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ABSTRACT

This paper uses millions of records from a cross-country and time series database of both publicly listed and private companies to disentangle the role of technological change, market power, and globalization in driving a fall in the labor share. Labor shares are measured at the enterprise level as the share of total remuneration to workers in value-added. Technological change is measured using research and development expenditures or total factor productivity growth. Market power is measured using four firm and twenty firm concentration ratios and globalization is measured as export shares in total revenues. We also supplement the cross-country evidence with a more in depth look at China using its industrial census. The evidence suggests that between 1995 and 2019 the most important driver of falling labor shares was technological change. Greater market power (measured by firm concentration ratios) also contributed to lower labor shares, but the magnitudes are smaller. Finally, the evidence on globalization is mixed: trade shares are at times negatively associated with the labor share but in the case of China there is a strong positive relationship between exporting and labor shares at the enterprise level.

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There will come a point where no job is needed. You can have a job if you want to have a job for personal satisfaction, but AI will be able to do everything.

Elon Musk, November 2023

Many studies have addressed the decline in the US labor share, which goes back over several decades. The fall in the share of GDP that goes to labor is not just a US phenomenon. Dao et al (2017) document that labor shares—usually measured as the share of total compensation to workers in value-added--have fallen in many countries, accounting for at least two thirds of global GDP. These shifts in labor's share have in turn contributed to higher inequality. Most individuals with lower incomes receive most of their income from labor compensation, while individuals who are wealthy receive a large fraction of their incomes through capital ownership. When the fraction of the pie that goes to labor falls, inequality is likely to rise.

In fact, it can be shown that falling labor shares are directly associated with rising income inequality as measured by the Gini coefficient. The Gini coefficient can be defined as the sum of the labor share of income multiplied by the concentration index of labor income and capital income multiplied by the concentration index of capital. Since labor income is more equitably distributed across US households than capital income, when the labor share declines the Gini coefficient rises. Jacobson and Occhino (2012) estimate that for the United States a decline in the aggregate labor share of 8 percentage points is associated with an increase in the Gini coefficient of 2 to 3 percent. Consequently, understanding the causes of a declining labor share is important for a broader understanding of why overall income inequality has been rising in the United States and elsewhere.

Many of the studies that evaluate falling labor shares focus on one leading explanation for the decline, such as labor-saving technical change, or the rise in market power of certain "superstar" firms. Consequently, Grossman and Oberfeld (2021) conclude that all these studies "over explain" the decline in labor's share. An econometric interpretation would be that favoring one story induces the standard bias due to omitted variables: if only one right hand side variable is included, its coefficient (in absolute value) could be biased upwards if it takes on a greater magnitude to compensate for all the elements that are excluded from the specification.

This paper uses a comprehensive data source (Orbis) to address multiple popular explanations for changing labor shares, seeking to disentangle competing hypotheses. To avoid over-explaining the magnitude of the labor share decline, I embed multiple factors in the estimation framework simultaneously. To make the research problem tractable, I focus on three of the most popular explanations for declining labor shares in the economics literature: technical change, globalization, and market power. Figure 1 shows that the average labor share at the company level—defined as total remuneration to employees divided by value added--declined significantly for nearly two thirds of the countries in our sample between 1995 and 2019. The declines are most evident for industrial countries, including many European countries and Japan. The decline was perhaps most dramatic for the United States, which shows a fall of 25 percentage points for publicly listed firms.

Many of the explanations for that decline have suggested that technological change--such as labor-saving innovations or the increasing use of robots--are responsible for the decline in the US labor share (see, for example, Acemoglu and Restrepo (2020), Restrepo (2023)). Figure 2 shows that in the United States, expenditures on research and development as a share of company revenues have increased in every single sector. Acemoglu and Restrepo (2020) regress changes in wages and employment shares on exposure to robots and find a significant negative effect. Other research strands emphasize a falling price of investment goods (which could also be a consequence of globalization) which has made it attractive for firms to invest in labor-saving technology. Karabarbounis and Neiman (2014) attribute half the decline in the US labor share to a fall in the relative price of capital goods.

Other authors, such as Autor, Dorn, and Hanson (2013), Pierce and Schott (2016), and Harrison (2005), suggest that globalization may be the cause. These kinds of arguments often rely on the ability of firms to easily relocate to where the cost of labor is lower, while owners of labor are more restricted in their movements. Pierce and Schott (2016) show that China's membership in the WTO led to a strong decline in the growth of manufacturing employment in the United States. This theme is popular in political circles, but the evidence is not conclusive. For example, Feenstra, Ma, and Xu (2019) show that between 1991 and 2011 the net job losses from import competition in the United States were offset by the gains to workers in US exporting industries. Others point to the difficulties in disentangling globalization's impact. For example, Karabarbounis and Neiman (2014) emphasize the falling price of investment goods, resulting in part from globalization, in accelerating the replacement of people with machines.

A third popular explanation for falling labor shares in the United States is increasing market power, associated with the rise of superstar firms. Figure 3 shows that the market share of the top four or top twenty companies in most US sectors increased between 1995 and 2019. The rising concentration of business activity is particularly clear for manufacturing but has occurred in other sectors as well. Autor, Dorn, Katz, Patterson and Van Reenen (2020) regress changes in labor shares for US sectors on four and twenty firm concentration ratios and show that labor shares are significantly and negatively associated with increases in concentration. Autor et al (2020) document an increasing concentration of market share in the United States and elsewhere and posit a likely association with greater market power, as companies wrestle excess profits away from labor.

Increasing concentration of both wealth and market share has been the subject of both academic (Philippon (2015)) and popular books. Karabarbounis and Neiman (2014) attribute half of the decline in the US labor share to rising markups.

Autor et al (2020) document for the United States that much of the shift to lower labor shares has occurred as the market share of larger firms with greater market power—and lower labor shares—has increased. If reallocation of market shares towards these kinds of firms has occurred, then we would also expect that weighting labor shares by firm size would lead to an even greater decline. Figure 4 redoes the graphs in Figure 1 but weights the labor share averages by firm size. The decline is even more pronounced for countries like the United States, Great Britain, and Japan, indicating a reallocation of the labor force towards companies with low labor shares.

For the United States, the fall in the labor share is so dramatic that it warrants further investigation. Figure 5 shows both the unweighted labor share in value added from Figure 1 for the United States and traces the evolution of profit shares and remuneration in revenues. Figure 5 shows how labor shares in value added could fall so dramatically in the United States. Between 1997 and 2019, profits as measured by EBITDA/revenue doubled, climbing from 8 to 16 percent for listed companies in the Orbis database. While revenue increased, labor compensation did not climb as quickly. Consequently, labor compensation shares in revenues fell from 28 to 12 percent. The ratio of labor compensation to profits flipped--falling from 80 to 40 percent as a result. For further corroboration, Appendix A.4 shows a similar pattern for one of the largest companies in the United States—Amazon. Appendix A.4 also shows the pattern for Walmart. For Amazon, the labor share in value added fell by half and profits doubled. While Walmart's labor share did not decline, Walmart's labor share in value added was miniscule to begin with—rising from less than 2 to almost 4 percent of value added. One implication is that overall labor share in the United States could fall as aggregate employment shifts from high labor share (like United Airlines) to low labor share (like Walmart) companies.

This paper takes an agnostic view and uses a comprehensive Orbis dataset of millions of observations that spans three decades across countries to identify which of these leading explanations is most salient in explaining changes in labor's share. Orbis covers both listed and unlisted companies, with coverage varying across countries. For the United States, all listed companies are included, which means coverage accounts for 8,000 of some of the largest companies in the US. For other countries, like France, most medium and large companies are included even if they are not listed entities. While Orbis has several shortcomings, it is also universally acknowledged as the most consistent and comprehensive firm level database available. Autor et al (2020) write that "BVD Orbis is the best publicly available database for comparing firm panels across countries". Coverage is particularly good for manufacturing; Kalemli-Ozcan, Sorensen, Villegas-Sanchez, Volosovych, and Yesiltas (2015) estimate that Orbis accounts for between 60 and 70 percent of manufacturing activity in most European countries. This version of the Orbis dataset has been cleaned under the guidance of Sebnem Kalemli-Ozcan and others in partnership with the National Bureau of Economic Research in order to provide consistency over time. For other excellent works using Orbis, see Gopinath and Kalemli-Ozcan (2017) as well as Gourinchas and Kalemli-Ozcan (2020).

One shortcoming of the Orbis database is that its coverage of both the United States and China is incomplete. To compensate for this shortcoming, we also report results for China using their census of manufactures for the period 1998 through 2007. To be consistent with the Orbis data, labor's share is again defined as the share of total compensation in value added. The recent study, Yang and Tsou (2021), also explores the determinants of the labor share in China. They find that the firm level labor share is negatively associated with total factor productivity as a measure of technology and positively associated with export activity. They find similar results using alternative technology measures, such as product innovation and research and development expenditures. However, they do not explore the role of market power.

Orbis provides a consistent lens over time regarding company level investments in technology, their experience with globalization, and their reported market power. Based on available accounting data as reported by Orbis, investment in technology is measured as the ratio of research and development expenditures to total sales. Globalization is measured using a standard trade share: the share of export revenues in total sales. Market power is measured in the same way as Autor et al: the 4 or 20 firm concentration ratio (CR4 or CR20) in a specific type of industry and country and year.

Grossman and Oberfeld (2020) are concerned about the lack of identification in many studies of the labor share, emphasizing in particular the challenges associated with cross sectional studies. Through the use of a time series panel, we are able to go beyond cross sectional studies and also are able to address the problem of identification directly. Our measures of globalization, market power, and technology exclude the firm's own investment or exposure, providing a way of reducing the simultaneity that could likely result from regressing a firm's labor share on its own technology and exporting decisions.

