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Corporate Tax Cuts and the Decline in the Manufacturing Labor Share

Barış Kaymak*   Immo Schott†

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Abstract

We document a strong empirical connection between corporate taxation and the manufacturing labor share, both in the US and across OECD countries. Our estimates associate 30 to 60 percent of the observed decline in labor shares with the fall in corporate taxation. Using an equilibrium model of an industry where firms differ in their capital intensities, we show that lower corporate tax rates reduce the labor share by raising the market share of capital-intensive firms. The tax elasticity of the labor share depends on the joint distribution of labor intensities and value added at the micro level. Given the empirical distribution in the US manufacturing sector, our quantitative analysis suggests that corporate tax cuts explain a significant part of the decline in the manufacturing labor share since the 1950s. The shift away from traditionally large, labor-intensive production units raised the concentration of market shares and reduced the concentration of employment.

JEL classification: E25, H32, L11, L60

Keywords: Labor share of income, corporate taxation, industry dynamics, firm size distribution

* Department of Economic Research, Federal Reserve Bank of Cleveland. E-mail: barkaymak@gmail.com

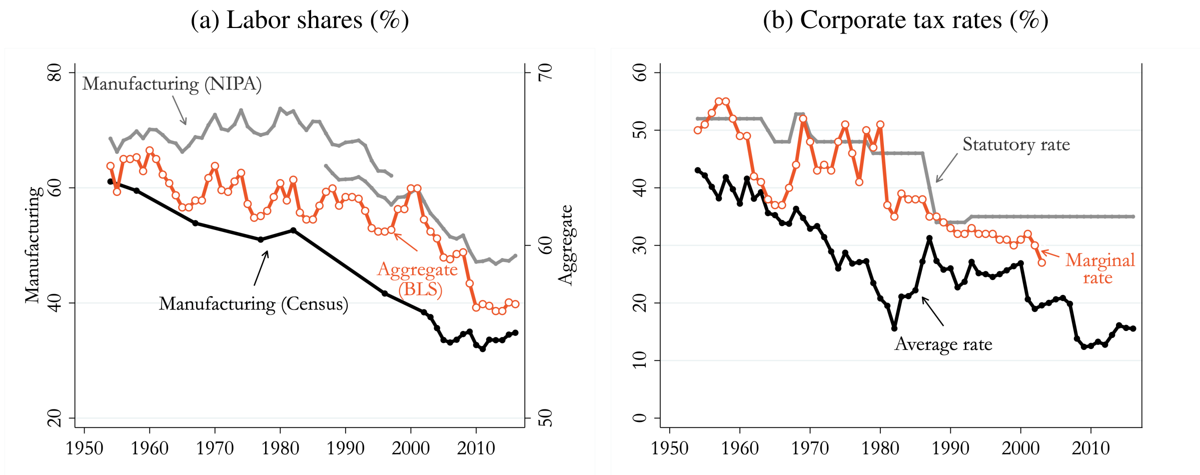
† Division of International Finance, Board of Governors of the Federal Reserve System. Email: immoschott@gmail.com

1 Introduction

Labor's share of income has been falling across the world, with the most striking declines observed in industries that have traditionally been capital intensive, such as manufacturing or mining (see, for instance, Elsby et al. (2013) or Karabarbounis and Neiman (2013)). In this paper we show that the decline of the labor share coincides with a downward trend in corporate tax rates and provide a framework to measure the marginal contribution of lower corporate tax rates to the decline of the labor share.

The downward trend in the labor share of income in the US is shown in Figure 1. Since 1953 the aggregate labor share fell by approximately 7 percentage points (pp), from around 65 percent to 58 percent. This is shown as the dashed red line, plotted against the right y-axis in panel (a). This decline is driven primarily by the manufacturing sector. Manufacturing labor share measures from the Census and the BEA are shown as the solid black and grey lines in the same figure. While the two sources somewhat disagree on the level of the manufacturing labor share, they both show declines of over 20 pp between the 1950s and 2016.[1] Because of the shift in the sectoral composition of US production away from manufacturing toward relatively labor-intensive sectors, such as services, the decline in the aggregate labor share has been muted.

Figure 1: Corporate taxation and labor's share of income in the United States



Panel (a) shows the headline aggregate labor share measure from the US Bureau of Labor Statistics (right y-axis), together with manufacturing labor shares from the US Census and the National Income and Product Accounts provided by the Bureau of Economic Analysis (BEA) (left y-axis). We complement the historical BEA data with BEA KLEMS data from 1986 onward. The average effective corporate tax rate in Panel (b) is the ratio of federal corporate tax revenue to corporate income. Sources: FRED, Tax Policy Center, and Gravelle (2004).

[1] In Online Appendix B, we compare labor share measures from a variety of data sources and discuss the differences. The total decline in the manufacturing labor share varies between 20 to 29 percentage points depending on the source and definition.

Over the same time period, business taxation has fallen. The average corporate tax rate - measured as the ratio of federal corporate tax revenue to corporate income - shows a steady decline from 46 percent in the 1950s to 16 percent in 2016 (Figure 1-b). The secular decline over the years is the result of various tax reforms that reduced the effective marginal tax rate (MTR) either by directly lowering the statutory tax rate on corporations or by expanding regulatory exemptions and allowances, such as the depreciation allowance or the investment tax credit. Based on the statutory provisions, Gravelle (2004) estimates that the effective MTR on corporate income had declined from over 50 percent in the 1950s to 27 percent by 2003. Relative to the headline statutory rate, these average and effective marginal rates better capture various provisions and exemptions in the tax code as well as efforts to minimize tax obligations. According to IRS statistics, C-corporations represented about 72% of business receipts on average between 1980 and 2015. The fact that C-corporations cover a large share of output in the economy is our main motivation for focusing on corporate tax policy. However, a similar trend is seen in tax rates on pass-through entities due to the secular fall in top marginal income tax rates since the 1950s and major tax reforms during the 1980s. The NBER's tax calculator TAXSIM estimates that the MTR fell from 46 percent to 35 percent for partnerships and from 36 percent to 23 percent for sole-proprietors between 1979 and 2008.[2]

These patterns are not unique to the United States. As we show below, there have been large decreases in labor shares among OECD countries, especially in manufacturing, where the labor share declined by 0.34 pp per year on average between 1981 and 2007. Throughout this period, corporate tax rates in those countries dropped by 19 pp on average. More importantly, we find that the labor share fell by more in countries with larger declines in their corporate tax rate, with a correlation coefficient of 0.71 in our sample. Using the co-variation between these trends within countries and over time, we estimate that 30 to 60 percent of the decline in the manufacturing labor share is associated with the fall in corporate taxation.

Motivated by these facts, we propose a model to study the impact of corporate taxation on the labor share. Our objective is to quantify the role of tax cuts, abstracting from other factors that might also impact the labor share. Our model is one of heterogeneous firms that differ in productivity as well as capital intensities. The aggregate industry labor share is given by an output-weighted average of firm-level shares. A reduction in the corporate tax rate lowers the cost of capital relative to labor. This disproportionately benefits capital-intensive firms and allows them to capture a larger share of the market. The ensuing reallocation of output toward capital-intensive firms lowers the aggregate labor share.

The extent of this reallocation - and thereby the decline in the labor share in our model - depends on the micro-level distribution of factor price elasticities and output in an industry.

[2]We abstract from organizational choices. If businesses reorganize to minimize tax obligations as in Dyrda and Pugsley (2018), firms' tax liabilities may have fallen by more than what Figure 1 suggests.

We show that the net-of-tax elasticity of the industry's labor share is determined by the output-weighted coefficient of variation of firm-level labor shares. Larger dispersion in labor shares or higher capital intensity at the industry level leads to larger declines in the industry's labor share in response to tax cuts.

We apply the model to study the long-run decline in the manufacturing labor share. Due to the availability of micro-level data on value added and factor intensities for the universe of establishments, the US manufacturing sector offers a unique opportunity to study a wide set of quantitative predictions about the marginal impact of tax rates. These include the industry's distributions of firm sizes, employment, and market shares, as well as its labor share. Importantly, the distribution of output and factor intensities is itself endogenous to tax rates. Therefore, to assess the long-run effects of tax changes allowing for such variations in the capital-labor substitutability, we adopt a calibration approach where we match the joint distribution of labor shares, value added, and employment at the firm level in 1967. This is essential to pin down the tax elasticity of the sectoral labor share. We then simulate two economies: one with an effective corporate tax rate of 50 percent, as estimated for 1954, and one with a tax rate of 20 percent, the estimated rate for 2014. The difference in industry labor shares of the two economies is 12.6 pp, which is about half of the observed decline in US manufacturing.

Although we focus on the manufacturing sector due to data availability over a long horizon, declines in the labor share are also seen to varying degrees in most other US sectors. For example, the mining sector experienced a similarly steep decline, whereas the wholesale and retail trade sectors show more modest reductions. Interestingly, the US service sector shows a slight upward trend in its labor share throughout our period of analysis.[3] While a rise in the labor share is difficult to reconcile with lower capital taxes in our setup, our model does offer a number of reasons for the sectoral variation in the extent of the decline in the labor share. Section 6 is dedicated to analyzing these sectoral differences. To do so, we combine the different tax elasticities that are implied by the sectors' micro-level distributions of factor intensities with the evolution of each sector's effective tax rate. The model's predictions correlate positively with the realized changes in the labor share across sectors, largely reflecting sectoral differences in tax elasticities. Changes in sector-specific effective tax rates have also played a role, implying relatively larger declines in manufacturing and transportation, and smaller declines in services and mining.

In our model, a reduction in corporate taxation also has implications for the distributions of employment and value added. The shift of production toward capital-intensive firms translates

[3] Across the countries in our sample, the labor share has declined in most industries, albeit to a lesser degree relative to manufacturing. The two exceptions are the service sectors in Denmark and the US, where we see slight increases in the labor share. In our analysis of the cross-country data below, we point to the relevance of counteracting trends in the service sector, which have more than offset the downward pressure on the labor share from tax cuts.

into higher market concentration. However, because the expansion of output implied by lower corporate tax rates is led primarily by capital-intensive firms, the concentration of employment declines. Labor-intensive firms, initially among the largest employers, shrink in size, in terms of both output and employment.

In Section 7, we test these predictions among US manufacturing industries. First, using the variation in state-level effective corporate tax rates, we find that lower corporate income tax rates are associated with a decline in the state's manufacturing labor share. Second, in industries where the effective tax rate declined by more, sales and value added became more concentrated over time in line with the model's predictions. Third, both employment concentration and average establishment size in manufacturing show a steady decline since the 1970s. Fourth, capital and investment per worker increased by more in manufacturing industries located in states that lowered their corporate tax rates. These patterns corroborate the theory that the decline in the labor share was caused in part by lower corporate tax rates.

The model's predictions regarding the distributions of labor shares and value added are consistent with recent empirical findings. Autor et al. (2020) show that a large part of the decline in the labor share took place within industries and that it was associated with rising market concentration in those industries. In their analysis of manufacturing establishments, Kehrig and Vincent (2021) show that the correlation between market shares and labor shares declined over time, resulting from a shift of market shares toward capital-intensive establishments. They document that the distribution of labor shares across establishments has otherwise remained stable.

Our paper contributes to the recent literature on the causes of the decline in the labor share. We focus on an institutional element, corporate taxation, however not to the exclusion of other proposed explanations. Several studies focus on aspects of the production function as an explanation. Karabarbounis and Neiman (2013) argue that a decreasing price of capital equipment in recent decades has led to capital deepening and reduced the labor share of output, implying that capital and labor are substitutes in production (with an elasticity of substitution greater than one). Lawrence (2015) argues that capital and labor are complements and attributes the fall of the labor share to effective labor deepening that resulted from labor-augmenting technical change. Glover and Short (2019) find an elasticity of substitution between capital and labor near or below unity, implying that capital deepening cannot explain the decline in the labor share. Alvarez-Cuadrado et al. (2018) assume that labor and capital are gross complements, and argue that the fall in the labor share is a result of differences in the paces of capital-biased technical change in the service and manufacturing sectors. In Acemoglu and Restrepo (2018) the automation of tasks reduces the labor share as more and more tasks are completed by machines.

Another strand of papers focuses on changes in the market structure to explain the fall in the labor share. Autor et al. (2020) argue that the increase in market concentration could result from a rising price elasticity of demand that led to an increase in product competition among firms and resulted in the most efficient (and capital-intensive) firms grabbing a larger share of the market. On the other hand, De Loecker et al. (2020) find that firms' market power has increased in the US, and argue that this raised the profit share at the expense of the labor and capital shares.[4]

Broadly speaking, the literature has largely ignored institutional elements that may potentially be responsible for the decline in the labor share. One exception is Elsby et al. (2013), who consider deunionization in the US as a potential factor, but find little correlation between the rate of unionization and labor shares across industries.[5]

In the next section, we document the link between corporate taxation and the labor share among OECD countries. In Section 3, we present our model and in Section 4, we provide a theoretical analysis of the effect of corporate taxation on the industry. Section 5 presents the quantitative evaluation of the impact of lower corporate taxes. Section 6 examines the variation in the decline of the labor share across major sectors. Section 7 assesses the predictions of the model in regard to the distributions of employment and value added in the US manufacturing sector. Section 8 concludes.

2 Corporate taxes and the labor share in OECD countries

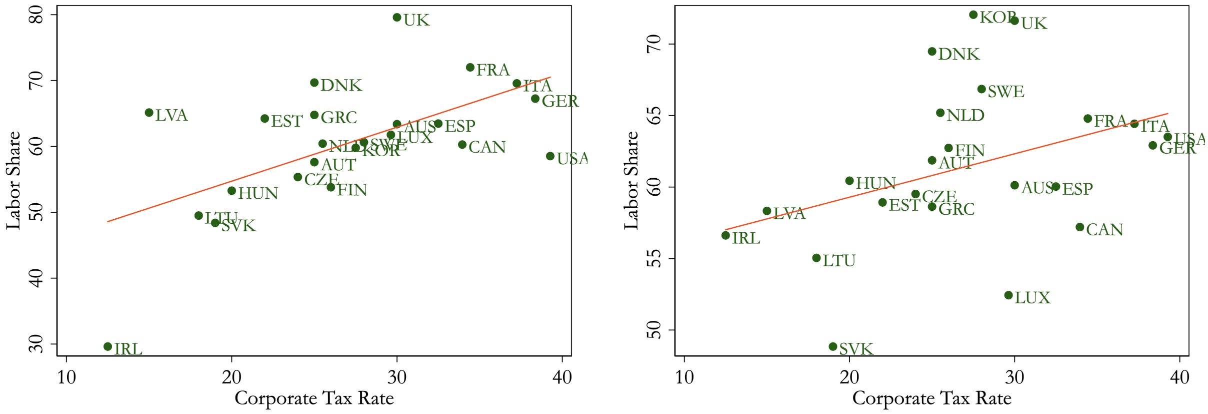
In this section we empirically investigate the link between corporate taxation and the labor share at the country level. Our data cover the period 1981–2007 for a set of OECD countries. The data on labor shares come from the World KLEMS database. Corporate tax rates are taken from the OECD and represent the combined central and sub-central statutory tax rates, where applicable.[6] See Online Appendix B for the details of our data sets.

Between 1981 and 2007 labor shares fell considerably. For the countries we observe throughout the sample period, the average fall in the aggregate labor share was 0.26 pp per year. This trend is more pronounced in the manufacturing sector, where the labor share fell by

[4]The idea that productive firms have gained an advantage vis-à-vis the rest of the economy is also expressed in Aghion et al. (2023) and Akcigit and Ates (forthcoming). In Aghion et al. (2023), productive firms expand into new markets due to falling costs. This leads to higher long-run markups and a lower long-run labor share. In Akcigit and Ates (forthcoming), a decline in knowledge diffusion across firms increases markups of top-firms and thereby reduces the labor share.

