports: total FOB value of exported goods, the investment made in buildings, machinery and equipment, transport equipment, and land and sales.
v) Production: valued added, gross production value.

The most recent information in the F1 is available up to 2015 but there was a change in 2008 onward [5] that only allows the construction of a panel data for the 1979-2007 period. In addition, the plant identifier changed in the 2001 survey. Thus, ENIA survey extends from 1979 to 2000 where the unique identifier is called "PADRON" and the same survey covering 1995 through 2007 in which case the identifier is called NUI.

The data reported in the F1 is complemented using the information contained in "Formulario Número 3" (Form 3, hereafter F3) that identify the specific goods that the plants produce and export. F3 contains information on value and quantities of each one of the products of the plant. The products were codified according to the "Clasificador Unico de Productos" (CUP) until 2000, but then there was a change in 2001 in which was adopted the Central Product Classification(CPC). Both codes are more disaggregated than an ISIC 7 digits category. However, it is possible to compare the products codified under CUP or CPC to the 7-digit ISIC code where the first five digits coincide with the official classification whereas the last two digits are country specific. INE provides a correspondence for the new classification regarding the old product category.

[4] I do not have access to this information but according to INE, 91.7% of firms are single-plants during the period 1997-2003 so I use plant and firm indistinctly.

[5] The most important modification was that the plant identifier is a random value due to confidentiality restrictions since 2008. Hence, it is not possible observing the plant over time.

Overall, the information is available for the 1979-2007 period in the case of F1 and from 1995-2006 for the F3 survey. Due to entry and exit of plants in the dataset, the final sample is composed of 47,218 plant-year-observations as is shown in Table 10. Using deflator for the gross value of production at the 4-digit ISIC level constructed by INE, nominal variables such as sales and value added are transformed to constant 2003 Chilean pesos. Labour productivity is calculated as valued added over the number of employees. In the case of the value of capital at constant prices, I use the perpetual inventory method. In order to do this, ENIA survey recollects information on the the book value of four types categories of capital: building, machinery and equipment, vehicles, and land. For each kind of capital is calculated the net investment flow (purchases of new or used capital minus sales of capital). Once obtained the net investment is deflated by a price investment calculated as the ratio of current gross capital formation to constant gross capital formation in 2003 Chilean pesos from ECLAC. Then, it is applied the formula $K_{it} = K_{it-1} \cdot (1 - \delta) + I_{it}$, where K is capital, δ is the depreciation rate, and I is investment. I use the following rates of depreciation that we also utilize: 7% for machinery, 3% for building, 11.9% percent for vehicles whereas the land is assumed not to depreciate.

Table 10: Plants by year

Year	Plants	Single-Product	Multiproduct	% Multiproduct
1995	4329	2198	2131	49%
1996	4742	2388	2354	50%
1997	4596	2324	2272	49%
1998	4230	2157	2073	49%
1999	3830	1940	1890	49%
2000	3549	1834	1715	48%
2001	3385	1715	1670	49%
2002	3674	1818	1856	51%
2003	3698	1827	1871	51%
2004	3931	1987	1944	49%
2005	3866	1917	1949	50%
2006	3685	1846	1839	50%

I also apply data-cleaning procedure to the plant data. In the case of the F1 survey, first I drop plants that exit from the sample and then reappear[6]. Second, I exclude plants with missing information, zero or negative values on sales, employment and ISIC code. Third, I eliminate plants where the growth of a variable jump by a factor of 4 or more. Regarding the F3 survey, I drop plants with missing, zero or negative values on sales and/or product's quantity.

[6]As a robustness check, I include the plants with discontinuous data over the sample period and the main results do not change