The firm-level results show that higher investments in R and D, increasing exposure to globalization, and higher concentration (CR4 or CR20) are all associated with a significantly lower share of total compensation in the company's value added. The magnitudes are highest for technology investments. A 1 percentage point increase in R and D expenditure is associated with a two percentage point decline in the labor share on average. A 1 percentage point increase in trade shares is associated with a 0.2 percentage point decline in the labor share, and for CR4 the impact is slightly lower. All effects are statistically significant, but the impact of technology investments is the greatest.

As is evident from studies of productivity growth, there is no reason why the sector level results need to be the same. If there are dramatic changes in market share over time, with the largest firms characterized by lower labor shares and growing over time, the impact of market power could be magnified in the sector data. Or the reverse could be true: if smaller firms with higher labor shares become more prominent over time, then the impact of market power at the sector level could be lower. Aggregating the firm-level data to the sector level in the Orbis data—keeping only those countries with at least 100,000 observations—yields surprisingly consistent results. The impact of the three factors—technology investments, globalization, and market power—remain significant and of roughly the same magnitude. The results remain in the five and 10 year long differences.

The story for China is different. Industrial countries are over-represented in the Orbis dataset, and consequently the results can best be interpreted as revealing of industrial country experience—particularly European industrial country experience. Traditional trade theory as illustrated by the Stolper Samuelson theorem tells us that in countries with a comparative advantage in producing capital intensive goods opening up to trade would lead to a rise in the return to capital and a fall in the return to labor. In China, we would expect the opposite: globalization should increase the return to labor (presumably if China has a comparative advantage in producing labor-intensive goods) and lower the return to capital. The results for China during the 1998 through 2007 period reveal that higher labor shares at the firm level are associated with higher trade exposure. Our firm level results are consistent with Yang and Tsou (2021).

These two different datasets—the Orbis data which tracks millions of firms across countries and the Chinese census data—reveal a consistent pattern in identifying the causes of the declining labor share. The most important factor associated with falling labor shares is technology. By a factor of ten or twenty depending on the dataset and specification, investments in technology are much more important than either globalization or market power. While market power is significantly associated with declines in labor shares both across the world and for China itself, the role of globalization is much more nuanced. Across many countries, increases in exports are associated with falling labor shares. For China, the results are reversed: increases in globalization are associated with rising labor shares. While globalization may have hurt labor in countries like the US, that same globalization (as measured by firm-level export activity) has been associated with significant gains for labor in China.

The remainder of the paper is organized as follows. Section I presents a stylized model to understand how various factors could affect labor's share. Section II describes the Orbis data and presents the results at both the firm and sector level. Section III presents the results for China and Section IV concludes.

I. Theoretical Framework

This approach combines an imperfect competition framework with bargaining over rents. The theoretical framework allows us to nest the Autor et al (2020) model as a special case where workers have no bargaining power and therefore an increase in market power need not automatically translate into a lower labor share. The framework also differs from Borjas and Ramey (1995), who examine the link between rising wage inequality and falling industry rents. They assume that the fraction of rents allocated between workers and owners is constant; what changes is the extent of rents as global conditions become more competitive. Borjas and Ramey (1995) and Abowd and Lemieux (1993) also assume that bargaining power is fixed; in this paper, bargaining power varies with the ease of relocation abroad. We include capital in the production function, which allows us to model rent-sharing as a function of both worker bargaining power and capital's bargaining power. The framework is complementary to, but differs from, Rodrik (1997) and Slaughter (1996), who argue that rising labor demand elasticities could shift the incidence of nonwage costs, costs associated with the implementation of labor standards, and government taxes towards labor.

Firms and workers first choose the profit maximizing level of output, and then bargain over the rents. This approach was pioneered by Brown and Ashenfelter (1986) and in the bargaining literature, has come to be known as the efficient bargaining model. An alternative approach would have been to allow employment to be chosen taking into account the negotiated wage, the so-called right to manage model. Like Blanchard and Giavazzi (2001), we propose an efficient bargaining model because we want to capture the possibility that the actual wage may be different from the marginal revenue product of labor. In this framework, the share of rents going to workers depends on the relative bargaining strengths of labor and capital.

We assume there are only two factors of production, labor and capital. The representative firm uses a vector v of inputs, with v_L units of labor and v_K units of capital. The competitive return to factors is given by the vector $\mathbf{w_0} = (w_{L0}\ w_{K0})$. The wage under perfect competition would be w_{L0}, and the return to capital would w_{K0}. Total returns are denoted by the vector $\mathbf{w} = (w_L w_K)$ with excess returns given by the difference between the two vectors. The utility functions for labor and capital are denoted by:

(1a) $U_L = (w_L - w_{L0})v_L$ *(1b)* $U_K = (w_K - w_{K0})v_K$

The revenue function is denoted by G(**P**,**v**). The price vector **P**, in turn, can be written as a function of the production function **Y(v)**, so we have **P(Y(v))**. Under imperfect competition, excess profits are equal to:

(2) $G(\mathbf{P(Y(v)), v}) - \mathbf{w_0 v}$

Maximizing (2) with respect to **v** yields the following first order condition:

$$[\partial Y/\partial v]P = \mu w_0$$

The variable μ is the markup given by $(1/\varepsilon + 1)^{-1}$. The elasticity of demand is given by ε. We can implicitly define the optimal choice of v as:

$$\mathbf{v^* = R(P,\mu,w_0)}$$

The excess rents given by (2) can be written as:

(4) Rents $= G(\mathbf{R}) - \mathbf{w_0 R}$

Thus, total revenue, G(**R**), factor demands, **v***, and *total* rents are determined by equations (1) through (4) and are independent of labor and capital's bargaining power.

Bargaining Over Rents

Labor and capital bargain to determine their share of the rents. The outcome of bargaining, if we assume Nash bargaining, can be derived from finding the solution to maximizing—over w_L and w_K—the following, which is the product of the surplus each player receives over their so-called threat point:

$$[(w_L v_L - U_{L0}) x (w_K v_K - U_{K0})]$$

Before we can solve for returns to labor and capital, we need to define the threat points. We assume that if bargaining breaks down, owners of capital or labor have the option to leave the firm, incur a fixed cost F_L or F_K, and receive alternative returns w^*_L or w^*_K. These alternative returns are not necessarily equal to the competitive return. We will assume that fixed costs are proportional to the quantity of the factor employed, so that we can write $Fi = f_i v_i$. Consequently, we can write the threat points as:

(5a) $U_{L0} = w^*_L v_L - f_L v_L$

(5b) $U_{K0} = w^*_K v_K - f_K v_K$

So our maximization problem becomes

(6) Maximize $\{w_L v_L - w^*_L v_L + f_L v_L\}\{w_K v_K - w^*_K v_K + f_K v_K\}$

over w_L and w_K and subject to $w_L v_L + w_K v_K = G(R)$

The first-order conditions with respect to w_L and w_K are (where λ is the multiplier on the constraint):

(7) $v_L(w_K v_K - w^*_K v_K + f_K v_K) = \lambda$

(8) $v_K(w_L v_L - w^*_L v_L + f_L v_L) = \lambda$

Combining these first-order conditions yields the following expression for the wage:

(9)

$$\mathrm{w_L} = \frac{1}{2}\left[\frac{G(R)}{v_L} + w_L^* + \frac{(f_K - w_K^*)v_K}{v_L} - f_L\right]$$

The expression for the return on capital is analogous to (9). With bargaining, wages depend positively on labor productivity, but now they also depend positively on the alternative returns to labor and the fixed cost to capital of relocating and negatively on the alternative return to capital and the fixed cost to labor of relocating.

Multiplying both sides of (9) by v_L and dividing both sides of (9) by $G(R)$ yields the following expression for the labor share S_L:

(10)

$$\frac{w_L v_L}{G(R)} = S_L = \frac{1}{2} + \frac{1}{2}\left[\frac{w_L^* v_L}{G(R)} - \frac{f_L v_L}{G(R)} - \frac{w_K^* v_K}{G(R)} + \frac{f_K v_K}{G(R)}\right]$$

We can think of the alternative vector **w*** as equal to the competitive return $\mathbf{w_0}$ plus a vector $\mathbf{\Omega}$ which might be positive or negative. If factors receive above their competitive returns because of positive markups then $\mathbf{\Omega}$ will be greater than zero. But $\mathbf{\Omega}$ could be negative—for example, if a company chooses to close down domestic operations and move to a location where wages or the cost of capital is lower than the home competitive return. So we could rewrite (10) as:

(11)

$$\frac{w_L v_L}{G(R)} = S_L = \frac{1}{2} + \frac{1}{2}\left[\frac{(w_{0L} + \Omega_{0L})v_L}{G(R)} - \frac{f_L v_L}{G(R)} - \frac{(w_{0K} + \Omega_{0K})v_L v_K}{G(R)} + \frac{f_K v_K}{G(R)}\right]$$

The expression for capital's share is analogous to (11). If fixed costs of relocating or alternative returns to the factors differ, then excess profits will not be split equally across factors. In particular, labor's share will rise if: (1) alternative returns to labor rise (2) alternative returns to capital fall (3) fixed costs to capital of relocating rise or (4) fixed costs to labor of relocating fall.