[5]Several papers attribute a significant fraction of the decline in *aggregate* labor shares to measurement issues, coming from housing (Rognlie, 2015) and intellectual property products (IPP) (Koh et al., 2020). The latter authors show that IPP matters mainly outside of manufacturing, which is our focus. We rely on administrative data for calculating manufacturing labor shares and do not use household-level data that might be susceptible to, e.g., changes in house prices.

[6]We use statutory tax rates in our cross-country analysis. The operating assumption is that the relative changes in the statutory rates are representative of those in the effective rates across countries.



(a) Manufacturing

(b) Aggregate

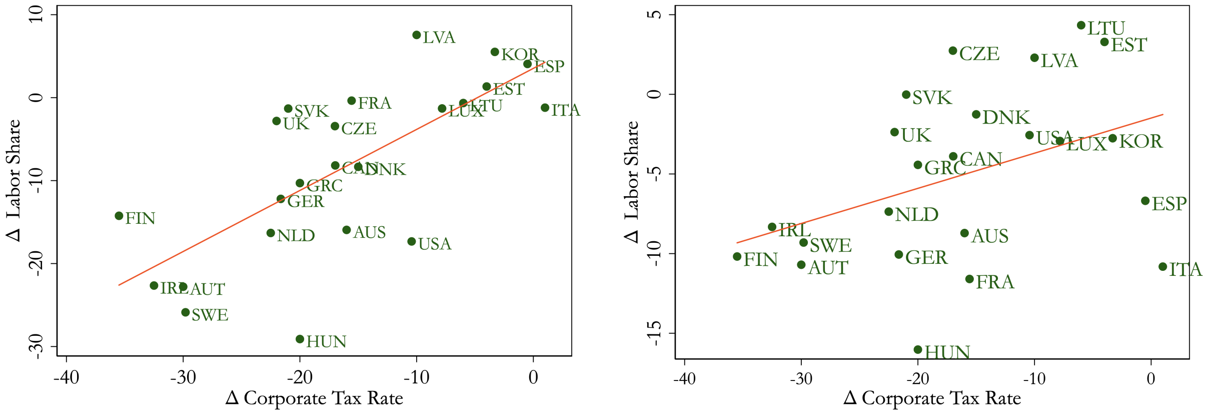
Figure 2: Corporate tax rate and labor share across countries
Statutory corporate tax rate and labor shares of income in the manufacturing sector and the aggregate economy in 2007. The correlation coefficient is 0.60 (s.e. 0.14) for the manufacturing sector and 0.39 (s.e. 0.17) for the aggregate economy. Source: OECD and KLEMS.

0.34 pp per year. This pattern is shared by most countries. The largest declines occurred in Sweden, Austria, and Ireland, where manufacturing labor shares declined by well over 20 pp. The smallest changes occurred in Spain, Italy, and France.

At the same time, there have been significant cuts to corporate tax rates. For the same set of countries, the average decline in the corporate tax rate between 1981 and 2007 was 19 pp, with substantial variation across countries. Among the countries with the largest cuts are Finland, Ireland, Austria, and Sweden with declines of over 30 pp (see Klein and Ventura (2021) for a detailed analysis of the business tax reform in Ireland). Almost no change in the corporate tax rates occurred in Italy and Spain. The underlying time series are shown in Online Appendix B.3.

At a cross-sectional level, there is a strong correlation between corporate tax rates and labor shares of income. Figure 2 shows a scatter plot of the two variables in 2007, for both manufacturing and the aggregate economy. The correlation coefficient is 0.60 with a standard error (s.e.) of 0.14 for manufacturing and 0.39 (s.e. 0.17) for the aggregate economy. The fact that the correlation is higher for manufacturing is not surprising. Because labor costs are deducted from profits, the tax burden essentially falls on capital. As a result, capital-intensive sectors are more sensitive to the corporate tax rate.

Figure 3 shows the country-level changes in the labor share between 1981 and 2007 against the changes in the corporate tax rate. There is a strong positive correlation between the two variables, especially in the manufacturing sector, where the correlation coefficient is 0.71 (s.e. 0.12). Countries that implemented larger cuts in corporate tax rates experienced a stronger fall in labor's share of income. A positive relation is also observed for the aggregate economy, with



(a) Manufacturing

(b) Aggregate

Figure 3: Trends in corporate tax rate and labor share: 1981–2007

Changes (in percentage points) in statutory corporate tax rate and labor shares of income between 1981 and 2007. The correlation coefficient is 0.71 (s.e. 0.12) for the manufacturing sector and 0.41 (s.e. 0.17) for the aggregate economy. Source: OECD and KLEMS.

a correlation coefficient of 0.41 (s.e. 0.17).

To test the relationship between labor shares and corporate tax rates more formally, we regress the labor share on the corporate tax rate, controlling for fixed country and year effects. The results are reported in Table 1. In manufacturing, the coefficient on the corporate tax rate is 0.36 (s.e. 0.09). This suggests that a 10 pp drop in the corporate tax rate is associated with 3.6 pp decrease in a country's manufacturing labor share.[7] Given the observed declines in the tax rates, the estimates in columns 1 and 2 of Table 1 imply that, on average, the corporate tax cuts are associated with a 7.7 pp drop in the manufacturing labor share and a 2.6 pp drop in the aggregate labor share throughout the sample period. These values correspond to 60 percent of the observed decline in manufacturing and 30 percent of the aggregate decline.

One concern with these results may be the presence of other factors that lead to a decline in the labor share and that may be correlated with changes in the corporate tax rate during the sample period. To address this concern, we include country-specific trends in the labor share for each sector in columns 3 and 4 of Table 1. The coefficient of the corporate tax rate is therefore identified by the accelerations and decelerations in the pace of the decline in the labor share. For the manufacturing sector, the coefficient on the corporate tax rate is somewhat smaller at 0.18 (s.e. 0.06). This lower coefficient implies that corporate tax cuts explain 31 percent of the decline in the manufacturing labor share for the countries in our sample. The coefficient for the aggregate economy remains almost unchanged at 0.10 (s.e. 0.05), and implies that corporate taxes are associated with 26 percent of the decline in the aggregate labor share.

[7]To check the sensitivity of the results to specification, we regressed 10-year changes in the labor share on 10-year changes in the corporate tax rate. The coefficients are 0.36 (0.18) for manufacturing and 0.15 (0.05) for the aggregate economy. These results are reported in Online Appendix D.3.

Table 1: Corporate taxation and the labor share

	Manufacturing	Aggregate	Manufacturing	Aggregate
Corporate Tax Rate	0.36	0.12	0.18	0.10
	(0.09)	(0.04)	(0.06)	(0.05)
Country Trends	No	No	Yes	Yes
N	579	579	579	579

The dependent variable is labor's share of income. All specifications control for fixed year and country effects. Specifications (3)-(4) control for country-specific linear trends. Standard errors are clustered at the country level. Source: OECD and KLEMS.

It is important to note that the coefficients in columns 3 and 4 are identified by the deviations from trend in one country relative to another. The assumption behind this approach is that the long-run association between the trends in corporate taxes and the labor share is a coincidence. As a result, the estimates represent a shorter-run elasticity of the labor share with respect to tax rates. Reflecting the Le Chatelier principle (Samuelson, 1947), the long-run elasticity is presumably larger if short-run adjustments to the factor intensity of production are costly. The estimates from the trend specifications can therefore be considered as a lower bound to the extent that the correlation between trends in fact reflects a causal relationship. We conclude that the fall in corporate taxes can explain between 31 to 60 percent of the decline in the manufacturing labor share across countries.

In Online Appendix D.2, we show that lower corporate tax rates were also accompanied by a rise in capital investment across countries. A 10 percentage point reduction in the tax rate is associated with a 3 to 5 percent increase in the capital-to-labor ratio across specifications. Combined with the positive tax elasticity of the labor share in Table 1, our findings are consistent with the substitution of capital for labor in response to a reduction in corporate taxes. This is in line with Karabarbounis and Neiman (2019), who also emphasize factor substitutability in their analysis of the role of falling capital prices in the global decline in the labor share. Note, however, that our findings in Table 1 are not driven by a correlation between corporate tax rates and investment good prices. Controlling for the price of capital in our regressions does not significantly affect our results in Table 1. The coefficients on the corporate tax rate are 0.32 (0.09) and 0.09 (0.04) for manufacturing and the aggregate economy.[8]

Our takeaway from the cross-country analysis is that falling corporate tax rates are an important element for understanding the decline in the labor share, especially in the manufacturing sector. The results should nonetheless be interpreted with caution, as causality is hard to establish without truly exogenous shifts in corporate tax policy, which are hard to come by at a macro scale. We therefore develop a model to analyze, theoretically and quantitatively, the

[8] These are the lowest coefficients we obtained across three alternative measures for the relative price of capital obtained from the Penn World Tables (version 9.1): the prices of capital stock, capital services, and investment goods, all relative to the price of household consumption. We have also controlled for labor costs using labor compensation per employee as a proxy for the wage rate. The coefficients in this case increase from 0.32 to 0.33 in manufacturing and 0.09 to 0.11 in the aggregate economy.

effect of corporate taxes on the labor share. The model allows us to study this effect in isolation by abstracting from other factors that might influence the empirical trends in the labor share.

3 An industry model with heterogeneous factor intensities

We develop an industry equilibrium model that builds on Hopenhayn and Rogerson (1993), modified to include corporate taxes and heterogeneity in labor intensities. The resulting framework connects the production technologies at the firm level with the industry-level response to changes in factor prices, in the spirit of Houthakker (1955) and more recently Oberfield and Raval (2021). This allows us to quantify the impact of tax changes on an industry's labor share based on the empirical distributions of output and labor shares among firms.

The model economy contains a mass of firms, a representative household, and a government. All firms produce a single good using capital and labor. Capital is managed by firms and labor is provided by the household. Output can be consumed or invested. The government taxes firms and redistributes the proceeds to the household in a lump-sum fashion, ensuring a balanced budget at all times. Time is discrete and the horizon is infinite. In what follows, we present the decision problems of firms and the household, describe the composition of firms in the industry, and define the stationary competitive equilibrium.

3.1 Incumbent firms

At time t there is an endogenous mass of incumbent firms, indexed by j. Firms differ in their capital stocks, determined by past investment choices, and in their production technologies, defined by efficiency, ε_j, and capital intensity, α_j. Technology is time-invariant.[9] Given capital, k_{jt}, each firm hires labor, n_{jt}, to carry out production. Output is given by $q_{jt} = \varepsilon_j {k_{jt}}^{\alpha_j} {n_{jt}}^{\beta_j}$. The production function displays diminishing returns to scale: $\alpha_j + \beta_j = \gamma < 1,\ \forall j$, implying a unitary elasticity of substitution between capital and labor at the establishment level. Our choice of a Cobb-Douglas form at the micro level is motivated by empirical work that highlights roughly constant labor shares for a given establishment over time (Kehrig and Vincent, 2021). As we show below, the industry labor share depends on how output is allocated across establishments and can thus vary over time.[10] We drop the firm subscripts j and t from hereon

[9]As we show below, the industry labor share is determined by the cross-sectional distribution of firms' factor intensities. For a given stationary distribution, temporal variations in firm-level capital intensities do not change the industry's labor share. We use the terms firms and establishments interchangeably throughout the exposition of the model. Note also that output and value added are identical in our model.

[10]As in Oberfield and Raval (2021), the elasticity of substitution between capital and labor is larger at the industry level than at the plant level in our model. Whereas they estimate a less than unitary elasticity both at the plant and industry level, our model features a more than unitary elasticity at the industry level since the plant level

for brevity.

Firms produce and sell their output to maximize profits net of taxes. Formally, letting p denote the price of the output good and w the wage rate, we define a firm's income before taxation as revenue minus labor expenses:[11]

$$\pi_b(k,\varepsilon,\alpha) = \max_n \; p\varepsilon k^\alpha n^\beta - wn, \tag{1}$$

where $\beta = \gamma - \alpha$. Let $n(k,\varepsilon,\alpha)$ denote the associated labor demand. A fraction $\tau > 0$ of $\pi_b(k,\varepsilon,\alpha)$ is taxed. The remaining income is distributed to shareholders and used to finance capital investment, i, which determines next period's capital stock : $k' = i + (1-\delta)k$, given a rate of depreciation $\delta \in (0,1]$.

Incumbent firms may stochastically exit the economy at an exogenous rate x independent of their technology or size.[12] Conditional on survival, future profits are discounted with $\rho \in (0,1)$. The effective discount rate, including the probability of firm survival, is $\tilde{\rho} = \rho \cdot (1-x)$. Given its capital stock, k, and its technology, (α,ε), a firm chooses k' to maximize its value, defined by the present-discounted distributions to shareholders.

$$V(k,\varepsilon,\alpha) = \max_{k'} \left\{ (1-\tau)\pi_b(k,\varepsilon,\alpha) + pk(1-\delta) - pk' + \tilde{\rho}V(k',\varepsilon,\alpha) \right\} \tag{2}$$

Let $k'(k,\varepsilon,\alpha)$ denote the associated capital policy function.

3.2 Entry and exit

Once a firm exits, it cannot re-enter the market at a later period. It liquidates all remaining resources and distributes them to its shareholders. There is a large mass of ex-ante identical potential entrants who can join the industry anytime by paying an entry cost of $c_e > 0$ units of output. This represents the cost of setting up shop, identifying a target customer group, etc. Once the entry cost has been paid, entrants draw a random efficiency level ε from the density $H(\varepsilon)$, and capital intensity α from the density $G(\alpha)$. The two draws are independent. The new firm then makes an investment for the first period of operation.

Potential entrants weigh the entry cost against the expected value of a firm before its technology is revealed. Free entry implies that the net value of entry must be zero at any equilibrium

elasticity is 1, as we show in Section 4.

[11]For expositional simplicity, we do not allow firms to write off depreciation expenses or debt service. This has no bearing on our quantitative results because the simulations below are based on *effective* marginal tax rates that already take into account the tax provisions for depreciation and debt-financing.

[12]This is motivated by empirical work in Kehrig and Vincent (2021), who do not find a significant role for entry and exit in the decline of the manufacturing labor share. A model with endogenous exit behavior would predict larger declines in the labor share than we find here.

with positive entry, giving the following equality.

$$pc_e = \int \int V(0, \varepsilon, \alpha) dH(\varepsilon) dG(\alpha). \tag{3}$$

Factors that raise the value of an incumbent firm for a given price level, such as a decline in the corporate tax rate, attract more entry. This triggers a change in the equilibrium price to ensure that the free-entry condition is satisfied.

3.3 Distribution of firms

The equilibrium distribution of firms is determined by entry and exit. The evolution of the distribution of incumbent firms, denoted by μ, is given by

$$\mu'(k', \varepsilon, \alpha) = \int_k (1-x)\mu(k, \varepsilon, \alpha)\, \mathcal{I}(k', k, \varepsilon, \alpha)\, dk \; + M h(\varepsilon) g(\alpha) \mathcal{I}(k', 0, \varepsilon, \alpha), \tag{4}$$

where the indicator function $\mathcal{I}(k', k, \varepsilon, \alpha) = 1$ if $k'(k, \varepsilon, \alpha) = k'$ and M denotes the mass of entrants.

3.4 Households

There is a representative household with preferences over streams of consumption goods. The household is endowed with one unit of productive time each period. Labor is supplied inelastically to the production sector in return for wage income. The household owns all firms.[13] Consumption expenditures are financed through disposable income, which consists of labor earnings, dividends from firms, and transfers from the government: $p \cdot C = w \cdot 1 + D + T$.