Appendix Figures

Figure 7. Evolution of the relative price of capital

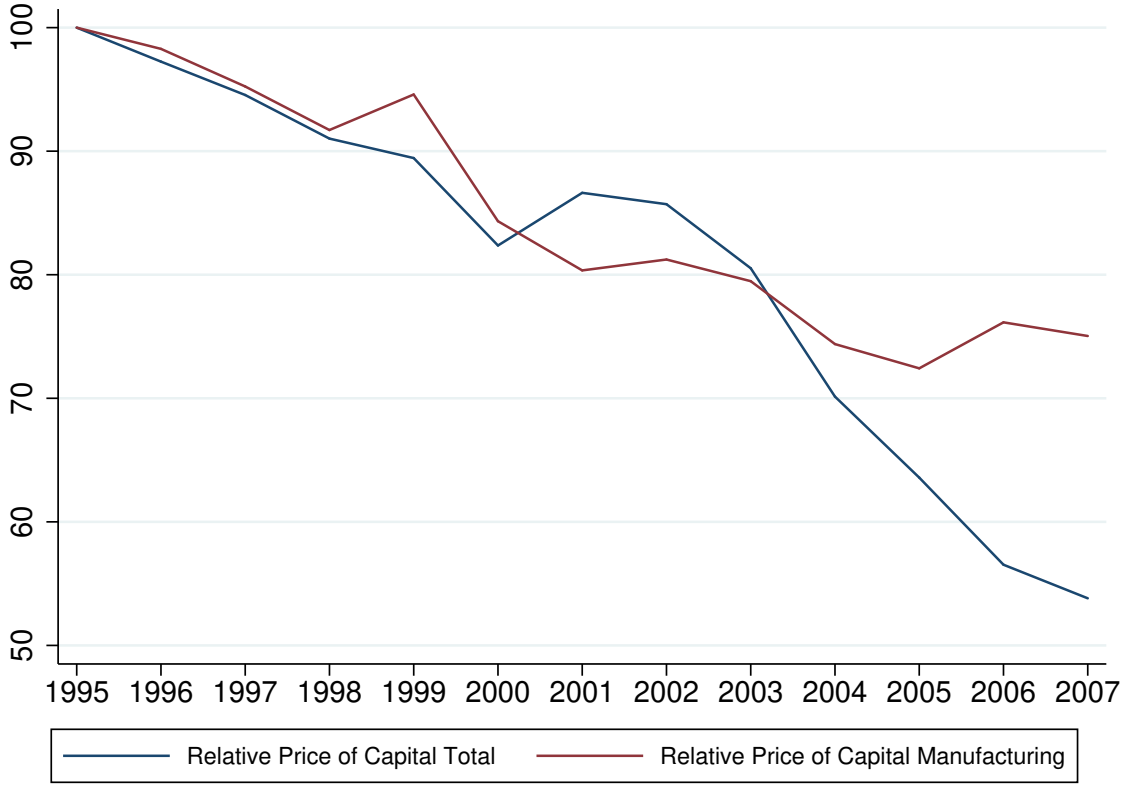


Figure 8. Evolution of participation index in GVCs

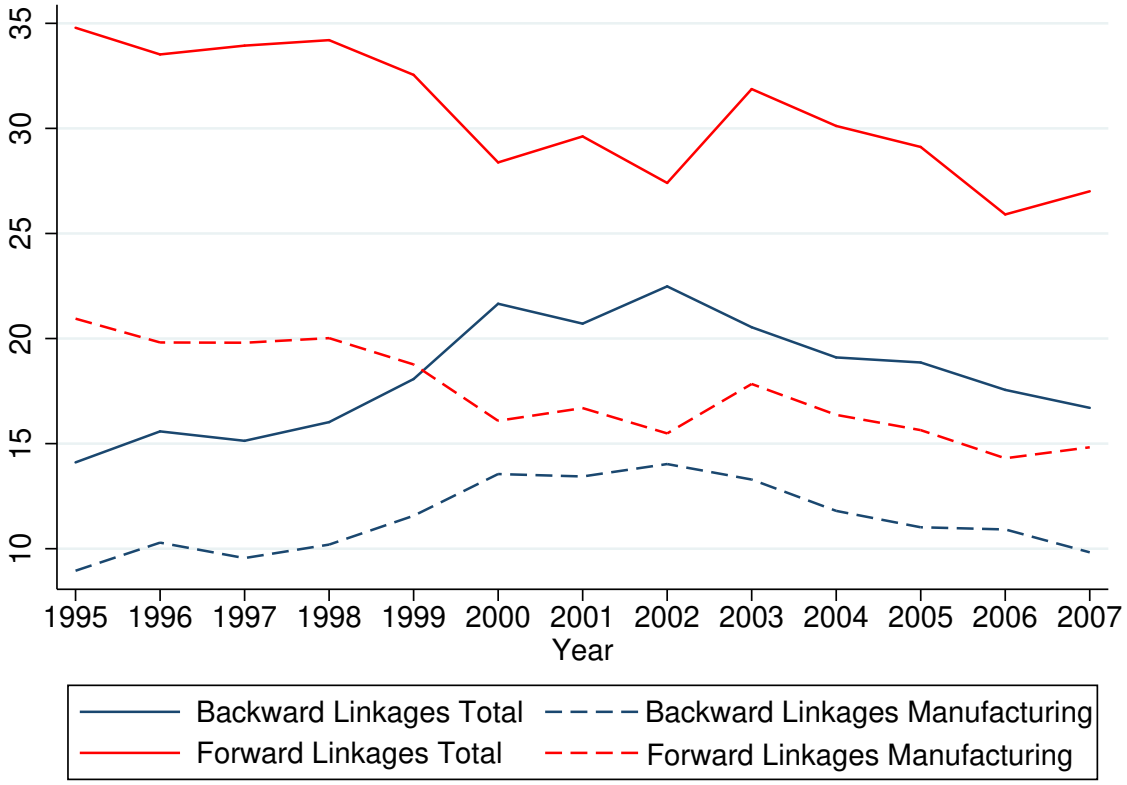
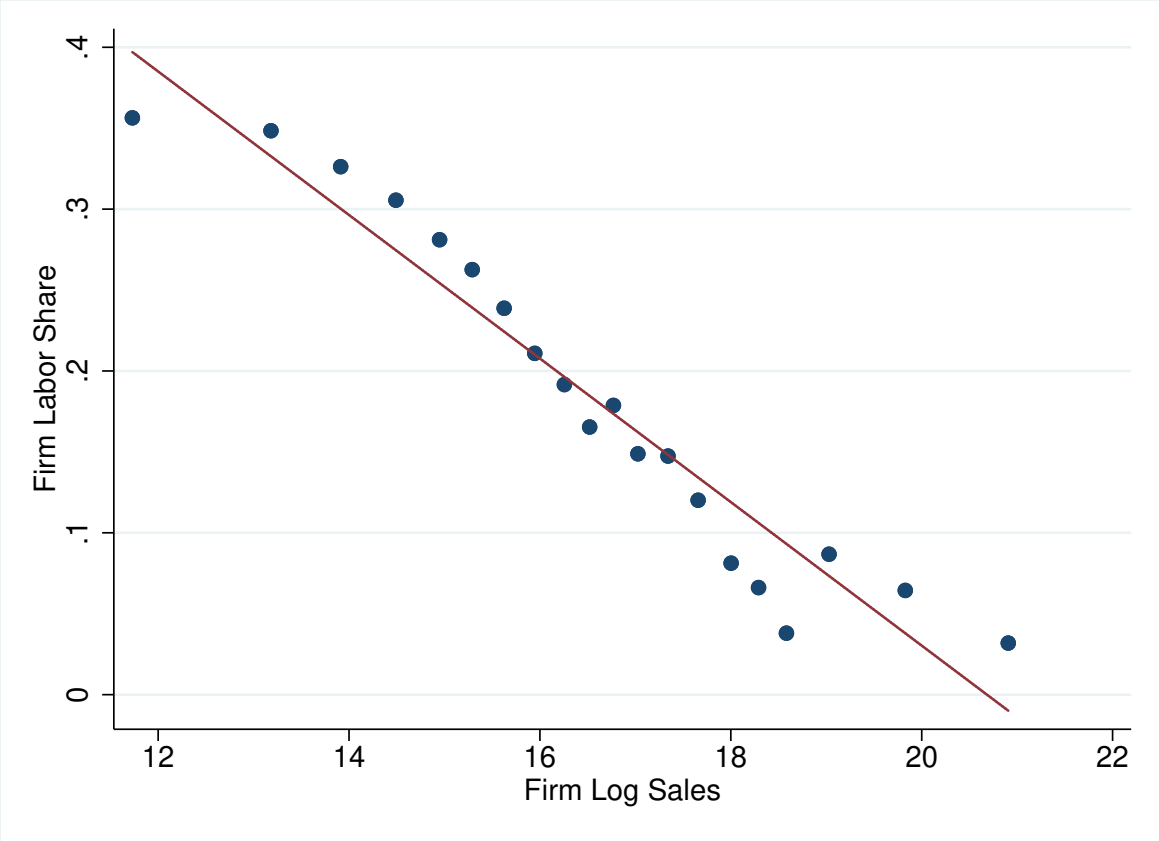


Figure 9. Labor share at the firm level



Note: The database is divided into 20 quantiles, and for each of them the average labor participation is plotted. Each firm is weighted each by its value added in 1995.