Using what appears to be a very different approach, which incorporates monopolistic competition, unemployment and Dixit-Stiglitz utility functions in a general equilibrium framework, Blanchard and Giavazzi (2001) also derive an expression for labor's share which is remarkably similar to equation (10). One major difference is that they *assume* that worker rents are a function of labor market institutions, while we *derive* the share of rents going to workers as a function of global market factors. Under perfect competition, labor's share will be equal to $w_{L0}v_0/G(R)$, where G(R) is equal to PY and P is equal to marginal costs. In Blanchard and Giavazzi (2001), labor's share is equal to the competitive share, multiplied by $(1 + \mu B)/(1 + \mu)$. Labor's share rises with an increase in bargaining power, which is proxied by B. They do not model the determinants of bargaining power, stating only that they are a function of labor market institutions. In our framework, labor's share is also equal to the competitive share plus a fraction of the excess rents as determined by worker bargaining power. However, bargaining power is determined by global market factors, which are explicitly incorporated into the bargaining framework.

To understand what this framework implies for the effects of technical change, globalization, and market power on labor shares, it is helpful to think of a specific form for the production function for output **Y**. Autor et al propose a production function of the general form $Y = A_i L^{\alpha} K^{\beta}$ where A is a firm-specific technology shifter. Using this production function, then equation (3) could be written as:

$$(12) \qquad \frac{\alpha}{\mu} = \frac{w_{0L} v_L}{PY}$$

The Autor et al (2020) framework assumes no bargaining and a perfectly competitive labor market. That would be equivalent to an outcome in the bargaining model where labor ends up at its threat point and the threat point is simply the competitive wage. In a world where firms have market power and retain all the surplus in a bargaining game, and where the labor market is competitive, then labor's share from (12) is by definition inversely related to the markup μ. Sectors with higher markups—where all the excess profits go to capital owners—will automatically have lower labor shares. This model makes it clear that with imperfect competition and wage bargaining, higher markups could be associated with lower labor shares but other outcomes are possible. Whether or not greater markups are associated with lower labor shares will depend on the relative strengths of the two bargaining units.

What about the role of technology? The framework highlights that the ability of capital owners to easily find alternatives through investment in robots or automation will reduce labor's share. A new technology like AI could lower labor's alternative return and raise capital owner's alternatives simultaneously. Lower priced robots that can replace workers again could hurt labor by weakening their threat points and strengthening those of capital owners. We could also rewrite the production function to make technological change a function of L. With A(L), the first order conditions then become:

$$(13) \qquad \frac{\alpha+\eta}{\mu} = \frac{w_{0L} v_L}{PY}$$

The symbol η is the elasticity of the technology parameter A with respect to L. If A'(L) is negative, then technological change could be associated with a lower labor share. This would be the case if a shortage of labor or labor unrest induced investments in the creation of new robots.

Finally, globalization could affect labor's share by affecting either alternative returns or the fixed costs of relocation. A reduction in tariffs or capital controls makes it easier for owners of capital to offshore activities, reducing the labor share in the bargaining model. In a Stolper-Samuelson world, opportunities to trade for the labor scarce countries (like the United States) would likely reduce the alternative wage and employment, while trade in labor abundant countries could increase their alternative returns. We might expect, in this framework, for globalization to have opposite effects on the labor share depending on a country's comparative advantage.

II. Estimation Results: ORBIS

We begin by presenting the results using the Orbis data, as provided to NBER researchers in a cleaned form and linking individual firms over time. We keep all observations from 1995 through pre-pandemic years, which includes 2019. We also only retain countries with at least 100,000 observations. This reduces the sample size to slightly over 139 million records (see Appendix Table A1). The distribution across countries is reported in Appendix Table A1. It is evident from the Table that the countries with the largest number of observations are typically European countries. France tops the list, with 19 percent of the total data, while coverage is also high for Spain, Great Britain, Italy, Canada, and Belgium. Several Asian countries are also well represented, including Japan, South Korea, and Vietnam. Notably poorly represented are the United States, with only 160,000 observations in total representing listed companies, and China. For this reason, we have added a section for China reporting results using their manufacturing census data.

Appendix Tables A2 and A3 show the breakdown by year and by sector. The years with the highest representation are 2006 through 2019. One appeal of the Orbis data is its better coverage in recent years; most analyses of US labor shares stop in 2010. One challenge in examining labor shares and calculating market specific measures such as concentration ratios is the need for consistent measures of sectoral company affiliation across countries and over time. Typically, the sectoral breakdown and classifications available vary across countries and over time. This would make it impossible to create concentration ratios that are consistent across more than a handful of countries. To solve this challenge, we use the Orbis classification which assigns every company to one of 20 sectors. The distribution is listed in Appendix Table A3. While these sectors are less disaggregated than a 2 or 4 digit SIC or NAICS classification, the advantage is that they are consistent across time periods and over time. We can see in Appendix Table A3 that representation is highest for manufacturing and services.

We will estimate regressions with labor share as the dependent variable and various proxies for technological change, globalization, and market power as independent variables. When we estimate equations in levels, we will include country, sector, and time fixed effects. While there are also likely to be firm fixed effects, the large number of observations precludes adding these. To take into account the possibility of firm fixed effects, we will also present results in first and long differences. We are most confident in the first and long difference results, but will begin with levels estimations. A standard specification for firm i in sector j and year t will be as follows:

$$LaborShare_{ijt} = B_1 SectorRandD_{ijt} + B_2 CONCRATIO4_{ijt} + B_3 SectorTradeshare_{ijt} + f_i + s_j + D_t$$

In the firm level results, the dependent variable labor share is defined as total compensation to all employees divided by value added, reported in Orbis as "costs of employees" and "added value". Over two thirds of the companies included in Orbis do not report one of these variables, which reduces the sample size from over 139 million records for our chosen sample period and countries (Appendix Tables A1 and A2) to 42 million. We measure investment in technology as research and development expenditures divided by company revenues. Exposure to globalization is measured as export revenues as a share of total revenues. Since not all countries report export revenue, we will present these results separately. Finally, we measure 4 firm and 20 firm concentration ratios as the share of the 4 and 20 largest companies in each market segment in each country and year, where market segments are defined as in Appendix A2.

One concern raised by Grossman and Oberfeld (2021) is the over reliance in labor share studies on cross-section estimation and lack of focus regarding simultaneity issues. This framework follows the same company over time between 1990 and 2019, and thus the identification is based on the time series, not the cross-section—particularly in the first and long differences. To address simultaneity concerns, in the company level analysis we define all right hand side variables at the sector level, excluding the firm's own values. This means that the ratio of research and development expenditures to revenues are calculated at the sector level, excluding that company's research and development in the numerator and its revenues in the denominator. We do the same for the trade share, excluding the firm's export revenues in the numerator and its revenues in the denominator. This means that for n firms i in sector j at time t, we have technology defined as:

$$SectorRandD_{ijt} = \frac{\sum_{k\neq i}^{n}(researchdevelopmentexpenses_{kjt})}{\sum_{k\neq i}^{n}(total\ revenue_{kjt})}$$

We graph both this firm-specific measure as well as the mean in Figure 6. While the firm-specific measure follows the overall trend in the ratio of research and development to total revenue as reported in Figure 6, there is significant variation in firm-specific measures at each point in time when their own contribution is excluded from the sector-level mean. This variation provides the necessary identification for the estimation.

For the 4 firm and 20 firm concentration ratios, we include all companies in calculating the top four and top twenty market shares within each sector, country, and year. However, we exclude the companies that were in the top four and top twenty in the estimation, to avoid simultaneity bias, although the inclusion or exclusion does not affect our basic results. We also do the same for sectoral trade shares. We have the sectoral trade share for firm I in sector j at time t defined as:

$$SectorTradeshare_{ijt} = \frac{\sum_{k\neq i}^{n}(exportrevenue_{kjt})}{\sum_{k\neq i}^{n}(total\ revenue_{kjt})}$$

Our first set of results are reported in Table 1. The first two columns report results in levels and the last two columns report results in first differences. In the first two columns, market power as proxied by CR4 and CR20 (the 4 and 20 firm concentration ratios) is positively related to the labor share. Research and development spending at the sector level is negatively related to the labor share. The magnitudes indicate that a one percentage point increase in research and development expenditures are associated with a 1.4 percentage point decline in labor's share in value added at the firm level. The second two columns report the results in first differences. The signs of the two independent variables remain the same, but the magnitudes are smaller.

Table 2 reports the standard specification in levels and first differences including our measure of globalization, the sectoral trade share. Since many countries and firms in ORBIS do not report trade activity, the number of observations drops to nearly 13 million in levels and 9.5 million in first differences. There are fourteen countries in the sample (down from 43) where export activity is recorded. We report levels results in the first two columns and first differences in the last two columns. Again, the first two columns include year effects, sector effects and country effects, while only year effects are included in the last two columns. Unchanging sector and country effects drop out with a first difference specification, as do any firm level fixed effects.

Both concentration ratios switch from positive to negative when we take into account firm fixed effects and move to the first differences specification. The coefficient on CR4 at -0.016 indicates that a percentage point increase in the four firm concentration ratio would result in a -0.016 reduction in labor share, which is a small magnitude. The coefficient on CR20 similarly switches to negative in the fixed effects and is also small in magnitude.

In contrast, the coefficient on sector level research and development expenditures remains of the same sign and magnitude across specifications and comparable to the magnitudes in Table 1. The coefficient of -1.4 in the last two columns suggests that a 1 percent increase in research and development expenditures as a share of firm revenues would lead to a 1.4 percentage point decline in labor's share in value added at the firm. The coefficients on export shares are negative across all four columns, increasing in magnitude in the first differences. A coefficient of -0.19 in column (3) indicates that if trade shares at the firm level were to increase by 10 percentage points as a share of revenues, then labor's share would decline by nearly 0.2 percentage points.