3.5 Competitive equilibrium

Let $s = (k, \varepsilon, \alpha)$ denote the state of a firm. A stationary recursive competitive equilibrium consists of nine endogenous objects: a policy function for labor demand $n(s)$, a policy function for capital demand $k'(s)$, a value function for firms $V(s)$, a positive mass of entrants M, a distribution of incumbent firms $\mu(s)$, aggregate consumption C, aggregate dividend payments

[13]Because we study steady-state equilibria, we abstract from the household's portfolio choice problem for brevity. More generally, the household chooses a consumption stream C_t along with shares $a_t(s)$ of each firm type $s = (k, \varepsilon, \alpha)$, to maximize lifetime utility $\sum_{t=0}^{\infty} u(C_t)$ subject to the sequential budget constraint $C_t + \int \nu_t(s) a_{t+1}(s) ds = w_t \cdot 1 + \int (\nu_t(s) + D_t(s)) a_t(s)) ds + T_t$, where $\nu_t(s)$ is the price of a share and $D_t(s)$ denotes dividends. At the steady-state, $C_t = C_{t+1}$, implying the constant discount rate $\tilde{\rho}$ in the firm's problem; $\nu_t(s)$ equals the value of a firm $V(s)$, and the household holds the entirety of all firm types: $a_t(s) = \mu_t(s)$.

to households D, government transfers to households T, and an output price p, such that *i)* $n(s)$ solves the labor decision problem in (1), *ii)* $k'(s)$ solves the investment problem in (2), *iii)* V is the value function (2) evaluated at the optimal policy functions, *iv)* the labor market clears $\int n(s)\mu(s)ds = 1$, *v)* the distribution of incumbent firms is stationary: $\mu'(s) = \mu(s)$, *vi)* the household's budget constraint holds: $p \cdot C = w \cdot 1 + D + T$, *vii)* dividends equal net aggregate profits $D = \int [(1-\tau)\pi_b(s) - p\delta k]\,\mu(s)ds - Mpc_e$, *viii)* the government budget is balanced $T = \tau \int \pi_b(s)\mu(s)ds$, and *ix)* the free-entry condition (3) is satisfied at price p.

The wage rate is the numéraire and, hence, does not appear explicitly. The equilibrium definition implies aggregate feasibility, i.e., total output equals the sum of aggregate consumption, investment, and resources spent on entry costs: $\int q\mu(s)ds = C + \int \delta k\mu(s)ds + Mc_e$.

Given the parameters, we compute the numerical solution to the stationary equilibrium as follows. For a given tax rate τ, we guess a price level p and compute policy functions for capital and labor along with the associated value function. If the value does not equal the entry cost pc_e, we adjust the price guess. We continue this guess-and-verify procedure via a bisection method until we find the equilibrium price at which the free-entry condition is satisfied. Because the distribution of incumbent firms is homogeneous of degree one in the mass of entrants, M can be pinned down through the labor market clearing condition. The stationary distribution of firms then determines aggregate dividends and taxes, which determine the steady-state consumption level.

4 Corporate taxes and the industry labor share

In this section we analyze the stationary equilibrium of the model and demonstrate how corporate taxes affect factor demands and the labor share in the industry. To maintain tractability, we aggregate firms with different efficiencies, ε, but the same level of capital intensity α. This yields a representative firm for each type α with the production function $q(k, n, \alpha) = \mathbb{E}[\varepsilon^{\frac{1}{1-\gamma}}]k^{\alpha}n^{\beta}$. Without loss of generality, we normalize productivity such that $\mathbb{E}[\varepsilon^{\frac{1}{1-\gamma}}] = 1$.[14] We return to the original formulation for the quantitative analysis in Section 5.

In what follows, we first establish the relationship between factor prices and the distribution of output among firms with different capital intensities. This allows us to translate changes in relative factor prices into changes in industry factor shares. The partial equilibrium effects are analyzed first, followed by the general equilibrium effects that arise from changes in the industry's price level. We conclude by linking the effects of a change in the tax rate to equilibrium

[14] We abstract from long-run growth. Balanced growth, where firm-level distributions of employment and output are stable, requires that entry costs rise with output (Klenow and Li, 2022). In our model, this is necessary to keep the labor share stable in a growing economy. By normalizing aggregate productivity, we implicitly assume that the entry costs rise with aggregate productivity.

prices and establish our main result. Finally, we discuss the elasticity of factor substitution in our framework.

The optimal labor and capital demand functions implied by the firm's problem in (2) are:

$$n(\alpha) = \left(\frac{\beta}{\bar{w}}\right)^{\frac{1-\alpha}{1-\gamma}} \left(\frac{\alpha}{r_\tau}\right)^{\frac{\alpha}{1-\gamma}} \qquad \text{and} \qquad k'(\alpha) = \left(\frac{\beta}{\bar{w}}\right)^{\frac{\beta}{1-\gamma}} \left(\frac{\alpha}{r_\tau}\right)^{\frac{1-\beta}{1-\gamma}}, \tag{5}$$

where $\bar{w} = w/p$ is the effective cost of labor and $r_\tau \equiv \frac{1}{1-\tau}\left(\frac{1-\tilde{\rho}}{\tilde{\rho}} + \delta\right)$ is the gross user cost of capital as a function of the effective discount rate, the corporate tax rate, τ, and the depreciation rate, δ. Note that r_τ is increasing in τ, while $\bar{w}$ is decreasing in the price level, p. Labor demand is not distorted by the corporate tax rate because labor costs are deducted from profits in (1). By contrast, corporate taxes reduce capital demand by increasing the cost of capital r_τ. Combining the factor demands in (5), output is given by

$$q(\alpha) = \left(\frac{\alpha}{r_\tau}\right)^{\frac{\alpha}{1-\gamma}} \left(\frac{\beta}{\bar{w}}\right)^{\frac{\beta}{1-\gamma}}, \tag{6}$$

and the corresponding capital and labor cost elasticities of output are

$$\eta_{q,r_\tau} = -\frac{\alpha}{1-\gamma} \qquad\qquad \eta_{q,\bar{w}} = -\frac{\gamma-\alpha}{1-\gamma}. \tag{7}$$

Capital-intensive firms (higher α) are more sensitive to changes in the cost of capital and less sensitive to changes in the cost of labor. Similarly, changes in the real wage, $\bar{w}$, generate a stronger output response among labor-intensive firms. As a result, the distribution of output across firms depends on the relative cost of capital and labor.

The industry labor share, denoted by $\hat{\beta}_q$, is the output-weighted average of firm-level labor shares:

$$\hat{\beta}_q = \int \lambda(\alpha)\beta(\alpha)dG(\alpha) = \gamma - \int \lambda(\alpha)\alpha dG(\alpha) = \gamma - \hat{\alpha}_q, \tag{8}$$

with output weights $\lambda(\alpha)$ given by

$$\lambda(\alpha) = \frac{q(\alpha)}{\int q(\alpha)dG(\alpha)}. \tag{9}$$

Because $G(\alpha)$ is fixed, changes in the industry labor share in the model are driven entirely by changes in the distribution of output. The following lemma establishes how a firm's output weight $\lambda(\alpha)$ responds to a change in the cost of capital.[15]

[15] All proofs can be found in the Appendix.

Lemma 1 *The partial elasticity of output share $\lambda(\alpha)$ with respect to the cost of capital r_τ is:*

$$\eta_{\lambda,r_\tau} = -\frac{\alpha - \hat{\alpha}_q}{1-\gamma}$$

Lemma 1 shows that the change in the market share of type-α firms depends on their relative capital intensity. Following a drop in the cost of capital, firms with above-average capital intensities ($\alpha > \hat{\alpha}_q$) see a rise in their output shares, while those with below-average intensities see a decline. These changes reduce the industry's labor share. The proposition below reports the magnitude of this effect in partial equilibrium.

Proposition 1 *For a given price level p, a decrease in the cost of capital lowers the industry's labor share, with the marginal change given by:*

$$\frac{\partial \hat{\beta}_q}{\partial \log r_\tau} = \frac{\hat{\sigma}_q^2(\alpha)}{1-\gamma},$$

where $\hat{\sigma}_q^2(\alpha) = \int \lambda(\alpha)(\alpha - \hat{\alpha})^2 dG(\alpha)$ is the output-weighted variance of capital intensity in the industry.

When $\hat{\sigma}_q^2(\alpha) = 0$, all firms in the industry have the same capital intensity regardless of the relative factor price. However, when there is dispersion in capital intensities, a lower cost of capital raises the output share of capital-intensive firms, resulting in a fall in the industry's labor share. The larger the dispersion in factor intensities, the larger the reallocation of output, and, hence, the larger the decline in the industry's labor share.

Next, we discuss the impact of the corporate tax rate on the equilibrium price. In the model, the equilibrium price is determined by the free-entry condition, which equates the cost of entry to the expected value of the firm. A higher tax rate τ lowers the value of the firm while a higher price level raises the value of the firm as stated in Lemma 2.

Lemma 2 *Firm value is decreasing in τ and increasing in p.*

A decrease in the tax rate raises the firm value, which encourages entry. To ensure that the free-entry condition is met, the price level p must fall. This result is obtained by combining Lemma 2 with the free-entry condition in the proposition below.

Proposition 2 *With free entry, the equilibrium price, p, is increasing in the tax rate, τ.*

Proposition 2 states that any additional profits from lower tax liabilities are passed on to consumers through lower prices. This results in a higher real wage $\bar{w} = w/p$ (recall that the wage rate serves as the numéraire ($w = 1$)). As in Harberger's (1962) seminal analysis, a fall in the price, p, amplifies the gains from lower corporate taxes to consumers and workers, partially offsetting the gains in profits.[16] In industry equilibrium models, this is operationalized by the competitive pressure at the firm entry margin.

A fall in the equilibrium price effectively raises the cost of labor by reducing the revenue per unit of output sold relative to the wage cost of producing that unit. As labor-intensive firms are more sensitive to labor costs, their output share falls further as established by the following lemma.

Lemma 3 *The partial elasticity of output share $\lambda(\alpha)$ with respect to price p is:*

$$\eta_{\lambda,p} = -\frac{\alpha - \hat{\alpha}_q}{1-\gamma}.$$

Firms that are more labor intensive than the average firm in the industry, i.e. $\alpha < \hat{\alpha}_q$, see their output shares fall following a decrease in the price level. This additional shift of production toward capital-intensive firms results in a further decline in the labor share in the industry.

Proposition 3 *A decrease in the price level lowers the aggregate labor share, with the marginal change given by:*

$$\frac{\partial \hat{\beta}}{\partial \log p} = \frac{\hat{\sigma}_q^2(\alpha)}{1-\gamma}.$$

Together, Propositions 1 and 3 determine the total effect of a fall in the corporate tax rate on the aggregate labor share in equilibrium. The following proposition combines the partial and general equilibrium effects and gives the main result of this section.

Proposition 4 *The total (equilibrium) elasticity of the aggregate labor share with respect to the net-of-tax rate is given by:*

$$\eta_{\hat{\beta}_q,(1-\tau)} = -\frac{1}{1-\gamma}\left(\frac{\hat{\sigma}_q^2(\alpha)}{\hat{\beta}_q}\right)^2 < 0$$

The overall decline in the aggregate labor share in response to lower taxes depends on *i)* the tax elasticity of the user cost of capital, *ii)* the cost elasticity of industry prices, and *iii)* the dispersion of factor intensities in the industry. Increases in either of these factors lead to larger declines in the industry's labor share. Proposition 4 shows that these three factors can

[16] Recent empirical papers suggest that the tax burden is shared between capital and labor. Fuest et al. (2018), for instance, find that in Germany the economic incidence on capital of corporate taxation is half the statutory incidence. Saez and Zucman (2016) find that about a third of state-level corporate taxes are passed on to labor.

be summarized by the output-weighted coefficient of variation of micro-level labor intensities. A tax cut decreases the industry's labor share by more, the larger is the dispersion of labor intensities and the lower is the initial level of the industry's labor share. The span-of-control, γ, determines how elastic production is with respect to factor costs. Higher γ generates a larger shift in output toward capital-intensive firms, and result in a higher net-of-tax elasticity of the industry's labor share.

The reallocation of output away from labor-intensive firms raises capital and lowers labor per establishment. The following proposition lays out the relevant elasticities with respect to to the net-of-tax rate:

Proposition 5 *The equilibrium elasticities of the average demand for capital, $\bar{k}$, and labor, $\bar{n}$, with respect to the net-of-tax rate $(1-\tau)$ are:*

$$\eta_{\bar{k},(1-\tau)} = \frac{1}{1-\gamma}\left(1 - \frac{\hat{\beta}_k}{\hat{\beta}_q}\right) > 0 \qquad \textit{and} \qquad \eta_{\bar{n},(1-\tau)} = \frac{1}{\hat{\beta}_q}\left(\frac{\hat{\beta}_q - \hat{\beta}_n}{1-\gamma} - 1\right) < 0$$

Here $\hat{\beta}_k$ and $\hat{\beta}_n$ are capital- and employment-weighted averages of firm-level labor shares. Because employment is skewed toward labor-intensive firms and capital is skewed toward capital-intensive firms, $\hat{\beta}_k < \hat{\beta}_q < \hat{\beta}_n$ in our model. Combining the two elasticities gives the response of aggregate capital per worker in the industry, as shown in the following proposition.

Proposition 6 *The equilibrium elasticity of aggregate capital per worker with respect to the net-of-tax rate is:*

$$\eta_{K/N,(1-\tau)} = \underbrace{\left[1 + \frac{\hat{\beta}_n - \hat{\beta}_k}{1-\gamma}\right]}_{\eta_{K/N,\bar{w}/r_\tau}} \cdot \underbrace{\frac{1}{\hat{\beta}_q}}_{\eta_{\bar{w}/r_\tau,(1-\tau)}} > 1$$

This elasticity has two components. The term in brackets is the elasticity of factor substitution, $\eta_{K/N,\bar{w}/r_\tau}$. It is above one because $\hat{\beta}_k < \hat{\beta}_n$. Because the micro-level production function is Cobb-Douglas, the excess substitutability comes entirely from the reallocation of output across firms. The extent of substitutability along this extensive margin reflects the heterogeneity in factor intensities in the industry. When all firms have the same factor intensity, $\hat{\beta}_k = \hat{\beta}_n$, and the industry level elasticity of substitution is equal to one.[17] The second term in Proposition 6, $1/\hat{\beta}_q$, is the elasticity of the equilibrium factor price ratio with respect to the net-of-tax rate. It exceeds 1 in equilibrium, because the direct effect of a tax cut on the cost of capital is

[17] Some algebra makes this explicit: $\hat{\beta}_n - \hat{\beta}_k = \frac{\gamma}{\gamma - \hat{\beta}_q}\frac{\hat{\sigma}_q^2(\alpha)}{\hat{\beta}_q}$. As $\hat{\sigma}_q(\alpha)$ approaches 0, so does $\hat{\beta}_n - \hat{\beta}_k$.

compounded by the equilibrium price response in the industry (Proposition 2). That response depends on the labor intensity of the industry. The more capital intensive it is, the larger the effect of tax cuts on profits, and the stronger the price response in equilibrium.

Combining Propositions 3 and 6 yields the following relation between the response of the labor share and the response of capital per worker to a change in the tax rate:

$$\frac{\eta_{K/N,(1-\tau)}}{\eta_{\hat{\beta}_q,(1-\tau)}} = -\frac{\eta_{K/N,\bar{w}/r_\tau}}{\eta_{K/N,\bar{w}/r_\tau} - 1} \cdot \frac{\gamma}{\gamma - \hat{\beta}_q}, \tag{10}$$

where $\eta_{K/N,\bar{w}/r_\tau}$ is the elasticity of factor substitution. It exceeds 1 if and only if the labor share declines and the capital per worker increases following a tax cut. Easier substitutability (higher $\eta_{K/N,\bar{w}/r_\tau}$) is associated with a weaker response in capital per worker relative to the labor share response. Conversely, larger increases in K/N are needed to lower the industry's labor share, when substitutability is low.