Figure 10. Labor productivity and purchase of foreign licenses in top 4 firms

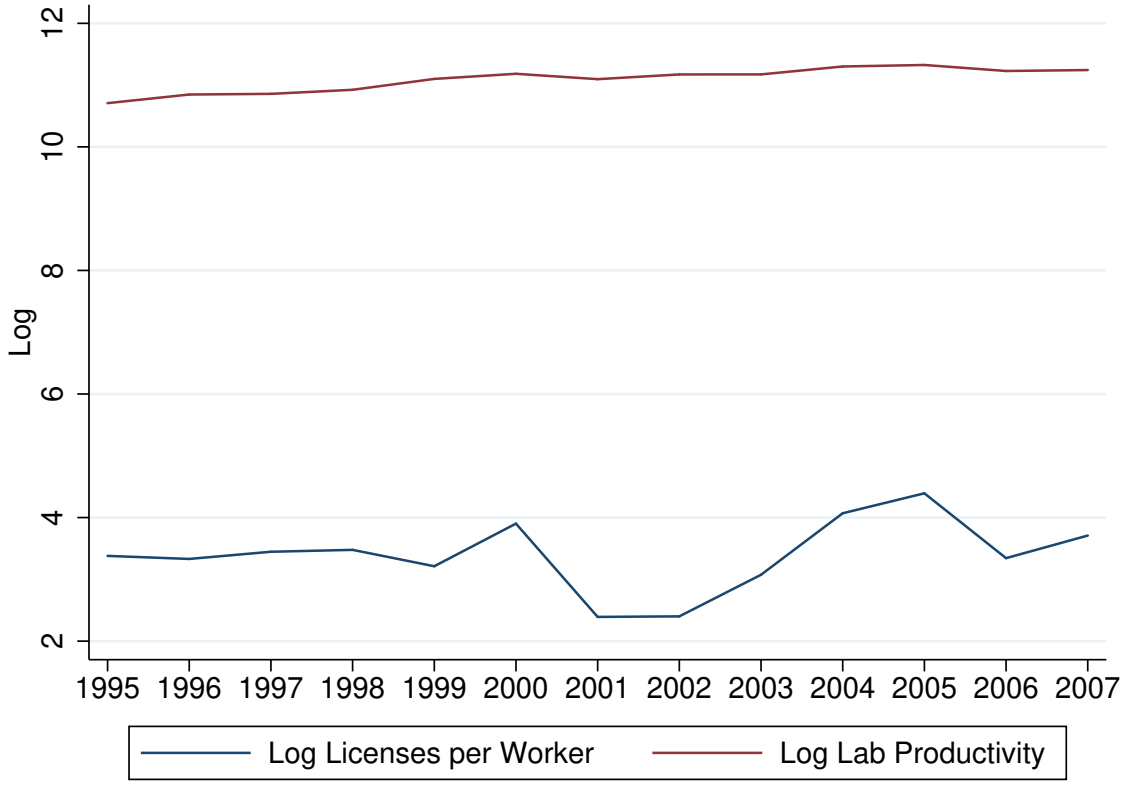


Figure 11. Labor productivity evolution and market concentration

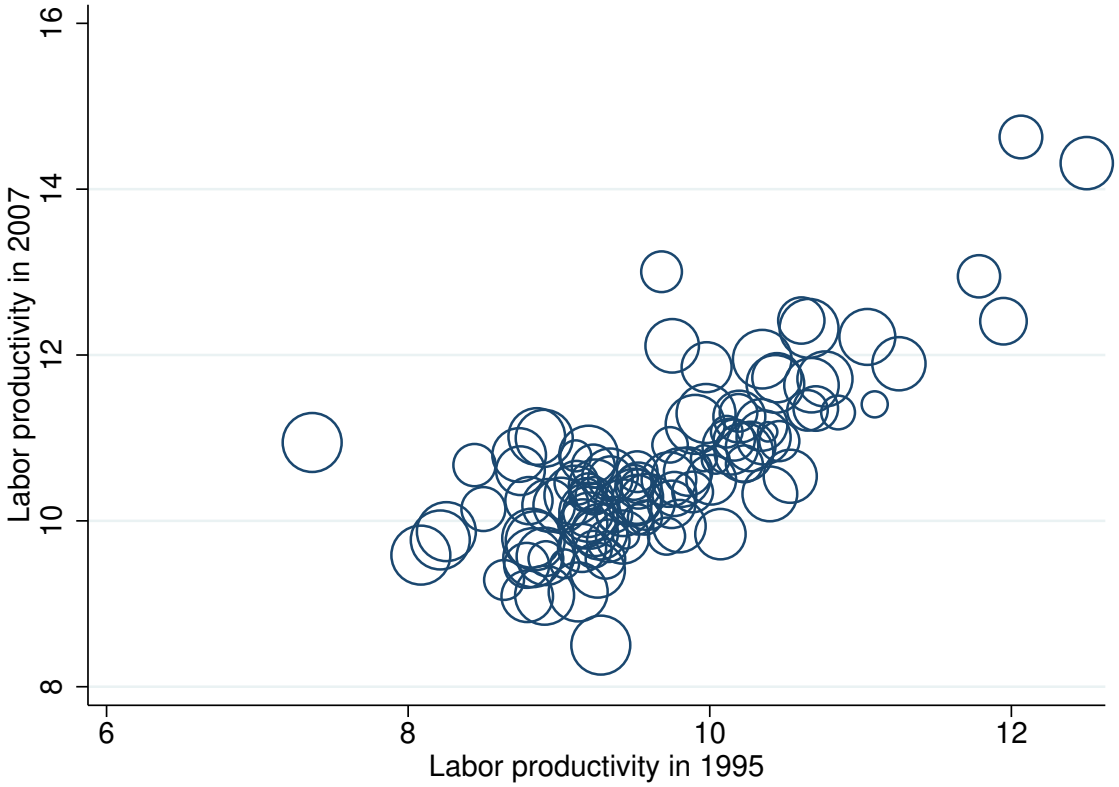


Figure 12. Markups evolution and market concentration