The results in Tables 1 and 2 consistently show that both export activity and more investment in research and development are associated with declines in labor share at the firm level. The magnitudes are greatest for research and development. With concentration ratios, the results are not consistent across specifications. In the larger sample, higher concentration ratios are associated with higher labor shares, but the sign switches in the smaller sample where we control for exposure to trade. The results in Tables 1 and 2 focus on within firm changes over time. However, the impact of these three factors could very well differ at the sector level, depending on the reallocation of market shares. If, for example, greater concentration of market power over time is associated with higher shares for larger firms, and larger firms typically have lower labor shares, then at the sector level the association could switch. Autor et al (2020) present a model and results for US firms showing that reallocation and not average firm changes in labor shares have driven the fall in labor shares. This phenomenon will not show up in firm-level changes but at the sector level. Consequently, we turn to the sector level results next.

Table 3 reports the results at the sector level (see Appendix Table A2 for a list of sectors). All four columns include sector, country, and time fixed effects. The first two columns include export shares in revenues at the sector level while the last two columns exclude trade shares, since the ORBIS dataset only reports trade activity for 14 of the 43 countries in our sample. Since sector fixed effects are included, this specification is akin to a sector first difference specification.

The coefficients are relatively stable compared to our company level results reported earlier, and the coefficients on the concentration measures are now larger and consistently significant and negative. A coefficient of -0.103 in the first column indicates that if concentration levels were to rise by 10 percentage points then labor shares would fall by 1 percentage point. The coefficient on research and development expenditures varies from -0.75 to -2.75. These coefficients are similar to those reported at the company level. They indicate that a 1 percentage point increase in the share of research and development in revenues would be associated with a decline in labor's share from between 0.75 to -2.75, or almost 3 percentage points. The coefficient on sectoral trade, which is between -0.09 and -0.10, indicates that a 10 percentage point increase in the share of exports in revenues would reduce the labor share by 0.1 percent. The coefficients on concentration ratios are of similar magnitude, between -0.10 and -0.155, with similar impacts on labor shares. The sector level results thus mirror the firm level results, with the largest impacts (by a factor of 2.7) coming from investments in technology.

Table 4 repeats the specification in Table 3 at the sectoral level but in differences. We report the results in five year differences in columns (1) and (2) and ten year differences in columns (3) and (4). The magnitudes are similar to those reported in Table 3 for the levels results. In the five year differences, the coefficient on concentration ratios ranges from -0.112 for CR4 to -0.129 for CR20. These magnitudes are quite similar to those for the United States reported by Autor et al (2020). The coefficients imply that a 10 percentage point increase in concentration would be associated with a 1.1 to 1.3 percentage point decline in labor's share. The coefficient on trade shares is consistent with earlier results and the coefficient indicates that a 10 percentage point increase in export shares is associated with a decline in labor's share between 2.1 and 2.2 percentage points. The magnitudes for impact of increasing trade are two times the magnitudes for concentration. The coefficient on research and development expenditures is twenty times larger but is barely significant at conventional levels in the five year differences. The coefficient implies that a 1 percentage point increase in research and development shares in revenues reduces labor's share by 2 percentage points.

The ten year differences, reported in the last two columns of Table 4, show similar results. The negative impact of concentration ratios is slightly lower, with a coefficient of -0.081 for CR4. The coefficient on trade shares is now half the magnitudes, and at 0.10 indicates that a ten percentage point increase in export shares would be associated with a reduction in labor's share of 1 percent. The coefficient on research and development expenditures remains significant and of a magnitude that is roughly 20 times larger in impact than the other variables.

Taken together, the results in Tables 1 through 4 show that higher concentration ratios are associated with lower labor shares at the aggregate level but not at the firm level. The Tables also show that higher ratios of exports to revenues for the 14 countries that report trade data at the company level are also associated with lower labor shares. Finally, our proxy for technical change which is the share of research and development expenditures is associated with lower labor shares. In terms of the magnitudes, the highest effects are for technology, while the effects of trade and concentration are roughly 20 times lower. A 1 percent increase in each of these factors is associated with a 1 percent decline in the labor share for technology, a 0.2 percent decline for trade, and a 0.1 percent decline for concentration.

III. Estimation Results: Chinese Census Data

One shortcoming of the ORBIS dataset is its poor coverage for two economic giants: the United States and China. In this section, we use manufacturing census data for 1998 through 2007 to explore the determinants of labor shares in China. The dataset, collected by the Chinese National Bureau of Statistics, is described in greater detail in Du, Harrison, and Jefferson (2012, 2014). We retain only the manufacturing enterprises and eliminate establishments with missing values or negative or zero values for key variables such as output, employees, capital, and inputs. The years covered include 1998 through 2007. This is a true panel, following the same firms over time. We dropped three sectors with incomplete information on prices from the sample. The final sample size is 1,545,626 observations. The dataset contains information on real and nominal output, assets, number of workers, renumeration, inputs, public ownership, foreign investment, sales revenue, and exports.

To be consistent with Section II, we define labor shares, concentration ratios and globalization exactly as with ORBIS. Average labor shares for the sample period, defined as total compensation divided by value added, are shown declining over the period 1998 through 2007 in Figure 7. Again, we exclude the firm's own export revenues in defining globalization as export revenues divided by total revenues. We also define concentration at the four and twenty firm level the same way, excluding those top four and top twenty firms from the sample in order to minimize endogeneity bias. One challenge is that research and development expenditures during the sample period are only reported for the last years of the sample. In order to be able to span the period before and after China's accession to the WTO, we shift to a different measure of technology, total factor productivity.

The standard approach to measuring firm-level performance is to identify total factor productivity (TFP) levels or growth. Since TFP is an overall efficiency parameter, it is best understood as measuring process innovation—the cost reduction associated with improving the efficiency in producing an existing product. Another measure of innovation is product innovation—associated with the introduction of new products or higher quality goods. Our primary focus is on process innovation, since product innovation is not reliably measured and was also less pervasive for firms in the sample during this period. Our total factor productivity measure is calculated in two different ways—first using OLS and firm fixed effects to derive coefficients on inputs before calculating TFP—and second using the Olley-Pakes method. For more details, please see Aghion, Cai, Dewatripont, Du, Harrison, and Legros (2015).

Results are reported in Table 5. In column (1) the coefficient on CR4 of -0.08 indicates that a 10 percent increase in concentration would reduce the labor share at the enterprise level by 0.8 percentage points. Labor share is defined as total compensation to all labor divided by value-added, which is consistent with the definition we use for the ORBIS dataset. The coefficient of -0.08 is not much different than the coefficients reported using the ORBIS data. The coefficient on export shares at the sector level (excluding the firm's own share) is quite different, however. For China, the coefficient on trade switches in sign to positive and significant. The estimate, which is 0.189 in the first column, indicates that a ten percentage point increase in the share of exports in revenue would be associated with a 1.89 percentage point increase in the labor share. Our two different measures of changes in total factor productivity (TFP) are reported in columns (1) and (2). Column (1) reports the impact of changes in TFP calculated using OLS and fixed effects to recover production function parameters needed for calculating TFP. The coefficient, -0.234, indicates that if TFP growth were to grow by five percentage points then this would lead to a 1 percent decline in labor's share.

Column (2) replaces the change in CR4 with the change in CR20. The results are similar, with the coefficient on CR20 almost exactly the same. The coefficient on trade shares also remains the same, as is the coefficient on TFP. Generally, the results are similar when using CR4 as a measure of concentration versus CR20. In columns (3) and (4) we replace the TFP measure with a TFP measure derived using a standard Olley-Pakes approach. The OP approach allows for the endogeneity of factor shares as well as entry and exit in calculating input coefficients.

The coefficients remain stable in columns (3) and (4) with the alternative measure of the change in TFP. The coefficient on TFP remains at -0.23, while the coefficient on trade shares decreases slightly. The coefficient on the two concentration measures becomes more negative, moving from -0.08 to -0.15, indicating a larger negative impact of concentration on labor shares. The coefficient of -0.15 indicates that a 10 percent increase in concentration would reduce labor's share in value added by 1.5 percentage points.

One question that frequently arises is how to measure market power. Four firm concentration ratios, while frequently used as a measure of market power, are not exactly correct. Concentration ratios measure the concentration of market structure, while markups would be a measure of actual collusive behavior. Another question that often arises is how to measure the scope of a particular market. To allow for the exercise of market power at the region level but not necessarily at the sector level (think of a "one company town") we also constructed alternative measures of market concentration at the region level.

County concentration levels have a different impact. At the region level, county concentration is positively related with labor share. We also explore extensions to this basic specification in Appendix Table A.5 In the appendix we replace TFP as a measure of technical change with patent counts. Using patent counts leads to very similar results as TFP. In both levels and five year long differences, increases in patent counts at the firm level are associated with significantly lower labor shares. In the last two columns of Appendix Tabel A.5, we show that adding controls for the log of the capital stock does not change the results.

IV. Concluding Remarks

This paper uses company level data from a global database (Orbis) to explore the relative importance of three popular explanations for the decline in the labor share. We focus on three possible drivers: market power, technological change, and globalization. The contribution of the paper lies in its broad coverage across more than 40 countries, consistent measures across countries due to the single data source Orbis, and ability to use time series and micro data to address possible endogeneity concerns.

The results at both the individual company or establishment level as well as aggregated to sector levels indicate that all three drivers are associated with declining labor shares. The magnitude is greatest for technology. If we measure technical change either using firm-level research and development expenditures as a share of sales or by deriving multifactor productivity (TFP) changes, we find that technology has a much greater impact than the other drivers. A 1 percentage point increase in research and development expenditures as a share of revenues is associated with a 2 percentage point decline in labor's share.