Note that the industry-level elasticities reported here are endogenous to how output, capital, and labor are distributed across firms with different factor intensities. These distributions are in turn determined by the level of the tax rate and, more broadly, by the relative costs of capital and labor. For instance, changes in factor costs alter not only the level of the labor share, but also its sensitivity to the tax rate. At the extremes, e.g., where the cost of capital is much lower than that of labor, the market shares are heavily concentrated, leading to a smaller tax elasticity of the labor share.[18]

In this sense, the elasticities above should be interpreted as local to the steady state. Measures of the elasticities based on point-in-time data on market shares and labor shares are therefore suitable only if the market share distribution can be assumed to remain reasonably stable. For longer-run analyses, as in the case of a secular decline in the tax rate, model simulations are preferable in order to capture endogenous variations in capital-labor substitutability.

5 Quantitative results

In this section, we provide a measure of the effect of lower corporate taxes on the decline in the manufacturing labor share in the US. Proposition 4 showed how the tax elasticity of an industry's labor share depends on the distribution of factor intensities and output at the micro level. We therefore calibrate the model to match the distributions of labor intensities, employ-

[18] At the limit, where the least labor-intensive firms produce the entire output, the elasticity converges to zero. Labor obsolescence, however, would not arise in our model at the limit, unless there is a mass of firms that exclusively use capital for production ($\beta = 0$).

Table 2: Calibration summary: Preset parameters

Parameter	Value	Target
δ	0.10	Depreciation Rate
γ	0.85	Span of Control
x	0.10	Exit Rate, Census BDS
ρ	0.96	Real Rate of Return $r \approx 4\%$
w	1	Numéraire
τ_{1967}	0.40	Corporate Income Tax in 1967
τ_{1954}	0.50	Corporate Income Tax in 1954
τ_{2014}	0.20	Corporate Income Tax in 2014

ment, and value added in the manufacturing sector in 1967.[19] We then simulate two economies: one where the corporate tax rate is 50 percent, the effective marginal corporate tax rate estimated by Gravelle (2004) for 1954, and one with a 20 percent corporate tax rate, the estimated marginal rate provided by the US Congressional Budget Office (2014).[20] All other primitives are kept constant to focus on the marginal effect of corporate taxation. Throughout our analysis, we compare long-run equilibria associated with different tax policies. Each equilibrium has a stationary distribution of firms in the industry and features a positive entry rate.

5.1 Model calibration

A model period corresponds to one year. The discount rate ρ is set to 0.96. The capital depreciation rate is $\delta = 0.10$. The span-of-control parameter is set to 0.85 as in Restuccia and Rogerson (2008) and implies that profits constitute 15 percent of income. The exogenous exit rate is set to 10 percent.[21] Recall that the wage is the numéraire. We set the 1967 corporate tax rate to $\tau = 0.40$ based on Gravelle (2004). These parameter choices are summarized in Table 2.

The remaining four parameters are jointly calibrated to four key moments that represent the distributions of employment, value added, and labor intensities in US manufacturing. A heuristic discussion of their connection to data moments can nonetheless provide some insight into their identification.

The first two parameters determine the heterogeneity in efficiency ε, which in turn affects the employment size distribution in the industry. We use average employment and concentra-

[19]We calibrate to 1967 data because this is the first year for which Census of Manufactures information on the joint distribution of labor shares and value added is available.

[20]The statutory rate in 1954 was 52 percent. The highest effective corporate tax rate was 63 percent in 1953.

[21]The exogenous exit rate we chose comes from the US Census Bureau's Business Dynamics Statistics manufacturing data and reflects the average rate between 1977 and 2004.

Table 3: Calibration summary: Jointly identified parameters

Parameter	Value	Targets from 1967	Data	Model
μ_ε	0.767	Average establishment size	60.5	60.5
σ_ε	0.290	Employment share of large establishments (250+)	0.60	0.60
$\underline{\beta}$	0.252	Manufacturing labor share	0.54	0.54
c_e	158.15	VA-weighted p50(LS) / median(LS)	0.89	0.89

tion of employment as targets for the mean and the variance of $\log \varepsilon$. Specifically, we target the number of employees per establishment and the fraction of employment in establishments with more than 250 employees from the 1967 Census of Manufactures.[22] To calibrate the distribution of labor intensities across firms in 1967, we follow the empirical evidence in Kehrig and Vincent (2021) and assume that labor shares β follow a symmetric triangular distribution across firms. This distribution is characterized by two parameters: an upper and a lower bound. Because β cannot exceed γ, the latter determines the upper bound. The lower bound, $\underline{\beta}$, is calibrated by targeting the manufacturing labor share in 1967, which was equal to 53.9 percent according to the Annual Survey of Manufactures (ASM).[23]

Finally, to pin down the entry cost c_e, we use a concentration measure from the joint distribution of manufacturing labor shares and value added. Specifically, we target the ratio of the value added (VA) weighted median labor share to the unweighted median labor share reported by Kehrig and Vincent (2021).[24] A ratio of one corresponds to a symmetric distribution of value added over firms with different labor intensities. Ratios below one represent an output distribution biased toward capital-intensive firms. This ratio, which we denote by Λ, was 0.89 in 1967, implying a roughly symmetric distribution of value added across establishments with different labor intensities. The entry cost c_e determines the equilibrium price p in the industry from the free-entry condition (3). As we showed above, changes in the equilibrium price in turn determine the real effective wage cost for the industry, w/p, and thereby the distribution of output over firms with different labor intensities. That is how c_e is identified.

The resulting parameter estimates are shown in Table 3 along with the targeted moments. These estimates minimize the average percentage difference between data and model moments at 0.3 percent. Table 4 compares the implied distributions of establishments, employment, and value added across production sites with the corresponding data from the manufacturing sector

[22]The Census BDS data and the Census of Manufactures report employment in various size-class bins. In 1967, establishments with 250+ employees constituted the largest 4.25 percent of all establishments and represent 60.05 percent of total employment. Below we compute Pareto indices to facilitate the comparison of concentration measures over time.

[23]Because there is some disagreement on the manufacturing labor share in 1967 across data sources (see Online Appendix B.2), we report results for alternative target values below.

[24]The median value added weighted labor share says that 50 percent of all value added is produced by establishments with a labor share lower than or equal to this value.

Table 4: Distributions of establishments, employment and value added.

Data: 1967					
Establisment Size:	<20	20-99	100-249	250-999	1,000+
Establishments	65.0	24.2	6.5	3.6	0.7
Employment	5.6	17.7	16.6	27.3	32.8
Value Added	5.1	14.9	14.9	27.1	38.0
Calibrated model					
Establishment Size:	<20	20-99	100-249	250-999	1,000+
Establishments	65.7	23.2	6.8	3.5	0.8
Employment	5.9	16.8	17.2	26.6	33.5
Value Added	6.1	17.2	17.6	26.5	32.6

The data come from the 1967 Statistical Abstract of the United States. Details can be found in Online Appendix B.

reported in the 1967 Statistical Abstract of the United States. Even though only average establishment size and one employment concentration moment were targeted, the model matches all three distributions very well. Both the share of establishments in the various size bins, and their share of total employment and value added are close to their empirical counterparts. This is an encouraging sign of the model's suitability for gauging the quantitative implications of tax changes, because these distributions determine the industry-level elasticities in the model.

5.2 Corporate tax cuts and the labor share in manufacturing

We now simulate two different economies: one with a corporate tax rate of 50 percent, as observed in 1954, and one with a corporate tax rate of 20 percent, as observed in 2014. The results are summarized in Table 5. The key finding is that a decrease in the corporate tax rate from 50 percent to 20 percent results in a decline in the labor share from 58.9 percent to 45.5 percent, i.e., a decline of 13.4 pp.

This decline reflects partial and general equilibrium effects of roughly equal magnitude. In our simulations, holding the price level constant while lowering the corporate tax rate to 20 percent reduces the labor share by 6.9 pp. The general equilibrium effect comes from a lower price. This reduces profits per unit of output relative to the cost of labor and thereby offsets gains from lower taxation, especially among labor-intensive firms. Fixing $\tau = 0.5$ while lowering the price to the equilibrium level associated with $\tau = 0.2$ gives a 7.4 pp drop in the labor share across steady states.[25]

The total decline of 13.4 for the 30 point drop in the tax rate between 1954 and 2014 implies

[25] The elasticity of the price with respect to the tax rate is slightly lower when entry costs are denominated in labor units versus output units. In that alternative scenario, the labor share falls by 11.9 pp in equilibrium.

Table 5: Policy experiment - A drop in corporate taxes

	Model Simulations			Data		
Year	1967	1954	2014	1967	1954	2014
Corp. tax rate (τ)	0.40	0.50	0.20	0.40	0.50	0.20
Labor share	0.54	0.59	0.46	0.54	0.61	0.34
Median LS ratio Λ	0.89	1.27	0.62	0.89	-	0.44
Inverse Pareto Index (250+)	0.84	0.88	0.80	0.84	0.84	0.77
Average Establishment Size	60.5	103.6	23.8	60.5	54.5	44.4
Price Level p	1.00	1.18	0.71	-	-	-
Cost of capital r_τ	1.00	1.20	0.75	-	-	-
Aggregate Capital Demand	1.00	0.54	2.80			

Column "1967" corresponds to the calibrated benchmark economy for which the price level and cost of capital have been normalized to one in the table. The model simulations for 1954 and 2014 use a corporate tax rate of respectively 50 percent and 20 percent. The "Data" columns use ASM and BDS data. The labor share ratio Λ is the output-weighted median divided by the unweighted median labor share. The output-weighted labor share moment is taken from Kehrig and Vincent (2021) and corresponds to the year 2012. This moment is unavailable in 1954. The inverse Pareto indices refer to employment concentration and are discussed in Section 5.5.

a 0.45 point decline in the labor share per point drop in the tax rate in the long run. This is slightly above the 0.36 (0.09) estimate obtained in the cross-country data (Column 1 of Table 1). Considering the 27 point decrease in the US manufacturing labor share, from 61 percent in 1954 to 34 percent in 2014, observed in the Census data, our results imply that corporate tax cuts explain about half of the total decline in the manufacturing labor share during this period.

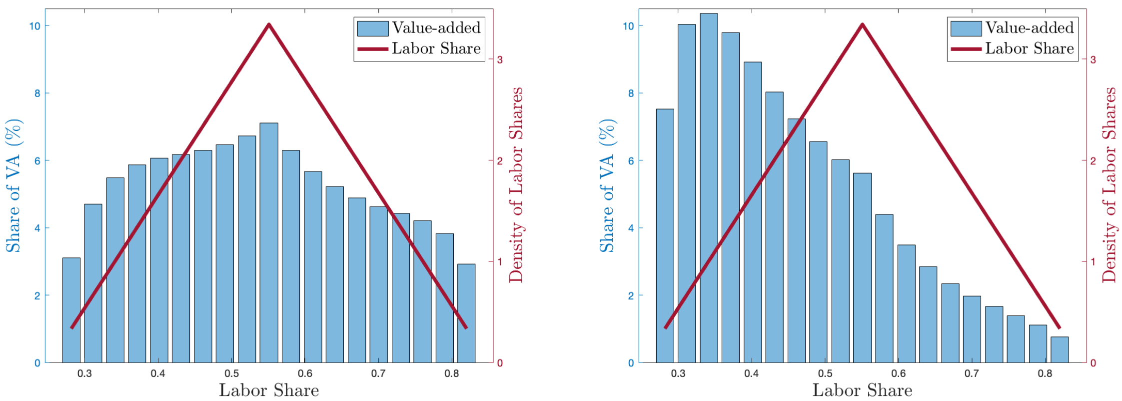
Recall from Proposition 3 that a lower industry labor share is associated with a larger sensitivity to tax rates for a given dispersion in factor intensities at the firm level. Because there is some disagreement across data sources on the level of the labor share in the 1960s, we performed model simulations with higher labor share targets for the 1967 economy. Raising the target to 70 percent, the highest estimate (reported by the BEA), results in an 8.7 point drop in the labor share between 1954 and 2014. This corresponds to roughly 40 percent of the 21 point decline observed in the BEA data. The implied rate of decline in the labor share is 0.29 point per point drop in the tax rate, which is slightly below our cross-country estimate of 0.36 (0.09).

The tax elasticity of the labor share also depends on the span of control parameter, γ. Higher values of γ raise the cost elasticity of production and imply a larger output reallocation toward capital-intensive firms. Setting $\gamma = 0.9$, for instance, results in a decline of 26 pp whereas setting $\gamma = 0.8$ implies a decline of 8.1 pp in the manufacturing labor share.

It is worth noting, however, that these alternative calibrations generate a poorer fit of the firm level distributions of employment and value added. Both the higher γ, and the higher initial labor share result in a counterfactually high concentration of employment among large employers relative to the data, whereas the benchmark calibration is consistent with the observed distributions of employment and value added as shown in Table 4.

5.3 Implications for the output distribution

The reallocation of production in response to the lower tax rate is shown in Figure 4, which groups firms according to their labor share on the horizontal axis. For each labor share type, the (red) line shows the frequency of firms and the (blue) bars show that group's share of output. The benchmark economy with $\tau = 0.40$ displays a roughly symmetric distribution of output, implying little cross-sectional correlation with labor share (panel a). Half of the output is produced by firms with a labor share lower than 49 percent, whereas the median labor share is 55 percent (recall that their ratio $\Lambda = 0.89$ is a calibration target). Following the decrease in the tax rate, production shifts toward capital-intensive firms (panel b). Half the output is now produced by firms with less than a 34 percent labor share, whereas the median labor share is still 55 percent, implying $\Lambda = 0.62$. An even greater reallocation can be seen in the US manufacturing data, where this ratio declines all the way to 0.44 at the end of our sample period (Kehrig and Vincent, 2021).



(a) Benchmark Economy, $\tau = 40\%$ (b) Lower Corporate Tax Rate $\tau = 20\%$

Figure 4: Joint distribution of labor shares and value added.
The figures show distributions of value added (blue bars, left axes) and firm-level labor shares (red line, right axes). Panel (a) shows the calibrated benchmark economy. Panel (b) shows the model economy with a corporate tax rate of 20 percent.

From the theoretical analysis in Section 4, the model unambiguously predicts a decline in the cross-sectional correlation between output shares and labor shares in response to a lower tax rate. However, this does not necessarily imply an increase in the concentration in the *unconditional* output distribution as well. Had market shares before the corporate tax cut been highly concentrated among labor-intensive firms, then the relative decline in the output share of those firms would have led to a declining market concentration instead. The fact that the distribution of output shares was approximately symmetric across labor intensities in 1967 implies that major changes in the tax rate in either direction would have resulted in an increase in market concentration.

To facilitate the comparison of concentration measures across time, we compute (inverse) Pareto indices implied by the output share of firms above a certain production level relative to their share in the firm population.[26] In our simulations, the output concentration index (implied by the output share of the largest 5 percent of firms, for instance) increases from 0.85 to 0.87 when the tax rate drops from 0.5 to 0.2. Concentration indices based on sales (and more recently on value added) show similar upward trends.[27]

5.4 Implications for capital investment

The reallocation of production away from labor-intensive firms increases the overall capital intensity of the industry. Comparing the 2014 economy with 1954 in Table 5, the model predicts a 3.5-fold increase in capital per worker. In comparison, the NBER manufacturing database shows a 4.6-fold increase in the capital-to-labor ratio in the US between 1958 and 2011, reflecting, in part, aggregate TFP growth.

The drop in the relative price of capital in the model, both directly from lower taxes and indirectly from the higher equilibrium real wage, implies a long-run average elasticity of substitution between capital and labor of 1.29 for the years 1954–2014. This value is consistent with the findings of Karabarbounis and Neiman (2019), who report the macro-level estimates to range between 1.17 and 1.49, with an average of 1.28. As we noted above, this elasticity is not constant in our model. The concentration of output among a smaller set of firms in later years reduces the (output-weighted) dispersion in factor intensities in the economy, which lowers aggregate factor substitutability in the industry. The average model elasticity of factor substitution between 1967 and 2014 is 1.1 instead.