Market power, as measured by four or twenty firm concentration ratios is also associated with a decline in labor's share. A 1 percentage point increase in the four firm concentration ratio is associated with a 0.1 to 0.3 decline in labor share at the aggregated sector level. Using the Orbis data, the impact of globalization as measured by export shares in enterprise revenues has a similar impact. We also complement these results with an in depth look at China for the 1998 through 2007 period, as China (and the United States) are not well covered by Orbis. For China, the results are similar in sign and magnitude for technology and market power. However, in China an increase in export shares is associated with rising labor shares, indicating a very different and positive effect of trade.

One implication of these results is that efforts to impose protectionist measures or reduce market power could have a smaller impact on labor shares relative to encouraging technological change in the direction of labor-using rather than labor-reducing technology. Policies which bias firm expansion towards capital investments instead of labor (such as subsidies to capital investments versus higher taxes on payroll) could be targeted if the goal is to increase the labor share. The positive relationship between labor shares and export activity in China also points to the likely benefits of globalization for returns to labor in emerging market countries.

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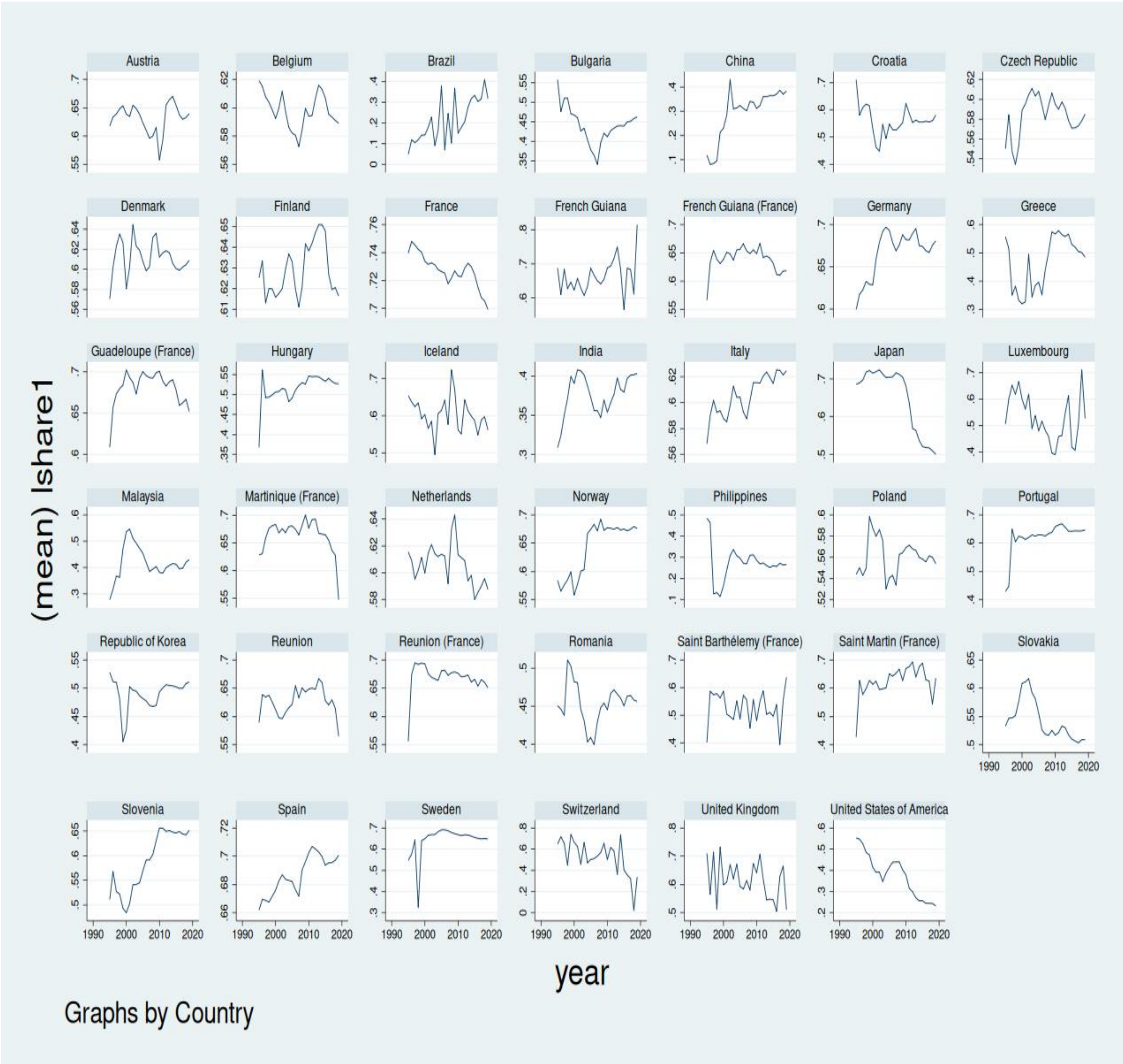


Figure 1: Labor Shares in Orbis as a share of value added: Unweighted Means

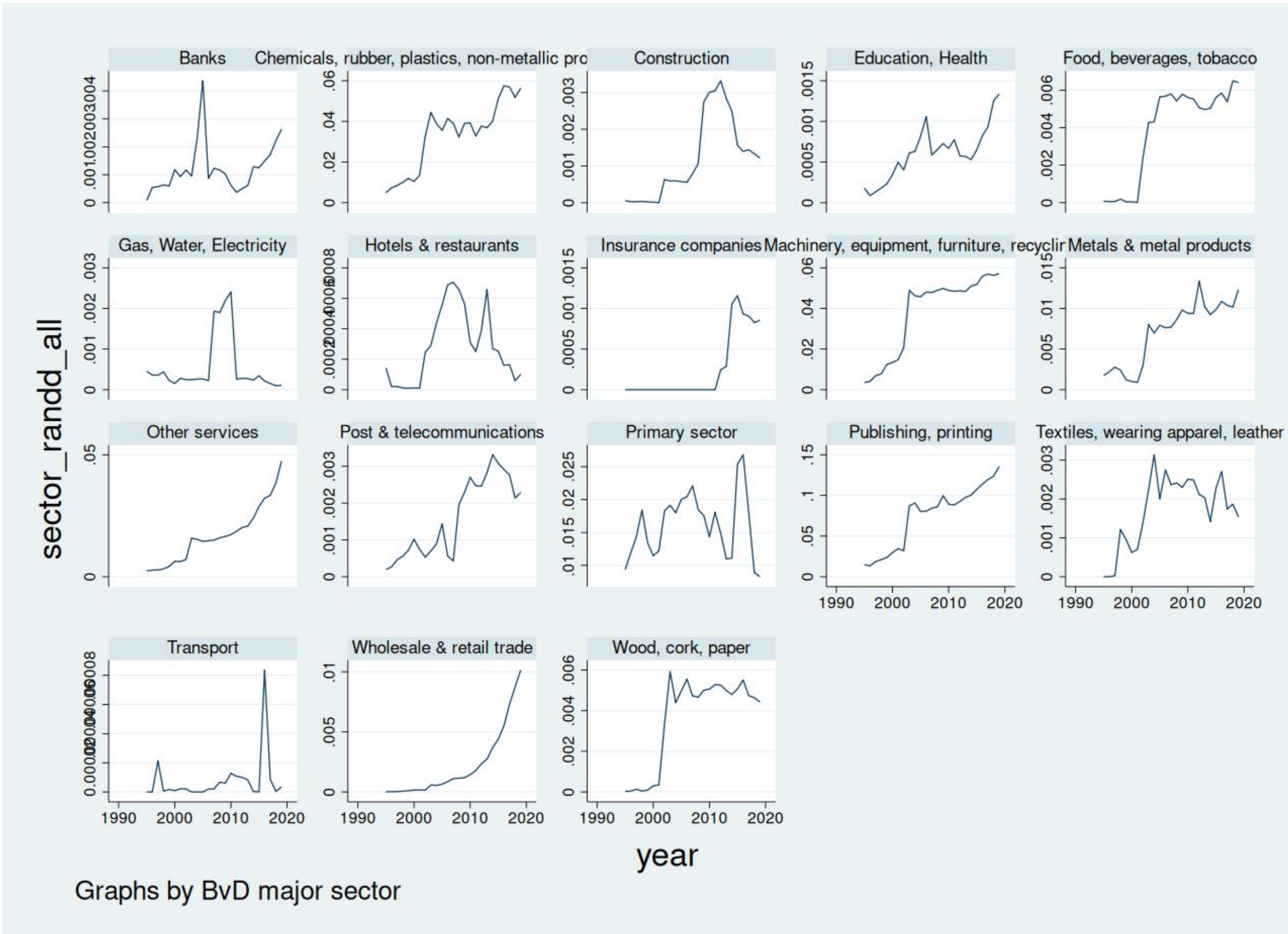


Figure 2

Share of Research and Development Expenditures in Revenues in the United States, by Sector (Orbis Dataset)