Recall from equation (10) that the relative tax elasticities of the labor share and of the industry's capital per labor are informative of the elasticity of factor substitution. The relative responses of the labor share and capital investment in the model are similar to our estimates from the cross-country data. From Table 5, capital doubles and the labor share declines from 0.54 to 0.46 between 1967 and 2014, the period closer to our cross-country coverage. These give a log-ratio of -4.3 ($= \ln(2)/\ln(0.46/0.54)$). In comparison, the cross-country estimates imply a 0.1 percent drop in the aggregate labor share and a 0.3 to 0.5 percent rise in capital per worker (Tables D.1 and D.2), implying a log-ratio that is in the -3 to -5 range.[28] Trends in US manufacturing suggest a similar ratio. In the NBER manufacturing database, the labor share fell from 0.54 to 0.34 while capital per worker increased 4.6 fold, implying a log-ratio of

[26] Letting q_x denote the output share of largest s_x percent of firms, the Pareto index is: $\iota_P = \log s_x/(\log s_x - \log q_x)$.

[27] The indices based on the sales shares of the top 4, 8, 20 or 50 firms increase from 0.74, 0.79, 0.85 and 0.89 to 0.78, 0.82, 0.87 and 0.91 between 1972 and 2012, the first and last years available in the data.

[28] The regression of the labor share to net-of-tax rate in logs yields an estimate of 0.10 (0.04), similar to 0.12 in Table 1 Column 1.

-3.3. The similarity of these ratios between the model and the data suggests that the extent of substitutability in the model is consistent with that observed across countries.

5.5 Implications for the employment distribution

Despite the rise in output concentration the model predicts a decline in employment concentration and a drop in average employment at the firm level (rows 4 and 5 of Table 5). In the benchmark economy, even though output is distributed symmetrically across firm types, employment is skewed toward labor-intensive firms because those firms require more labor per unit of output. With a lower tax rate, more output is produced by capital-intensive firms, which need fewer units of labor per output. As the industry moves from a traditional labor-intensive structure to a capital-intensive structure, the correlation between labor intensity and market share declines. Labor-intensive firms, initially among the largest employers, shrink in terms of both output and employment. As a result, the concentration of employment decreases and average employment falls.

Table 6 compares the employment distributions in the simulated 2014 economy with the data. Establishments with more than 250 employees, for instance, represented 4.3 percent of establishments and captured 60.1 percent of manufacturing employment in 1967. In 2014, only 3.2 percent of establishments had more than 250 employees and they accounted for 46 percent of manufacturing employment. The associated concentration index, defined by the inverse of the Pareto index implied by the share of employment among the largest employers, fell from 0.84 to 0.77. The comparable employment concentration index falls from 0.84 to 0.80 in the model (Table 5).[29] Although none of these moments were targeted in the model calibration, the model captures the reallocation of employment toward small firm in the data.

The shift in employment toward smaller firms also reduces average employment. The model overstates the magnitude of this effect (average employment goes from 61 to 24 versus from 61 to 44 in the data), which we attribute to the lack of technological progress in the model. An increase in industry TFP would raise the average establishment size in our model, mitigating the fall implied by the rising market shares of capital-intensive firms.

As was the case with value added concentration, it should be noted that the predicted lower employment concentration depends on the industry's initial size distribution. If employment is initially concentrated among labor-intensive firms - as in the case of the manufacturing sector - then lower taxes can be expected to reduce employment concentration.[30]

[29]Online Appendix Figure D.1 shows a secular decline in all concentration indices based on alternative size classes of establishments and of firms. Comparing the trends in employment concentration across major sectors, we find that manufacturing and mining stand out in both dimensions, while sectors with relatively smaller declines in their labor share do not show a decline in employment concentration.

[30]Sectoral differences in the firm-level correlation between initial value-added shares and factor intensities

Table 6: Employment Distributions

Data: 2014					
Establishment Size:	<20	20-99	100-249	250-999	1,000+
Establishments	67.1	23.6	6.1	2.8	0.4
Employment	9.5	23.7	21.2	28.2	17.3
Model: Simulation with $\tau = .2$					
Establishment Size:	<20	20-99	100-249	250-999	1,000+
Establishments	82.1	13.5	2.9	1.3	0.2
Employment	13.8	24.0	18.5	23.6	20.1

The upper panel shows the 2014 Census BDS data. The lower panel shows model simulation from the economy with the 20 percent corporate tax rate.

6 Beyond the manufacturing sector

Although we have focused our analysis on the manufacturing sector, it is reasonable to expect similar labor share declines in all sectors. After all, corporate taxes have declined for all corporations, which represent a large share of output in many sectors. Interestingly, however, with the exception of the mining sector, the decline in the labor share has been more moderate outside of manufacturing. In this section, we extend our quantitative analysis to other major sectors in the US and examine whether the relatively smaller declines in labor shares in other sectors are consistent with our proposed mechanism.

From the perspective of the model, two factors could lead to variation in the decline in the labor share across sectors. First, the tax elasticities of the labor share may differ across sectors, e.g., due to differences in the within-sector distributions of value added and factor intensities. This would lead to varying labor share responses to a given change in the tax rate. Second, reforms of the tax code can be reflected differently in the effective tax rates applicable to each sector. Such differences may arise from differences in capital composition, the size of fixed investment, or, simply, sector-specific allowances and exemptions. We illustrate the role of these two factors below.

In what follows, we maintain our calibration approach to quantify the marginal effect of tax cuts by major sector. Industry-level data moments, such as the exit rate or average employment, are available from the BDS for major sectors. In regards to the joint distribution of labor shares and value added, we draw on firm-level data from Compustat because the Census coverage of the requisite data is limited to the manufacturing sector. Compustat only covers publicly listed firms. This could confound our findings if publicly listed firms were selected differently

could result in divergent trends in employment concentration in reaction to falling tax rates. This could potentially explain the lack of correlation between the trends in employment concentration ratios and the labor shares across narrowly defined industries (Autor et al., 2020).

across sectors in a way that also correlates with their tax elasticities.[31] Because the model's tax elasticity is based on the output-weighted dispersion of factor intensities, our concerns regarding non-random selection are somewhat mitigated by the fact that listed companies represent a large share of US output. Finally, we find that the distribution of factor intensities within the manufacturing sector in Compustat is very similar to what was obtained from the Census data.

We compute the labor share for each firm as the ratio of its reported wage bill to its value added (defined by the sum of operating income before depreciation, changes in inventories, and the wage bill). Many firms lack information on wage payments, which presents a challenge for calculating labor shares. Following Donangelo et al. (2019) and İmrohoroğlu and Tüzel (2014), if the wage bill is not reported, we impute a value either by using reported values in adjacent years or by multiplying employment with the average wage in a firm's 3-digit industry from the Quarterly Census of Employment and Wages (QCEW) during that year.[32] This gives us a distribution of firm-level labor shares and value added by year. We exclude construction, agriculture, and financial services, each of which has fewer than 30 firms in our Compustat sample. We focus on the 10-year period prior to 1985 to compute our target moments.

Table 7 shows the descriptive statistics from Compustat for six major sectors. All moments are weighted by value added. Recall from Proposition 3 that sectors with a larger dispersion in labor shares and those with lower overall labor shares can be expected to be more sensitive to tax rates. The manufacturing, mining, and wholesale trade sectors fall into this category. By contrast TCPU (Transportation, Communications and Public Utilities) and retail trade show relatively little dispersion in labor intensities. The service sector shows a somewhat higher dispersion, but also a higher overall labor share.

Finally, our calibration requires a tax rate for each sector. Column 1 in Table 7 shows the average effective tax rates obtained from the IRS corporate tax statistics for 1985 - the benchmark year for our calibration - and for 2013. The difference is shown in Column 3.[33] The 1985 rates show substantial variation across sectors from 22 percent in services to 40 percent in manufacturing and TCPU. The tax rates in 2013 are more similar to each other, varying from 19 to 23 percent, with the exception of manufacturing, where the tax rate is 28 percent. This implies larger decreases in tax rates among sectors that had higher initial rates. Consequently, the lowest drop is seen in services (3 points) and the largest drops are seen in TCPU (19 points) followed by manufacturing (12 points).

[31] Specifically, Compustat data would understate tax elasticities if publicly listed firms were disproportionately selected from the middle of their sector's labor intensity distribution. If, in addition, such selection were stronger in sectors with limited declines in the labor share, then our findings would falsely attribute the sectoral differences in the decline in the labor share to tax cuts. We do not see an a priori reason to suspect that either is the case.

[32] Among firms that explicitly report their wage bill, the correlation between the imputed and the reported labor share is 0.86, which gives us some confidence in the imputation procedure. Online Appendix C provides the details.

[33] IRS data do not distinguish between wholesale and retail trade. We assume that the tax rate is identical in these two sectors and report results for each separately and also for the combined trade sector.

Table 7: Effective tax rates and the distribution of labor share across major sectors

	Tax rate			Labor share			
Sector	τ_{1985}	τ_{2013}	$\Delta\tau$	mean	median	std.	N
Manufacturing	0.40	0.28	-0.12	0.60	0.65	0.20	1,879
Mining	0.29	0.23	-0.07	0.41	0.30	0.22	203
TCPU	0.40	0.21	-0.20	0.71	0.70	0.11	117
Trade	0.32	0.23	-0.09	0.61	0.62	0.14	427
Wholesale Trade	-	-		0.59	0.58	0.19	202
Retail Trade	-	-		0.61	0.62	0.12	225
Services	0.22	0.19	-0.03	0.69	0.70	0.17	355

Columns 1-3 show average tax rates. Columns 4-6 show the mean, median, and standard deviation of the firm-level labor shares for each sector weighted by value added. N denotes the number of firms. Sources: IRS (1985–2013) and Compustat (1975–1985).

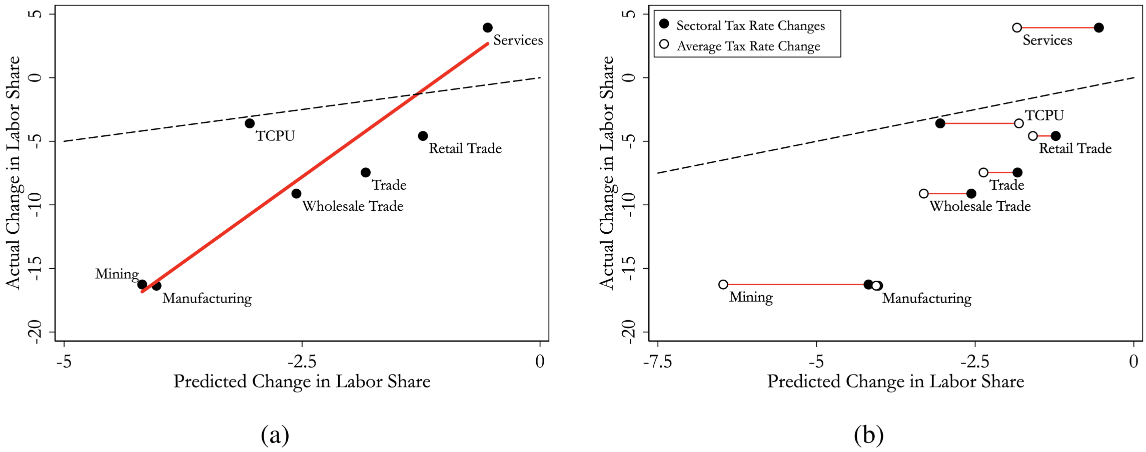


Figure 5: Declines in the labor share in major sectors: Model versus data
Panel (a) contrasts the declines in the sectoral labor shares in the data between 1985 and 2014 (y-axis) with the model predictions (x-axis). Dashed lines show the equality axis. The solid (red) line in Panel (a) shows the linear fit. Panel (b) adds model predictions assuming that all sectors paid the same tax rates (white circles). The difference between the two predictions are attributable to sectoral differences in the changes in effective tax rates.

To quantify the marginal impact of tax cuts on the labor share, we calibrate the model to match the sectoral labor shares given the tax rates in effect in 1985. We then simulate a new equilibrium using the 2013 tax rates. Details of our calibration, values for data moments, and calibrated parameter values for each sector can be found in Online Appendix C. We summarize the results in Figure 5. Panel (a) compares the predicted changes in the sectoral labor share from tax changes (x-axis) with the actual decline in the sector's labor share between 1987 and 2014 from the BEA.[34] Because tax rates fall in all sectors, the predicted changes are negative throughout. With the exception of services, where the actual labor share increased, the predicted changes are smaller than the changes seen in the data. The dashed line represents the 45° line on which the predicted and actual changes would be equal. Given the output shares of

[34] BEA data on sectoral labor shares are available beginning in 1987.

these major sectors during the 1980s, the model attributes 36 percent of the observed decline to lower tax rates on average.[35] Across sectors, the predictions correlate positively with the observed declines in the labor share with a coefficient of 0.89. This is encouraging, because it shows that the model gives a reasonable depiction of sectoral differences in labor share trends. Nonetheless, taxes only partially explain the sectoral differences in the decline in the labor share.

The predicted sectoral variation in the decline in the labor share is driven mainly by differences in the sectoral tax elasticities. This is illustrated in panel (b). For each sector, the black dot corresponds to the predicted decline in labor shares using that sector's specific tax rate (the same as in panel (a)). The white dots in panel (b) show the predicted changes assuming a uniform decline in their effective tax rates - taken to be the the change in the aggregate tax rate - starting from the initial sector-specific levels. These predictions are driven only by the differences in tax elasticities, yet they remain large. The (horizontal) differences between white and black dots for each sector are attributable to the differential effect of tax changes instead. TCPU shows a relatively muted decline in this counterfactual scenario, reflecting the more than average decline in its effective tax rate. In contrast, services and mining would have seen larger declines had the fall in tax rates in these sectors been comparable to the US average.

The labor share in the service sector presents a unique puzzle as it increases in the data despite the fall in the tax rate. The increase during the post-1986 period shown in Figure 5 is part of a longer-term upward trend in the US led by health care and education services prior to the 1986 tax reform (Elsby et al., 2013), which is likely to reflect factors outside of our model. From that perspective, our findings suggest that the service-sector labor share would have risen faster had it not been for the lower tax rates.

Cross-country data on the service-sector labor share shed some light on the importance of counteracting trends in the service sector. In our sample of OECD countries between 1981 and 2007, the service-sector labor share shows an upward trend only in Denmark and the US, and a downward trend in all other countries, albeit at a slower pace relative to manufacturing. To estimate the role of long-run trends for the service sector, we regress the labor share on the country's corporate tax rate, controlling for fixed country and year effects as we did for manufacturing in Section 2. The marginal effect of corporate tax rates on the service-sector labor share is 0.13 (0.06) when country-specific trends are included in the regression and 0.04 (0.06) when they are not. That is, controlling for trends reveals a higher tax elasticity in the service sector. This suggests that the long-run trends in the service-sector labor share have tended to counter the downward pressure from lower tax rates. The prediction for the US service sector in Figure 5 is consistent with an 0.18 ($= 0.55/3$) point drop in the labor share in

[35] Using 1980s' output weights to aggregate sectors in both 1985 and 2014, the total change is 2.2 points in the model. Constant weights imply a 6.1 point drop in the data. Because the composition of output trends toward services during this period, the actual change in the data is 3.3 points.

response to a 1 point decline in the tax rate, close to the 0.16 estimated from cross-country data controlling for long-run trends. This suggests lower taxes are likely associated with a decline in the labor share in services as well, albeit at a smaller rate than manufacturing, consistent with the model's predictions.