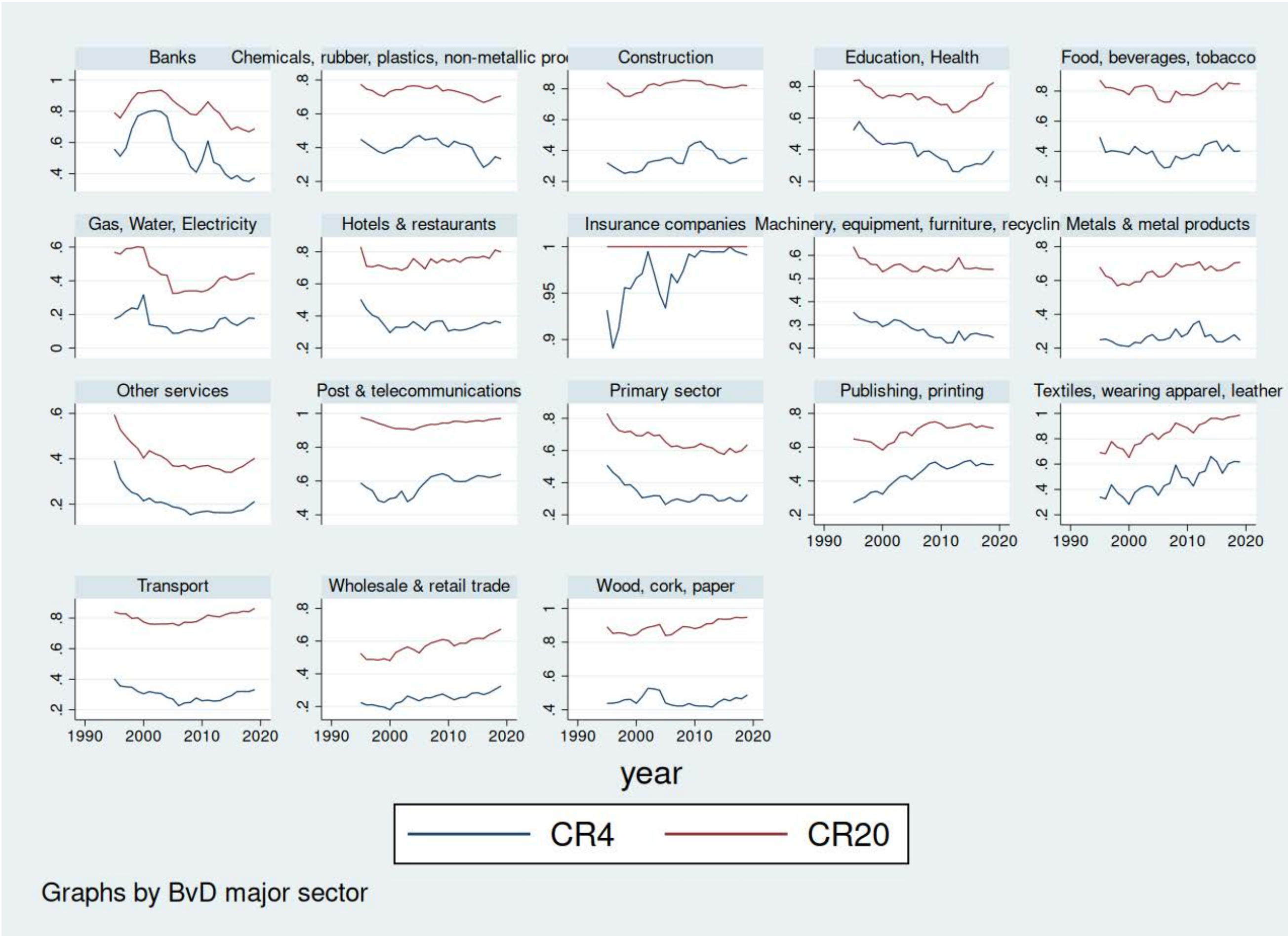


Figure 3

CR4 and CR20 Measures of Market Concentration in the United States, by Sector (Orbis Dataset)

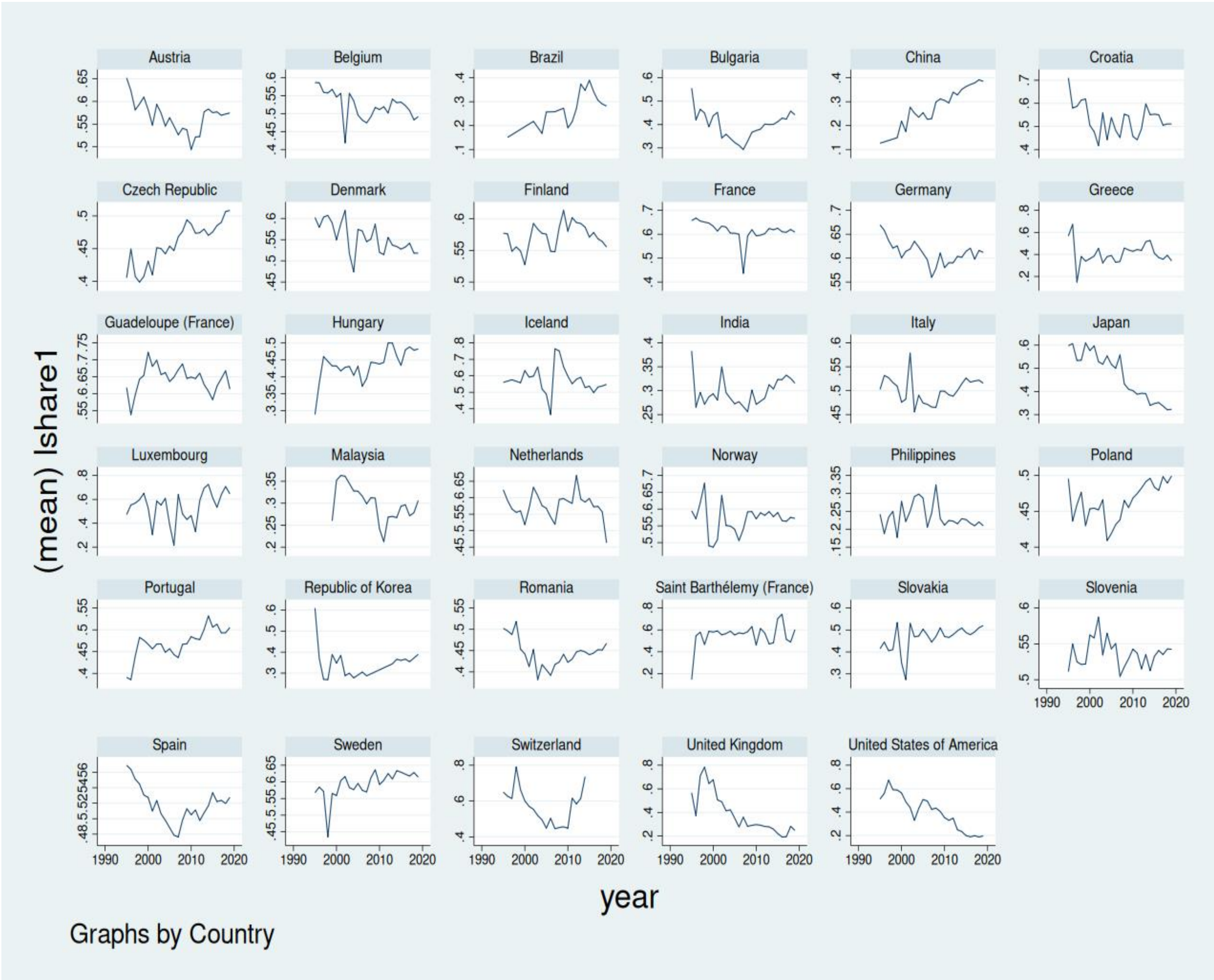


Figure 4
Labor Shares in Orbis as a share of value added weighted by Firm Size (Sales)

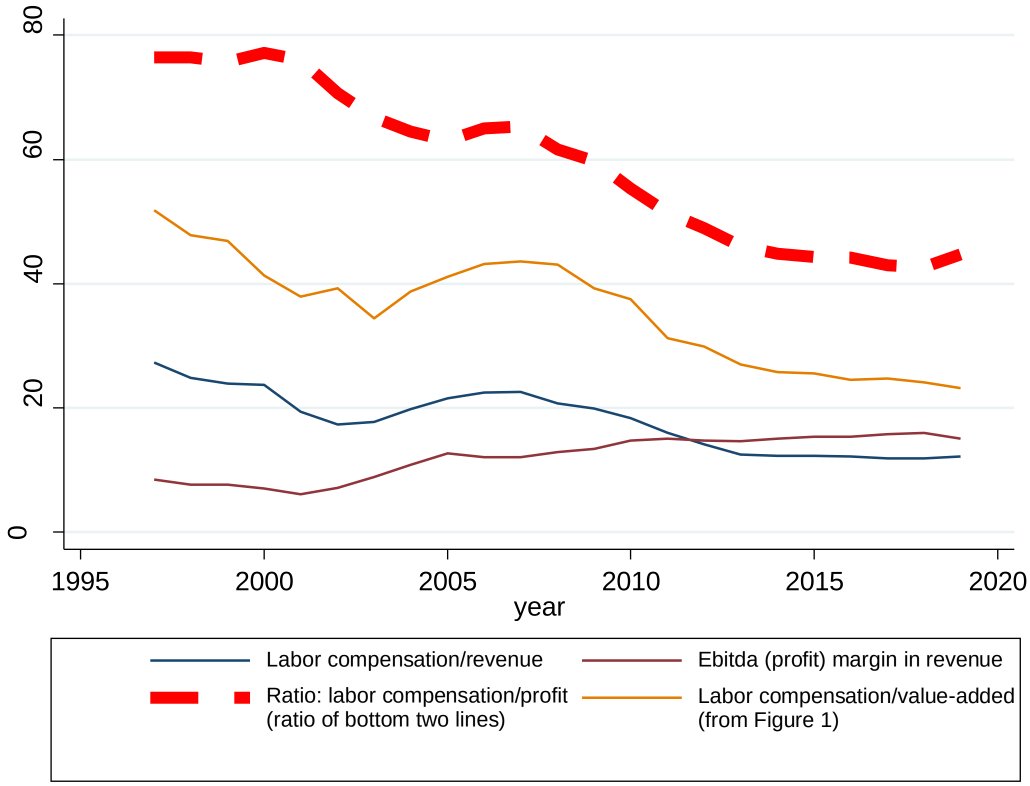


Figure 5
The Great Slide: United States Only
Key Ratios from Orbis Data

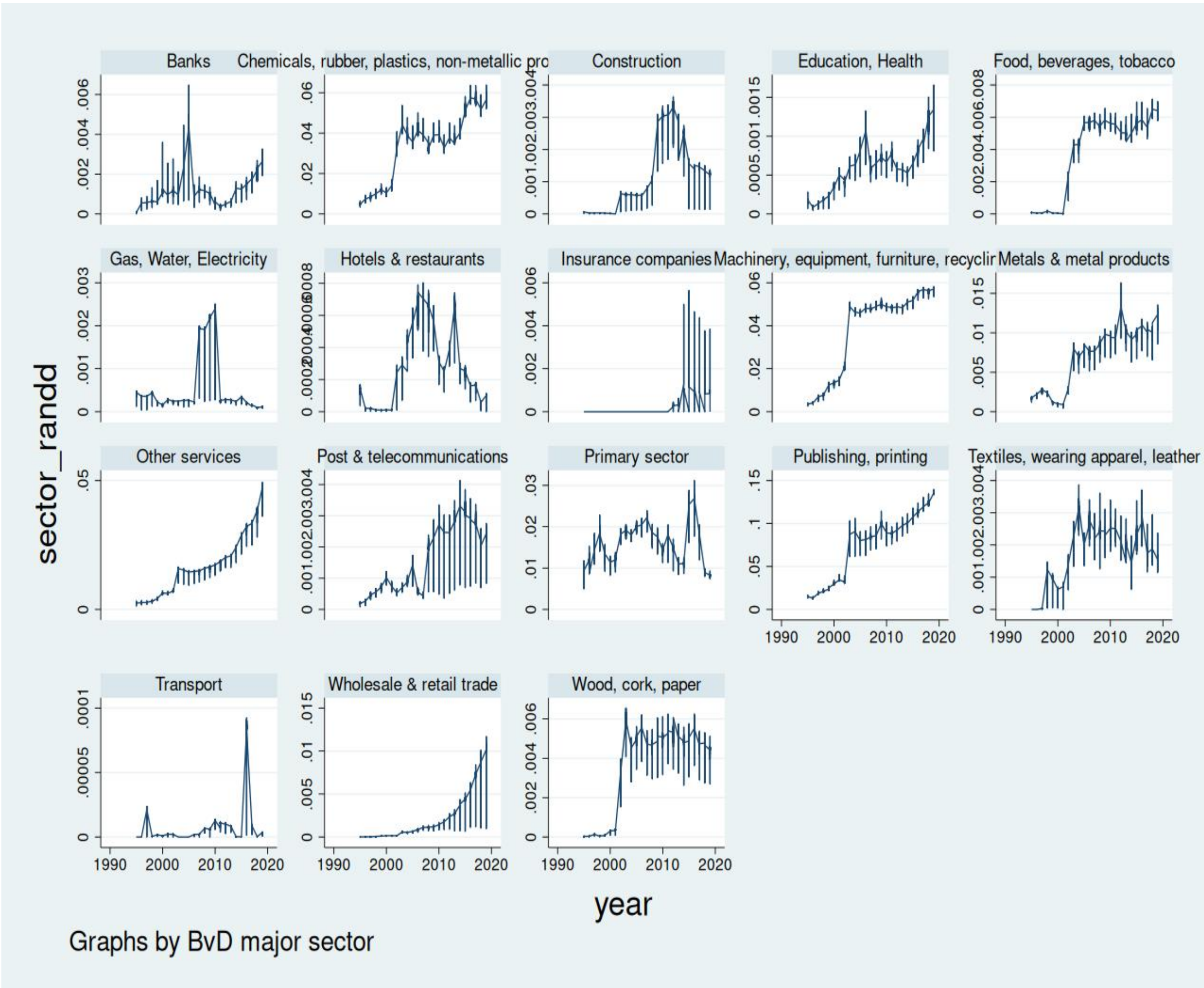


Figure 6

Research and Development Expenditures as a Share of Revenue, Excluding each Firm's own R and D and Sales measures, by Sector

(Orbis Dataset)

Figure 7
Mean Unweighted Total Compensation as a Share of Value-Added in China: Industrial Census for 1998 through 2007

Table 1: Firm Level Determinants of the Labor Share (No Controls for Globalization)

Dependent Variable:	Labor share	Labor share	Change in Labor Share	Change in Labor Share
CR4	0.017 (0.000)**			
Research and Development Share (RDSHARE)	-1.358 (0.012)**	-1.413 (0.012)**		
CR20		0.035 (0.000)**		
Change in CR4			0.007 (0.000)**	
Change in RDSHARE			-0.216 (0.024)**	-0.213 (0.024)**
Change in CR20				0.011 (0.000)**
Constant Term	0.348 (0.020)**	0.318 (0.020)**	0.007 (0.000)**	0.007 (0.000)**
R^2	0.12	0.12	0.00	0.00
N	42,292,459	42,292,459	31,650,088	31,650,088

Notes: In the first two columns, controls are included for sector, year, and country. In the last two columns, only year effects are added. Labor share is defined at the establishment level as total renumeration divided by value-/added. Research and development share is the share of expenditures divided by total revenues at the sector level.

Table 2: Firm Level Determinants of the Labor Share including Globalization				
Dependent Variable: Labor Share	Labor Share	Labor Share	Change in Labor Share	Change in Labor Share
CR4	0.024 (0.001)**			
Trade Share	-0.040 (0.001)**	-0.032 (0.001)**		
Research and Development Share (RDSHARE)	-1.028 (0.027)**	-1.152 (0.027)**		
CR20		0.070 (0.001)**		
Change in CR4			-0.016 (0.000)**	
Change in Trade Share			-0.191 (0.001)**	-0.187 (0.001)**
Change in RDSHARE			-1.403 (0.049)**	-1.342 (0.049)**
Change in CR20				-0.011 (0.000)**
R^2	0.16	0.16	0.01	0.01
N	12,760,542	12,760,542	9,480,799	9,480,799

Notes: The first two columns include sector and country dummies, as well as time dummies. The last two columns, which report first difference results, only include time dummies. Labor share is defined at the establishment level as total renumeration divided by value-added. Research and development share is the share of expenditures divided by total revenues at the sector level. Trade shares are the share of exports in revenues at the sector level. RDSHARE, Trade share, CR4 and CR20 all exclude firm i.

Table 3: Sector-Level Results with and without Trade

Dependent Var:	Labor Share	Labor Share	Labor Share	Labor Share
CR4	-0.103 (0.022)**		-0.134 (0.008)**	
Research and Development Share(RDSHARE)	-2.747 (0.606)**	-2.511 (0.613)**	-0.759 (0.142)**	-0.753 (0.142)**
Trade Share	-0.093 (0.032)**	-0.095 (0.032)**		
CR20		-0.100 (0.026)**		-0.155 (0.009)**
Constant Term	0.819 (0.053)**	1.230 (0.056)**	0.844 (0.024)**	0.885 (0.024)**
R^2	0.54	0.54	0.49	0.49
N	1,881	1,881	12,687	12,687

Notes: All four columns report levels specifications which include sector fixed effects, year fixed effects, and country fixed effects. All variables aggregated to the sector level. Labor share is defined at the sector level as total renumeration divided by value-added. Research and development share is the share of expenditures divided by total revenues at the sector level. Trade shares are the share of exports in revenues at the sector level. A * indicates significance at the 5 percent level and a ** indicates significance at the 1 percent level.

Table 4: Long Differences at the Sector Level: Determinants of Labor Shares

	Five Year Differences		Ten Year Differences	
	Change in Labor Share	Change in Labor Share	Change in Labor Share	Change in Labor Share
Change in CR4	-0.112 (0.032)**		-0.081 (0.035)*	
Change in RDSHARE	-2.057 (1.081)	-2.067 (1.080)	-2.011 (0.988)*	-2.019 (0.991)*
Change in CR20		-0.129 (0.037)**		-0.012 (0.062)
Change in Trade Share	-0.208 (0.048)**	-0.217 (0.048)**	-0.101 (0.047)*	-0.097 (0.047)*
R^2	0.08	0.08	0.05	0.05
N	1,242	1,242	920	920

Notes: All four columns report levels long difference specifications. All four columns include year fixed effects. All variables are aggregated to the sector level. Labor share is defined at the sector level as total renumeration divided by value-added. Research and development share is the share of expenditures divided by total revenues at the sector level. Trade shares are the share of exports in revenues at the sector level. A * indicates significance at the 5 percent level and a ** indicates significance at the 1 percent level.