Overall, we conclude that even though the corporate tax system applies to all entities in statute, the sensitivity of economic activity and output reallocation to tax rates depends on the distribution of factor intensities in each sector and on the effective corporate tax rate that applies to the sector.

7 Evidence from state corporate taxes and patterns across US manufacturing industries

In this section we empirically assess the relevance of the model's mechanisms that link corporate taxation to the labor share. In particular, we ask whether lower tax rates are associated with increased capital investment, higher market concentration, and firm entry across industries in the US manufacturing sector. To that end, we exploit differences in corporate tax policy across US states to construct tax rates for each manufacturing industry based on where they are located. We then relate these tax rates to industry characteristics and test whether the evolution of labor shares, investment, value added, and market concentration is broadly consistent with the model's implications.

7.1 Corporate taxes and the labor share across US states

We begin by discussing the cross-state patterns in the evolution of corporate tax rates and how they relate to changes in the manufacturing labor share in that state. Differences in tax policy across states are rather complex and stem not just from the headline statutory rate but also from the generosity of exemptions, loss-offset carry horizons, teaser credits for new businesses, etc. As a summary measure, we define each state's effective corporate tax rate by the ratio of corporate tax revenue to profits, measured by the total gross operating surplus. The resulting rates are low relative to the federal tax rate ranging from 0 percent to 4.2 percent. Unlike the average federal tax rate, which shows a downward trend over time, average state tax rates show a more mixed pattern (see Online Appendix B.3 for detailed graphs).

We relate these patterns in the tax rate to states' labor shares in manufacturing, obtained from the Census of Manufactures for every five years between 1972 and 2007.[36] Figure 6 plots

[36]In our analysis of the US manufacturing industry the labor share refers to the payroll share at operating

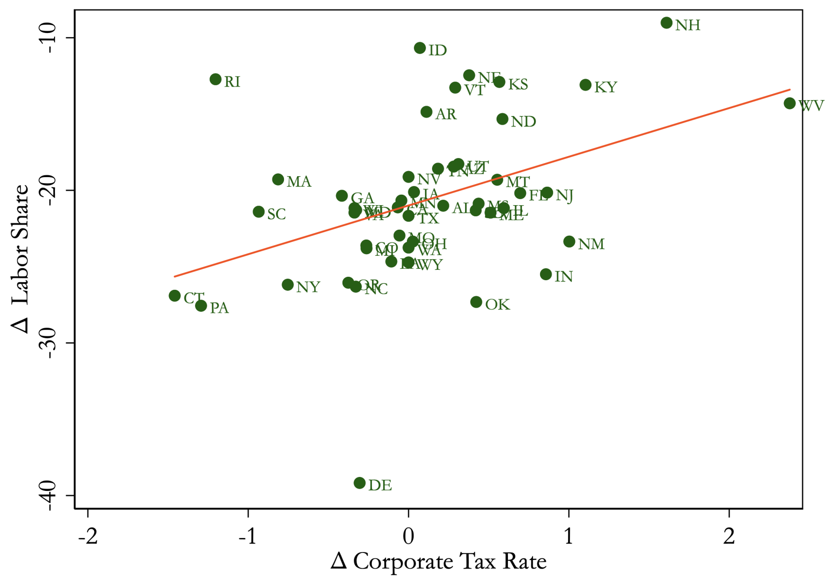


Figure 6: Corporate tax rate and manufacturing labor share in the US: 1972–2007
Graph shows the state-level changes in the manufacturing sector labor share and the average corporate tax rate in percentage points. The correlation coefficient between the two variables is 0.42 (s.e. 0.11).

the changes in states' labor shares against changes in average corporate tax rates between 1972 and 2007. Reflecting the aggregate trend, manufacturing labor shares have fallen in all states. More importantly, there is a strong positive link between the two variables: states with larger decreases in the state-level corporate tax rate experienced a larger fall in the manufacturing labor share.

Table 8 shows the estimates from a regression of state-level manufacturing labor shares on the state's average corporate tax rate. The specification in the first column controls for state and year fixed effects. The coefficient implies that a 1 percentage point drop in a state's average corporate tax rate is associated with a 2.35 pp drop in its manufacturing labor share. This is large relative to the cross-country estimates in Table 1. Note, however, that the average tax rates are well below the statutory rates, with an average ratio of 0.17 among states with positive tax rates. This suggests a statutory tax elasticity of 0.39 ($= 2.35 * 0.17$), which is closer to the 0.36 from the cross-country data.

In Column 2, we report estimates from a specification that controls for state-specific trends. The coefficient is 2.62 (s.e. 0.82), suggesting that the result is not driven by a spurious correlation between trends in labor shares and tax rates at the state level. The next two columns control for the changes in labor costs proxied by the state's average wage and salary disbursements during the year. The coefficient on the corporate tax rate remains similar.

manufacturing establishments and is defined as the ratio of total payroll to total value added. See Online Appendix B for detailed data definitions.

Table 8: Corporate taxation and the labor share across US states

	(1)	(2)	(3)	(4)	(5)	(6)
Corporate Tax Rate	2.35	2.62	2.80	2.81	3.47	3.23
	(0.74)	(0.82)	(0.69)	(0.81)	(0.77)	(1.08)
log Wage			0.08	0.08	0.12	0.12
			(0.04)	(0.05)	(0.04)	(0.07)
Unemployment rate					0.54	0.26
					(0.21)	(0.17)
State Trends	no	yes	no	yes	no	yes
N	384	384	384	384	336	336

The dependent variable is the payroll share of value added in the manufacturing sector of a state. Corporate tax rate denotes the average corporate tax rate in a state. All specifications control for year and state fixed effects. Standard errors are clustered at the state level. Data come from the Annual Survey of Manufactures 1972–2012, the BEA, and Saez and Zucman (2016). The last two columns cover the 1977 to 2012 period.

It is plausible that corporate tax rates react to economic conditions and are therefore not exogenous to the labor share. We think, however, that such endogeneity likely renders our estimates conservative. A procyclical tax policy, designed to smooth out cyclical fluctuations, would bias the estimates downward because the labor share is known to be countercyclical. Indeed, including the state unemployment rate as a control variable in columns (5) and (6) of Table 8 gives higher coefficient estimates for the tax rate.

These empirical patterns show that changes in corporate taxation are positively related to labor shares across US states, in line with the findings in Section 2 from cross-country data. The estimated coefficients vary from 0.39 to 0.58 across specifications after accounting for the difference between average and statutory rates. These are somewhat larger than the 0.18 to 0.36 range suggested by the cross-country data in Table 1. The state-level estimates likely reflect the high mobility of capital between states and therefore do not necessarily provide an accurate picture of what might be expected at the aggregate level.

7.2 From states to industries

To relate the trends in industry characteristics to changes in state-level corporate taxes, we compute industry-specific effective tax rates based on the location of establishments in each industry. In particular, we combine the state-level average corporate tax rates with data on the number of establishments by state and industry. In this way, we compute an establishment-weighted average of state-level tax rates for each 4-digit SIC industry available for the years 1974 to 2011.

The differences in effective industry tax rates emerge from changes in state-level tax rates given the location of establishments in each industry. The apportionment of a firm's tax liabilities can be more complicated in reality, e.g., if a firm operates multiple establishments across state boundaries, or if it produces in one state, but markets its product in another state. To test the accuracy of our approach in capturing the industry-level variation in effective tax rates, we regress the industry's labor share on the industry's tax rate. The coefficient on the corporate tax rate is 2.9 (s.e. 1.2) percent, which is comparable to the estimates reported in Table 8. This gives us confidence in the empirical results below, which compares outcomes across industries.

7.3 Capital-labor ratio

A key implication of the model is the reallocation of production away from labor-intensive firms, which raises the overall capital intensity of the industry. We now investigate this relationship among US manufacturing industries by testing whether industries that saw relatively larger increases in capital-labor ratios were those that experienced larger declines in labor shares and effective corporate tax rates. By comparing industries within the manufacturing sector we abstract from aggregate trends in investment activity in the US.[37]

The industry data come from the NBER Manufacturing Database, which provides information on labor compensation, value added, and capital investment in the manufacturing sector at the 4-digit SIC level. We measure the labor share by the ratio of total payroll to value added and the investment activity by the capital-labor ratio and investment expenditures per worker. We first check whether the labor share decline was accompanied by an increase in capital accumulation by regressing the investment measures on an industry's labor share while controlling for fixed year and industry effects. The results, presented in the first two columns in panel (a) of Table 9, show that industries where the labor share declined have experienced increased investment activity relative to other manufacturing industries. A 1 pp fall in the labor share is associated with a 0.33 percent increase in capital per worker and a 1.3 percent increase in investment per worker.

More importantly, the results presented in panel (b) of Table 9 show a significant tax response of capital investment. A 1 percentage point increase in the effective tax rate is associated with a 0.25 percent drop in capital per worker. This is qualitatively consistent with the model, but quantitatively much higher than our quantitative findings in Section 5 and our estimates from the cross-country data. This suggests a particularly high mobility of capital across industries in response to US state tax policies. Such mobility is limited at the aggregate level, where additional capital has to be either accumulated over time or financed by another country.

[37]Recent work by Gutiérrez and Philippon (2017) points out an apparent disconnect between market-based profitability measures and net aggregate investment rates after 2000. This seems especially puzzling in light of declining capital costs (see, e.g., Barkai (2020)). Farhi and Gourio (2018) provide an evaluation of possible theories.

Table 9: Capital deepening, sector size, and labor share in US manufacturing

	(1) $\log(K/N)$	(2) $\log(I/N)$	(3) $\log(I/K)$	(4) $\log(K/N)$	(5) $\log(I/N)$	(6) $\log(I/K)$
			Panel (a)			
Labor Share	-0.33	-1.25	-0.93	0.31	-0.80	-1.11
	(0.15)	(0.15)	(0.14)	(0.09)	(0.12)	(0.15)
			Panel (b)			
Tax Rate (x100)	-0.25	-0.26	-0.01	0.38	0.03	-0.34
	(0.09)	(0.09)	(0.10)	(0.08)	(0.08)	(0.12)
Industry Trends	No	No	No	Yes	Yes	Yes

Standard errors in parentheses are clustered by industry. All specifications control for fixed year and sector effects (4-digit SIC). Columns 4 - 6 also control for industry-specific trends. Data come from the NBER Manufacturing Industry Database 1958–2011. An industry's corporate tax rate is the establishment-weighted average of effective state corporate tax rates.

Column 2 projects investment per worker on the tax rates. A 1 percentage point increase in the tax rate is associated with a 0.26 percent drop in investment per worker, similar to the tax elasticity of capital per worker. This similarity is consistent with the long-run perspective of the model. Because $I/N = \delta K/N$ in the long-run equilibrium, the model predicts the same long-run tax elasticity for I/N and K/N.

The high sensitivity of investment to the labor share in panel (a) likely reflects a more mechanical short-run association between the two variables, which might arise from lumpiness of investment or cyclical factors. This view is consistent with the estimates in Columns 4-6, which show results from a specification that includes industry-specific trends as controls. Relative to Columns 1 to 3, these specifications highlight the shorter-run dynamics in the data by controlling for the long-run associations between investment activity and tax rates. The tax elasticity of investment per worker is slightly lower in absolute terms, but remains strongly negative at -0.80 (0.12), whereas the relationship between capital per worker and the labor share is now positive with an elasticity of 0.31 (0.09) percent. With respect to taxes, K/N rises in the shorter-run whereas I/N remains unchanged. These results suggest that a short-run reaction to a rise in corporate taxes occurs via reductions in employment and investment while the capital stock is relatively fixed. In the long run, capital declines. A similar result is obtained for I/K, which temporarily increases in response to tax cuts, but converges back to its initial level in the long-run steady state of the model. The estimates show a drop in I/K in the shorter run with an elasticity of -0.34 (0.12) and a recovery in the long run: the estimated response is 0.01 (0.10).

Table 10: Establishments in US manufacturing

	(1)	(2)
	Panel (a)	
Labor Share	-0.25	-0.27
	(0.13)	(0.08)
	Panel (b)	
Tax Rate (x100)	-0.31	-0.36
	(0.12)	(0.09)
Industry Trends	No	Yes

The dependent variable is log-number of establishments. Both specifications control for fixed year and sector effects (4-digit SIC). Column 2 also includes industry trends as controls. Standard errors in parentheses are clustered by sector. Data on the number of establishments by industry comes from County Business Patterns and covers the 1974 to 2011 period. An industry's corporate tax rate is the establishment weighted average of effective state corporate tax rates. See text for details.

7.4 Industry size

In response to lower taxes, the model predicts a temporary increase in entry rates and a permanent increase in industry size. The aggregate entry rate in the US, however, has seen a secular decline in recent decades (e.g., Decker et al. (2014)). In manufacturing, the total number of establishments in operation peaked during the mid-1990s, whereas the labor share continued to decline.[38] To circumvent factors outside of our model, we test the model's prediction using relative changes in industry size across industries within the manufacturing sector.

Table 10 shows the results from the regression of total number of establishments in an industry on that industry's labor share. A decline in the labor share is associated with an increase in the number of establishments in operation across industries. There is a particularly strong negative relationship between the number of establishments in operation and the tax rate faced by the industry. A 1 percentage point drop in the tax rate is associated with a 0.31 percent increase in the number of establishments. Column 2 shows that this elasticity is similar when we control for industry-specific trends. These relative patterns are qualitatively consistent with the economic mechanisms highlighted by the model.

7.5 Value added concentration in US manufacturing

Another key quantitative prediction of our model is that capital-intensive firms grow relative to labor-intensive firms, causing a reallocation of market shares that results in higher value added concentration. To test this prediction, we test whether manufacturing industries that saw larger

[38] According to data from the BDS, the number of manufacturing establishments displays an inverse U-shape between 1977 and 2013, with a peak at 361,244 in 1996.

Table 11: Industry concentration and taxes in US manufacturing

Dependent Variable	con-8	con-20	con-8	con-20	con-8	con-20
			Panel (a)			
Labor Share	-0.16	-0.13	-0.12	-0.10	-0.06	-0.05
	(0.07)	(0.05)	(0.05)	(0.04)	(0.04)	(0.02)
			Panel (b)			
Corporate Tax Rate (x100)	-2.15	-5.14	-1.11	-4.05	-3.90	-4.26
	(3.05)	(2.47)	(2.83)	(2.20)	(1.52)	(1.14)
Sample Period	1997–2012		1997–2012		1972–1992	
Concentration of	Value Added		Sales		Sales	

The measure of concentration is the inverse of the Pareto index implied by the share of value added (1997–2012) or sales (1972–1992) among the top 8 or 20 firms in the industry. The explanatory variable of interest is reported in the first column. An industry's corporate tax rate is the establishment-weighted average of effective state corporate tax rates. Each cell represents a separate regression and all specifications include industry and year fixed effects. Standard errors are clustered at the sector level.

decreases in effective corporate tax rates also saw larger increases in market concentration.

To that end, we combine 4-digit SIC-level concentration measures for manufacturing industries from the US Census with the NBER manufacturing database. Industry concentration is measured by the inverse of the Pareto index implied by the share of value added among the largest 4, 8, 20 and 50 firms, available every five years from 1997 to 2012. For earlier years, where value-added shares are not available, we construct similar measures based on the sales shares of the largest firms from 1972 to 1992. For brevity, we report results for the concentration measures based on the largest 8 or 20 firms. The measures using the largest 4 or 50 firms yield similar results (see Online Appendix D).

We first check if there is a negative relationship between an industry's labor share and market concentration. Panel (a) of Table 11 reports results from regressing the industry value-added concentration on that industry's labor share between 1997 and 2012. All specifications include fixed effects for industry and year. The standard errors are clustered at the sector level as before. The results show that in industries where the labor share has fallen, market concentration has increased. Focusing on the concentration of value added among the top 8 firms, for instance, the estimate of -0.16 in the first column suggests that a 10 pp decrease in the labor share is associated with a 1.6 pp increase in the market concentration index. These results are consistent with those of Autor et al. (2020).

In panel (b), we regress market concentration in an industry on that industry's effective corporate tax rate. The results imply that a drop in the corporate tax rate of a state is associated with an increase in the market concentration of industries that are heavily located in that state.

The estimated effects can be large. To put the numbers in context, consider the top 20 firms (in terms of value added) in an industry with a concentration index of 0.75 and a total of 241 firms in operation, roughly the median values in our sample. In this case, a 1 percentage point increase in the effective tax rate reduces the concentration index by 5.1 pp. Assuming a Pareto firm size distribution, this corresponds to roughly a 7 pp drop in the market share of the top 20 firms.[39] This is a sizeable impact, but it should be noted that the interquartile range of 20-year tax changes in our sample is only 0.71 pp.

Similar patterns emerge in Columns 3 and 4, where we repeat the regressions for the 1997–2012 period using sales concentration as a proxy for value-added concentration. The elasticities are slightly lower in absolute terms when sales concentration is substituted for output concentration, likely due to variations in the share of intermediate goods in production. The general pattern remains comparable: higher tax rates are associated with lower market concentration, consistent with the predictions of the model. Because data on value added concentration are not available prior to 1997, we examine the patterns in sales concentration during the 1972–1992 period (Columns 5 and 6). We find a somewhat weaker correlation between the labor share and the sales concentration, but the effect of taxes on market concentration remain similar.

In Online Appendix D.3, we report alternative specifications relating long-run differences in market concentration with corresponding changes in the labor share and tax rates across sectors. The difference specifications point to size effects that are larger and more precise over longer horizons and for concentration measures that are based on a large number of firms, e.g., the largest 50 firms. Specifications that control for industry-specific trends generally yield qualitatively similar results, but with lower size effects. Taken together, these alternative specifications reflect the tension between the model's predictions, based on steady-state comparisons, and the short- to medium-term fluctuations in market concentration especially as measured by a small number of large firms.

8 Conclusion

We highlight the role of an institutional factor, corporate taxation, for the global decline in the labor share. The evolution of market shares and the employment distribution in US manufacturing relative to other sectors corroborates the model's predictions. We find that the decline in corporate taxation is partially responsible for the shift of production from labor-intensive firms to capital-intensive firms over time. At the same time, the reallocation of production away from traditionally large, labor-intensive firms reduced the overall employment concentration in

[39] With a Pareto distribution, the value-added share of the top x% of firms is given by $x^{1-\eta}$, where $\eta \in (0, 1)$ is the concentration index. In this example, the value-added share of the top 20 firms falls from $0.54 = 20/241^{0.25}$ to $0.47 = 20/241^{0.3}$, where we assume that the total number of firms remains unchanged.

manufacturing.

The key mechanism in our model is a fall in the relative cost of capital induced by a lower corporate tax rate. Other theories that are based on changes in relative factor prices, for instance due to lower capital costs (Karabarbounis and Neiman, 2013; Barkai, 2020) would operate in a way that is qualitatively similar to a fall in the tax rate. Quantitatively, however, we suspect the impact is smaller for a given change in the relative prices. In the context of our model, lowering the interest rate from around 4 percent toward zero has resulted in a 5.7 pp decline in the labor share since 1954.[40] Since lower corporate taxes do not fully explain the decline in the labor share and the shift of output toward capital-intensive firms, we think that other factors may also be at play.[41]

Recent legislation brought significant changes to business taxation in the US, including a drop in the statutory corporate tax rate from 35 percent to 21 percent. Our simulations indicate that the complete elimination of corporate taxes decreases the labor share by an additional 5 percentage points starting from the model's implied 2014 values.

While our paper focused on corporate taxation, labor taxation can be equally important. The main taxes on labor in the US are the individual income tax and payroll taxes. The average individual income tax has been more or less stable in the US. Payroll taxes, on the other hand, increased significantly during the 1960s and 1970s, following the formation and expansion of the federal Social Security system and Medicare. Piketty and Saez (2007) report the average income and payroll tax rates between 1960 and 2001. The total rate increased from 14.9 percent to 22.9 percent, implying a 10.4 percent increase in the effective wage rate. Higher taxes on labor would reduce the labor share in our model in a way that is similar to that of corporate tax cuts. The model simulations predict a decline in the manufacturing labor share of 17.8 pp in response to changes in corporate and labor taxes combined, an additional drop of 4.3 pp attributable to labor taxes alone.

Our examination of labor share patterns across major sectors reveals significant differences in effective tax rates and in tax elasticities, stemming from the distribution of value added with respect to labor intensity. These differences partly explain the sectoral differences in the decline in the labor share. They do not, however, explain the *rise* in the US service-sector labor share during a period of declining corporate taxation. The diverging patterns in labor share between the service sector and the rest of the economy remains a potential avenue for future research.

[40]For this experiment we use the parameters from the benchmark economy, set $\tau = 0.50$ and let $\rho \to 1$.

[41]The positive relationship between corporate taxation and labor shares across US states suggests a non-trivial role for corporate taxation because firms in different states can be assumed to have access to similar prices for investment goods.

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A Theoretical Appendix

This Appendix contains the derivations and proofs for the theoretical results mentioned in the paper.

Factor Demands

From (2) the first-order conditions for labor and capital demand, evaluated in the stationary distribution and for $\varepsilon = 1$, are:

$$\bar{w} \equiv \frac{w}{p} = \beta k^{\alpha} n^{\beta-1} \tag{A1}$$

$$r_{\tau} \equiv \frac{1}{1-\tau}\left(\frac{1-\tilde{\rho}}{\tilde{\rho}} + \delta\right) = \alpha k'^{\alpha-1} n'^{\beta} \tag{A2}$$

The statement on page 14 in the main text, that for a given level of capital, labor demand is not distorted by the corporate tax rate, follows from (A1). On the other hand, (A2) shows that the presence of corporate taxes directly affects capital demand by increasing the effective cost of capital r_{τ}.

With firm output evaluated at the optimal labor and capital demand given by (6), the output elasticity of the real wage $\bar{w}$ is $\eta_{q,\bar{w}} = \frac{\partial \log q}{\partial \log \bar{w}} = -\frac{\beta}{1-\gamma}$, whereas $\eta_{q,r_{\tau}} = \frac{\partial \log q}{\partial \log r_{\tau}} = -\frac{\alpha}{1-\gamma}$, as was stated in (7) in the main text.

Proof of Lemmas 1 and 3

The elasticity of the value-added share $\lambda(\alpha)$ with respect to the cost of capital r_{τ} and with respect to the equilibrium price p is:

$$\eta_{\lambda,r_{\tau}} = -\frac{\alpha - \hat{\alpha}_q}{1-\gamma} \qquad\qquad \eta_{\lambda,p} = -\frac{\alpha - \hat{\alpha}_q}{1-\gamma}.$$

Proof. Let $Q = \int q(\alpha)dG(\alpha)$ denote aggregate output. From (9), the elasticity of $\lambda(\alpha)$ w.r.t. a factor price x is $\eta_{\lambda,x} = \eta_{q,x} - \eta_{Q,x}$. The elasticity of aggregate output is $\eta_Q = \frac{\partial Q}{\partial x}\frac{x}{Q} = \int \frac{\partial q}{\partial x}\frac{x}{Q}dG(\alpha) = \int \eta_{q,x}\frac{q}{Q}dG(\alpha)$. It follows that $\eta_{\lambda,x} = \eta_{q,x} - \int \eta_{q,x}\frac{q}{Q}dG(\alpha)$. The lemma then follows by replacing $\eta_{\lambda,x}$ with their definitions in (7) and the definitions of $\hat{\beta}_q$ and $\hat{\alpha}_q$. For example, to compute the elasticity with respect to the cost of capital, these steps yield $\eta_{\lambda,r_{\tau}} = -\frac{\alpha}{1-\gamma} + \int \frac{\alpha}{1-\gamma}\frac{q}{Q}dG(\alpha) = -\frac{\alpha-\hat{\alpha}_q}{1-\gamma}$. ■

Proof of Proposition 1

For a given price level p, a decrease in the cost of capital lowers the aggregate labor share, with the marginal change given by:

$$\frac{\partial \hat{\beta}_q}{\partial \log r_\tau} = \frac{\sigma_q^2(\alpha)}{1-\gamma}.$$

Proof. Following a change in factor price x, the change in the aggregate capital share is given by $\frac{\partial \hat{\alpha}_q}{\partial x} = \int \frac{\partial \lambda(\alpha)}{\partial x} \alpha dG(\alpha) = \frac{1}{x} \int \eta_{\lambda,x} \lambda(\alpha) \alpha dG(\alpha)$. Using $\int \eta_{\lambda,r_\tau}$ from Lemma 1, we obtain

$$\frac{\partial \hat{\alpha}_q}{\partial r_\tau} = -\int \frac{(\alpha - \hat{\alpha}_q)\,\lambda(\alpha)\alpha dG(\alpha)}{r_\tau(1-\gamma)} = -\frac{\int \lambda(\alpha)\alpha^2 dG(\alpha) - \hat{\alpha}_q \int \lambda(\alpha)\alpha dG(\alpha)}{r_\tau(1-\gamma)} = \frac{-\sigma_q^2(\alpha)}{r_\tau(1-\gamma)}.$$

It follows that $\frac{\partial \hat{\beta}}{\partial r_\tau} r_\tau = -\frac{\partial \hat{\alpha}}{\partial r_\tau} r_\tau = \frac{\sigma_q^2(\alpha)}{1-\gamma}$. ∎

Proof of Lemma 2

Firm value is decreasing in τ and increasing in p.

Proof. The firm's value function (2), evaluated at optimal factor demand levels is:

$$V(\alpha) = \frac{1-\gamma}{1-\hat{\rho}} \cdot \left((1-\tau)^{1-\beta} \cdot p^{1-\alpha} \left(\frac{\alpha}{r}\right)^{\alpha} \left(\frac{\beta}{w}\right)^{\beta} \right)^{\frac{1}{1-\gamma}}, \tag{A3}$$

The elasticity of firm value with respect to price is $\frac{1-\alpha}{1-\gamma} > 0$, and the elasticity of firm value with respect to the net-of-tax rate $(1-\tau)$ is $\frac{1-\beta}{1-\gamma} > 0$. ∎

Proof of Proposition 2

With free entry, the equilibrium price, p, is increasing in the tax rate, τ.

Proof. The proof follows from combining Lemma 2 with the free-entry condition (3). Because the entry cost is constant, a drop in firm value caused by higher taxes has to be matched with an increase in the price level to ensure that the free-entry condition holds. Formally, setting $pc_e = \int V(\alpha)dG(\alpha) = \frac{1-\gamma}{1-\hat{\rho}} \int (1-\tau)pq(r_\tau, w/p)dG(\alpha)$, which is the discounted value of future profits net of taxes, and rearranging in flow terms gives the following equation in output units:

$$(1-\hat{\rho})c_e = (1-\gamma)\int (1-\tau)q(r_\tau, w/p)dG(\alpha)$$

The implicit function theorem gives the derivative of p with respect to $(1-\tau)$ as:

$$\frac{dp}{d(1-\tau)} = -\frac{\int\left[q(r_\tau, w/p) + (1-\tau)\frac{\partial q(r_\tau, w/p)}{\partial(1-\tau)}\right]dG(\alpha)}{(1-\tau)\int\frac{\partial q(r_\tau, w/p)}{\partial p}dG(\alpha)}, \tag{A4}$$

Multiplying both sides by $(1-\tau)/p$ gives the elasticity of price w.r.t. the net-of-tax rate as:

$$\eta_{p,(1-\tau)} = -\frac{\int(1+\eta_{q,1-\tau})\, q(r_\tau, w/p)dG(\alpha)}{\int\eta_{q,p}\, q(r_\tau, w/p)dG(\alpha)} = -\frac{1-\hat{\beta}_q}{\hat{\beta}_q}, \tag{A5}$$

where $\eta_{q,1-\tau}$ and $\eta_{q,p}$ are partial elasticities of output with respect to $(1-\tau)$ and p. These elasticities are $\alpha/(1-\gamma)$ and $\beta/(1-\gamma)$ respectively from equation (6). Substituting them gives the last term in the equality above, which is negative since $\hat{\beta}_q \in (0,1)$. Noting that $(1-\tau)$ decreases with τ concludes the proof. ■

Proof of Proposition 3

A decrease in the equilibrium price level lowers the aggregate labor share, with the marginal change given by:

$$\frac{\partial\hat{\beta}_1}{\partial\log p} = \frac{\sigma_q^2(\alpha)}{1-\gamma}.$$

Proof. Following a change in factor price x, the change in the aggregate capital share is given by $\frac{\partial\hat{\alpha}_q}{\partial x} = \int\frac{\partial\lambda(\alpha)}{\partial x}\alpha dG(\alpha) = \frac{1}{x}\int\eta_{\lambda,x}\lambda(\alpha)\alpha dG(\alpha)$. Using $\int\eta_{\lambda,p}$ from Lemma 1, we obtain

$$\frac{\partial\hat{\alpha}_q}{\partial\log p} = -\int\frac{-(\alpha-\hat{\alpha}_q)\,\lambda(\alpha)\alpha dG(\alpha)}{\log p(1-\gamma)} = \frac{\int\lambda(\alpha)\alpha^2 dG(\alpha) - \hat{\alpha}_q\int\lambda(\alpha)\alpha dG(\alpha)}{\log p(1-\gamma)} = \frac{\sigma_q^2(\alpha)}{\log p(1-\gamma)}.$$

It follows that $\frac{\partial\hat{\beta}}{\partial\log p}\log p = -\frac{\partial\hat{\alpha}}{\partial\log p}\log p = -\frac{\sigma_q^2(\alpha)}{1-\gamma}$. ■

Proof of Proposition 4

The equilibrium elasticity of the aggregate labor share with respect to the net-of-tax rate is given by:

$$\eta_{\hat{\beta},(1-\tau)} = -\frac{1}{1-\gamma}\left(\frac{\sigma_q(\beta)}{\hat{\beta}_q}\right)^2 < 0$$

Proof. Recall that $\bar{w} = w/p$, where $w = 1$ is the numéraire and p is pinned down from the free-entry condition. We demonstrate the proof by expressing the relevant comparative statics with respect to the real wage, $\bar{w}$.

Using the first two propositions, the derivative of $\hat{\beta}$ with respect to $(1-\tau)$ is:

$$\frac{d\hat{\beta}_q}{d(1-\tau)} = \left(\frac{\partial\hat{\beta}_q}{\partial\bar{w}}\frac{d\bar{w}}{dr_\tau} + \frac{\partial\hat{\beta}_q}{\partial r_\tau}\right)\frac{dr_\tau}{d(1-\tau)} = \frac{\sigma_q^2(\alpha)}{1-\gamma}\left(1-\eta_{\bar{w},r}\right)\frac{1}{r_\tau}\frac{dr_\tau}{d(1-\tau)}, \tag{A6}$$

where $\eta_{\bar{w},r}$ denotes the elasticity of the equilibrium real wage rate with respect to the rental rate of capital as implied by the entry condition. Because $\bar{w} = w/p$ with $w = 1$ normalized and $r_\tau = r/(1-\tau)$ with $r = (1-\hat{\rho})/\hat{\rho} + \delta$ in all long-run equilibria, (steady-state) equilibrium adjustment to a change in the tax rate transpires solely through a change in the price level in our model. As a result, $\eta_{\bar{w},r_\tau} = -\eta_{p,r_\tau} = \eta_{p,(1-\tau)}$, which equals $-(1-\hat{\beta}_q)/\hat{\beta}_q$ from equation (A5). Equivalently, $1-\eta_{\bar{w},r_\tau} = 1/\hat{\beta}_q$.