Table 5: Chinese Labor Share Regressions, 1998-2007
All Specifications are in First Differences

	Change in Labor Share	Change in Labor Share	Change in Labor Share	Change in Labor Share
Change in CR4	-0.080 (0.006)**		-0.150 (0.006)**	
Change in CR4 at county level	-0.016 (0.004)**		-0.014 (0.004)**	
Change in Trade Share	0.189 (0.004)**	0.188 (0.004)**	0.177 (0.004)**	0.178 (0.004)**
Change in TFP Calculated with OLS first stage	-0.234 (0.001)**	-0.235 (0.001)**		
Change in CR20		-0.088 (0.004)**		-0.144 (0.004)**
Change in CR20 at county level		0.001 (0.005)		0.004 (0.005)
Change in TFP Calculated using Olley Pakes			-0.225 (0.001)**	-0.226 (0.001)**
R^2	0.14	0.14	0.14	0.14
N	733,548	733,548	733,548	733,548

Appendix Table A1: Sample ORBIS Coverage (Number of Observations and Percent of Total by Country) 1995-2019

IS Code (from BVD)	Number of Observations	Percentage of Total
AT	263,164	0.19
BA	305,812	0.22
BE	1,641,694	1.18
BG	5,291,213	3,80
CN	8,547,283	6.13
CO	3,318,870	2.38
CZ	2,047,110	1.47
DE	1,751,549	1.26
DK	187,792	0.13
DZ	232,136	0.17
EE	1,188,813	0.85
ES	14,017,507	10.06
FI	2,484,724	1.78
FR	26,648,120	19.13
GR	472,777	0.34
HR	1,495,481	1.07
HU	4,765,725	3.42
IN	613,980	0.44
IS	230,803	0.17
IT	13,249,422	9.51
JP	4,105,580	2.95
KR	4,465,769	3.21
LT	241,865	0.17
LV	1,147,642	0.82
MA	812,006	0.58
MK	510,779	0.37
MY	2,169,845	1.56
NL	244,309	0.18
NO	2,349,608	1.69
PH	120,990	0.09
PL	1,836,308	1.32
PT	4,744,813	3.41
RO	7,303,858	5.24
RS	1,393,809	1.00
SE	5,375,334	3.86
SG	342,065	0.25
SI	1,327,330	0.95

SK	1,666,758	1.20
TH	3,132,326	2.25
TW	141,558	0.10
UA	4,604,442	3.30
US	157,062	0.11
VN	2,383,389	1.71
TOTAL	139,331,420	100.00

Appendix Table A2

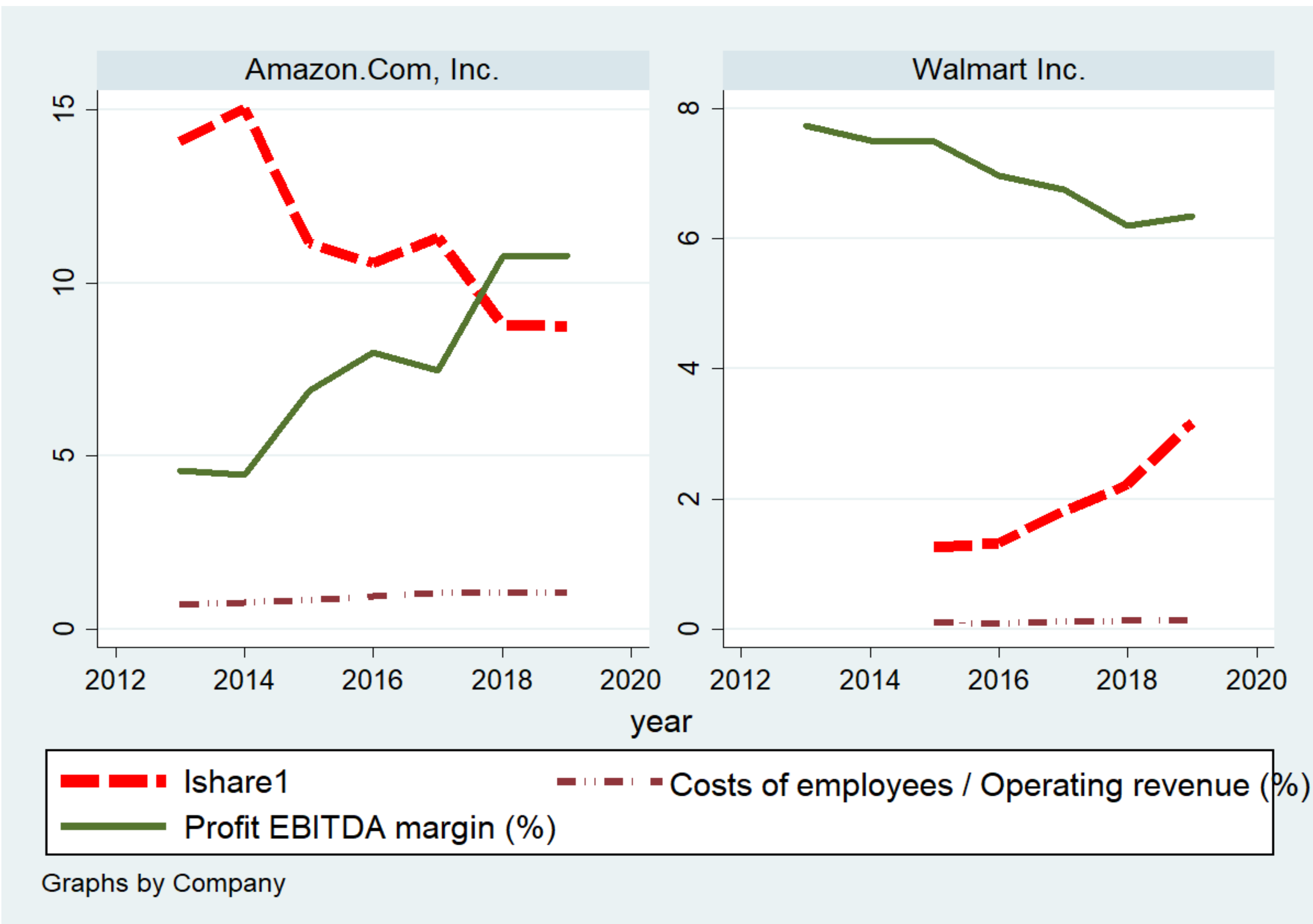
BvD major sector	Freq.	Percent	Cum.
Banks	586,804	0.42	0.42
Chemicals, rubber, plastics, non-meta..	3,492,515	2.51	2.93
Construction	16,716,787	12.00	14.93
Education, Health	4,682,746	3.36	18.29
Food, beverages, tobacco	2,731,167	1.96	20.25
Gas, Water, Electricity	873,543	0.63	20.87
Hotels & restaurants	6,729,901	4.83	25.70
Insurance companies	54,037	0.04	25.74
Machinery, equipment, furniture, recy..	7,374,811	5.29	31.04
Metals & metal products	3,624,388	2.60	33.64
Other services	41,543,345	29.82	63.45
Post & telecommunications	479,934	0.34	63.80
Primary sector	4,999,771	3.59	67.39
Public administration & defense	86,178	0.06	67.45
Publishing, printing	2,114,814	1.52	68.97
Textiles, wearing apparel, leather	2,464,516	1.77	70.73
Transport	5,435,211	3.90	74.64
Wholesale & retail trade	33,742,338	24.22	98.85
Wood, cork, paper	1,598,614	1.15	100.00
Total	139,331,420	100.00	

Appendix Table A3: Year Coverage

year	Freq.	Percent	Cum.
1995	635,015	0.46	0.46
1996	951,232	0.68	1.14
1997	1,182,118	0.85	1.99
1998	1,500,021	1.08	3.06
1999	1,741,844	1.25	4.31
2000	1,993,044	1.43	5.74
2001	2,512,884	1.80	7.55
2002	3,007,021	2.16	9.71

2003	**3,447,642**	**2.47**	**12.18**
2004	**4,244,054**	**3.05**	**15.23**
2005	**4,853,368**	**3.48**	**18.71**
2006	**5,115,059**	**3.67**	**22.38**
2007	**5,684,466**	**4.08**	**26.46**
2008	**6,023,847**	**4.32**	**30.78**
2009	**6,371,751**	**4.57**	**35.36**
2010	**6,642,710**	**4.77**	**40.12**
2011	**7,284,299**	**5.23**	**45.35**
2012	**7,608,112**	**5.46**	**50.81**
2013	**9,785,067**	**7.02**	**57.84**
2014	**11,273,903**	**8.09**	**65.93**
2015	**8,330,727**	**5.98**	**71.91**
2016	**10,528,234**	**7.56**	**79.46**
2017	**8,915,552**	**6.40**	**85.86**
2018	**10,509,032**	**7.54**	**93.40**
2019	**9,190,418**	**6.60**	**100.00**
Total	**139,331,420**	**100.00**	

Appendix Table A.4: Two Sample Companies--Amazon and Walmart



	Labor Share (Levels)		Change in Labor Share (Five Year Long Differences)					
CR4	-0.022							
	(0.007)**							
CR4_county	0.046							
	(0.001)**							
Trade Share (Sector)	0.005	0.002						
	(0.005)	(0.005)						
Patent count	-0.105	-0.107						
	(0.048)*	(0.048)*						
CR20		-0.048						
		(0.006)**						
CR20_county		0.031						
		(0.001)**						
Change In CR4_county			0.103		0.103		0.102	
			(0.007)**		(0.007)**		(0.007)**	
Change in Trade Share (Sector)			0.012	0.012	0.013	0.012	0.012	0.012
			(0.005)*	(0.005)*	(0.005)**	(0.005)*	(0.005)*	(0.005)*
Change in patent count			-0.380	-0.392			-0.338	-0.351
			(0.109)**	(0.109)**			(0.109)**	(0.109)**
Change in CR20				-0.016		-0.016		-0.017
				(0.005)**		(0.005)**		(0.005)**
dCR20_county				0.117		0.117		0.115
				(0.006)**		(0.006)**		(0.006)**
Change in patent Dummy (0 or 1)					-0.010	-0.010		
					(0.002)**	(0.002)**		
Change in log of Capital Stock							-0.008	-0.008
							(0.000)**	(0.000)**
R^2	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00
N	1,498,179	1,498,179	188,936	188,936	188,936	188,936	188,936	188,936

* p<0.05; ** p<0.01

Appendix Table A.5 Extensions with the Chinese Census DAta: Replacing TFP changes with Patent Counts and adding the Log of the Capital Stock as an Additional Control