Substituting this result back into equation (A6) gives the desired elasticity. In particular, noting that $dr_\tau/d(1-\tau) = -r_\tau/(1-\tau)$ from the definition of the user cost of capital, we have:

$$\frac{d\hat{\beta}_q}{d(1-\tau)} = -\frac{\sigma_q^2(\alpha)}{1-\gamma}\frac{1}{\hat{\beta}_q}\frac{1}{(1-\tau)},$$

which implies

$$\frac{d\hat{\beta}_q}{d(1-\tau)}\frac{1-\tau}{\hat{\beta}_q} = -\frac{1}{1-\gamma}\left(\frac{\sigma_q(\alpha)}{\hat{\beta}_q}\right)^2$$

noting that $\sigma_q(\alpha) = \sigma_q(\beta)$ gives the result. ■

Proof of Proposition 5

The equilibrium elasticities of average demand for capital and labor with respect to the net-of-tax rate $(1-\tau)$ are:

$$\eta_{\bar{k},(1-\tau)} = \frac{1}{1-\gamma}\left(1-\frac{\hat{\beta}_k}{\hat{\beta}_q}\right) > 0 \qquad \text{and} \qquad \eta_{\bar{n},(1-\tau)} = \frac{1}{\hat{\beta}_q}\left(\frac{\hat{\beta}_q-\hat{\beta}_n}{1-\gamma}-1\right) < 0,$$

Before we begin the proof, we establish the partial elasticities of average capital and employment for a given price level p. Note that aggregate capital and labor in the industry are given by:

$$K = M\bar{k} = M\int k(\alpha)dG(\alpha) \qquad\qquad N = M\bar{n} = M\int n(\alpha)dG(\alpha) \tag{A7}$$

with $\bar{k}$ and $\bar{n}$ denoting industry averages for capital and labor. Lemma 4 follows:

Lemma 4 *The partial equilibrium elasticities of average industry demands for capital and* *labor with respect to factor prices are:*

$$\eta_{\bar{k},r_\tau} = -\frac{1-\hat{\beta}_k}{1-\gamma}, \qquad \eta_{\bar{k},\bar{w}} = -\frac{\hat{\beta}_k}{1-\gamma}, \qquad \eta_{\bar{n},r_\tau} = -\frac{\hat{\alpha}_n}{1-\gamma}, \qquad \eta_{\bar{n},\bar{w}} = -\frac{1-\hat{\alpha}_n}{1-\gamma}.$$

where

$$\hat{\beta}_k = \gamma - \int \frac{k(\alpha)}{K}\alpha dG(\alpha) \qquad \text{and} \qquad \hat{\alpha}_n = \int \frac{n(\alpha)}{N}\alpha dG(\alpha)$$

are asset-weighted labor (cost-)share and employment-weighted capital (cost-)share respectively.

Proof. By definition,

$$\eta_{\bar{k},r_\tau} = \frac{r_\tau}{\bar{k}}\frac{\partial \bar{k}}{\partial r_\tau} = \frac{r_\tau}{\bar{k}}\int \frac{\partial k}{\partial r_\tau}dG = \int \eta_{k,r_\tau}\frac{k}{\bar{k}}dG = \int -\frac{1-\beta}{1-\gamma}\frac{k}{\bar{k}}dG = -\frac{1-\hat{\beta}_k}{1-\gamma}$$

The proofs for other elements follow similarly. For instance,

$$\eta_{\bar{n},\bar{w}} = \frac{\bar{w}}{\bar{n}}\frac{\partial \bar{n}}{\partial \bar{w}} = \frac{\bar{w}}{\bar{n}}\int \frac{\partial n}{\partial \bar{w}}dG = \int \eta_{n,\bar{w}}\frac{n}{\bar{n}}dG = \int -\frac{1-\alpha}{1-\gamma}\frac{n}{\bar{n}}dG = -\frac{1-\hat{\alpha}_n}{1-\gamma}.$$

■

Next, we prove Proposition 5 using Lemma 4:

Proof. As in the proof for Proposition 4, note that

$$\frac{d\bar{k}}{d(1-\tau)} = \left(\frac{\partial \bar{k}}{\partial \bar{w}}\frac{d\bar{w}}{dr_\tau} + \frac{\partial \bar{k}}{\partial r_\tau}\right)\frac{dr_\tau}{d(1-\tau)} = \bar{k}\left(\eta_{\bar{k},\bar{w}}\eta_{\bar{w},r_\tau} + \eta_{\bar{k},r_\tau}\right)\frac{dr_\tau}{d(1-\tau)}\frac{1}{r_\tau}.$$

Substituting for partial elasticities $\eta_{\bar{k},\bar{w}}$ and $\eta_{\bar{k},r_\tau}$ from Proposition 4, for $1-\eta_{\bar{w},r_\tau} = 1/\hat{\beta}_q$ as in the proof of Proposition 5 and noting that $dr_\tau/d(1-\tau) = -r_\tau/(1-\tau)$ from the definition of the user cost of capital, we have:

$$\begin{aligned} \frac{d\bar{k}}{d(1-\tau)} &= \bar{k}\left(-\frac{1-\hat{\beta}_k}{1-\gamma}\eta_{\bar{w},r_\tau} - \frac{\hat{\beta}_k}{1-\gamma}\right)\frac{-r_\tau}{(1-\tau)}\frac{1}{r_\tau} \\ \frac{d\bar{k}}{d(1-\tau)}\frac{1-\tau}{\bar{k}} &= \frac{1}{1-\gamma}(1-\hat{\beta}_k(1-\eta_{\bar{w},r_\tau})) = \frac{1}{1-\gamma}\left(1-\frac{\hat{\beta}_k}{\hat{\beta}_q}\right) \end{aligned}$$

For the elasticity of average labor, we similarly have:

$$\begin{aligned} \frac{d\bar{n}}{d(1-\tau)} &= \bar{n}\left(\eta_{\bar{n},\bar{w}}\eta_{\bar{w},r_\tau} + \eta_{\bar{n},r_\tau}\right)\frac{dr_\tau}{d(1-\tau)}\frac{1}{r_\tau} \\ \frac{d\bar{n}}{d(1-\tau)} &= \bar{n}\left(-\frac{1-\hat{\alpha}_n}{1-\gamma}\eta_{\bar{w},r_\tau} - \frac{\hat{\alpha}_n}{1-\gamma}\right)\frac{-r_\tau}{(1-\tau)}\frac{1}{r_\tau} \\ \frac{d\bar{n}}{d(1-\tau)}\frac{1-\tau}{\bar{n}} &= \frac{1}{1-\gamma}\left(1-\frac{1-\hat{\alpha}_n}{\hat{\beta}_q}\right) \end{aligned}$$

■

Proof of Proposition 6

The equilibrium elasticity of aggregate capital per worker with respect to the net-of-tax rate is:

$$\eta_{K/N,(1-\tau)} = \eta_{K,(1-\tau)} - \eta_{N,(1-\tau)} = \left[1 + \frac{\hat{\beta}_n - \hat{\beta}_k}{1-\gamma}\right] \frac{1}{\hat{\beta}_q} > 1$$

Proof. The proof follows from Proposition 5 and the fact that $\eta_{K/N,(1-\tau)} = \eta_{K,(1-\tau)} - \eta_{N,(1-\tau)}$. ■

B Data Appendix

This appendix describes the data and presents some descriptive patterns. The first section lists the data sources, Section B.2 compares the manufacturing labor share obtained from different data sources, and Section B.3 presents the underlying patterns in the manufacturing labor share and corporate tax rates across countries and US states.

B.1 Description of Data Sources

Data sources for cross-country analysis The OECD and KLEMS data used in Section 2 come from the following sources. Data on labor shares come from the World KLEMS website (worldklems.net). We use the 2011 update of the November 2009 release of the EU KLEMS database. Later releases do not include observations before 1996. We add to this the KLEMS data for Canada from the same website. The manufacturing sector is taken to be the time series "Total Manufacturing Sector."

The pre-2000 OECD data on corporate tax rates were collected from Table II.1 at http://www.oecd.org/tax/tax-policy/tax-database.htm#C_CorporateCapital. The post-2000 data come from Table II.1 at https://stats.oecd.org/index.aspx?DataSetCode=Table_II1%20. We use the basic combined central and sub-central (statutory) corporate income tax rate given by the adjusted central government rate plus the sub-central rate.

Data sources for benchmark manufacturing calibration The data targets used in the calibration of the model in Section 5 come from the following sources.

The entry rate was computed from the Census Bureau's Business Dynamics Statistics release available at https://www.census.gov/ces/dataproducts/bds/data.html. We use data from the manufacturing sector to compute the average exit rate targeted by the model. The same data set is used to compute the employment distributions in 2014.

Targets for the average establishment size, the concentration of employment in large establishments, as well as the distributions of establishments across employment and value added are available in the 1970 Statistical Abstract of the United States and draw on the Census of Manufactures.[A1] From the Annual Survey of Manufactures (ASM) we find that the labor share in manufacturing in 1967 was 53.9 percent. The labor share is the sum of all forms of compensation plus fringe benefits of all employees of operating manufacturing establishments divided by value added. For 1954 we impute fringe benefits using data from 1967. The benefit share of value added was 5.7 percent in that year. Employees comprise all full-time and part-time employees. Employees in administrative offices and auxiliary units are included. Employment in central administration - such as corporate headquarters, as well as proprietors and partners - is excluded.

Data sources for major sector calibration To construct our sample of firms in the Compustat database, we proceed as follows. From the annual Compustat database we exclude firm-year observations with an ISO Currency Code different than the US Dollar, firms in the finance, utilities, and government sectors, as well as observations with negative sales or negative total assets.

We compute firm-level labor shares as the annual wage bill divided by value added. To compute the wage bill, we use the Compustat variable *xlr* whenever available. For the remaining observations, we compute the wage bill by multiplying the number of employees with an imputed wage rate. For missing firm-year observations that have non-missing *xlr* values for the same firm in adjacent years, we impute a wage rate by inflating (or deflating) that firm's wage rate in the adjacent year (*xlr* divided by number of employees) according to the average rate of wage growth from the QCEW in that firm's sector. If a firm never reported its wage bill, then we assign a wage bill by multiplying the firm's employment with the average wage rate in that sector from QCEW.[A2] Value added is defined as the wage bill plus earnings before interest (*ebitda*) plus the change in inventory (*invt*). We remove negative observations of value added and trim the resulting labor share at 150 percent following Kehrig and Vincent (2021). We

[A1]The documents can be found at https://www.census.gov/library/publications/time-series/statistical_abstracts.html. For later years we use data from the Census Bureau's Annual Survey of Manufactures, available at https://www.census.gov/data/developers/data-sets/Annual-Survey-of-Manufactures.html.

[A2]If, for instance, a manufacturing firm reported 40 thousand dollars average salary (xlr/emp) in 1980, but did not report any salary information in 1981, we multiply 40 thousand dollars by the rate of wage inflation in the US manufacturing sector between 1980 and 1981 as reported in the QCEW.

exclude firms in agriculture and construction because there are very few firms in those sectors in the Compustat data. The resulting sector-level labor shares are presented in Table 7.

Data sources for US state analysis The US state-level data used Section 7.1 come from the Annual Survey of Manufactures 1972–2012 (labor shares), the BEA (unemployment rates), and the data appendix of Saez and Zucman (2016) (income from corporate taxation). State-level corporate tax rates denote the average corporate tax rate in a state. We focus on mainland US states; that is, we exclude Alaska and Hawaii.

Data sources for US industry analysis The US industry-level data come from the following sources. Data from the County Business Patterns (CBP) comes from the US Census. Data prior to 1986 are available in the National Archives Catalog, while post-1986 data can be found at the Census website.[A3] Our data-cleaning procedure follows that used in Autor et al. (2013), as does the concordance between the 1972 and 1987 SIC classification systems. For the concordances between the 1997 and 2002 NAICS and the 1987 SIC classification systems, we use the concordance provided on the NBER-CES Manufacturing Industry Database website.[A4] For the years 2007-2012 we use the concordances provided by the US Census.[A5] To compute establishment weights, we use the establishment counts from the CBP database.

From the US Economic Census, we obtain information on manufacturing concentration ratios at the four-digit SIC level.[A6] We combine these data with state-level average corporate tax rates. We compute industry-specific tax rates by industry-state-time specific establishment shares from the County Business Patterns. Industry-specific tax rates are then computed by weighting state-time specific average tax rates with these establishment shares.

For the regressions in Table D.8, we computed the 10-year differences in the labor share and the sales concentration indices from 1972 to 2012. The state tax data are only available for the years 1974 to 2011. We therefore replaced the differences at the two ends of the sample period by the difference in the effective tax rate from 1974 to 1992 and from 1992 to 2011.

[A3] https://www.census.gov/programs-surveys/cbp.html

[A4] http://www.nber.org/nberces/

[A5] https://www.census.gov/eos/www/naics/concordances/concordances.html

[A6] Manufacturing concentration data are available from the Census website. Data for years 1947-1992 is available in an Excel file at https://www.census.gov/data/tables/1992/econ/census/concentraion-ratio-data.html while the post-1992 data are available from the Census' FTP server at https://www2.census.gov

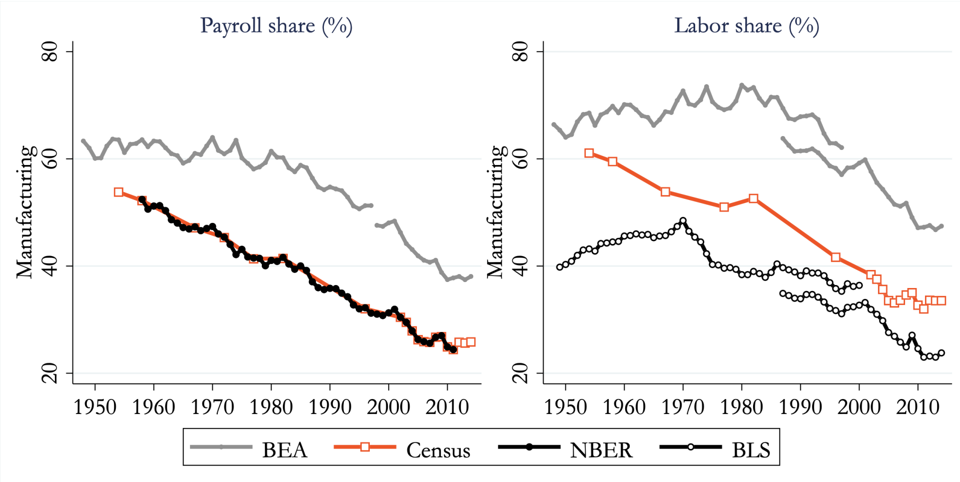


Figure B.1: Comparison of manufacturing labor share measures

B.2 US Manufacturing Labor Share: Definitions and Data Sources

Labor share measures can differ across data sources due to differences in how compensation and value added are defined. In Section 5 we calibrated the model to fit key moments of the distribution of establishment labor shares computed from US Census data. In this section we compare the Census labor share to manufacturing labor shares from other data sources, namely the industry-level NIPA data produced by the Bureau of Economic Analysis (BEA), the industry-level data from the Major Sector Productivity and Costs program of the Bureau of Labor Statistics (BLS), and the NBER manufacturing database. The resulting series are compared in Figure B.1 and Table B.1 and are explained below. The upshot of our analysis is that while sources somewhat disagree on the level of the manufacturing labor share, they all show a substantial decline, varying from 20 pp to 29 pp depending on source and definition. The Census and BLS data show a secular decline throughout our sample period, whereas the BEA series show a later but faster decline. We show below that this stems mainly from differences in the definitions of value added.

We define the *labor share* as the ratio of total labor compensation to value added, and the *payroll share* as the ratio of total payroll to value added, i.e. excluding fringe benefits. Figure B.1 shows the trends in payroll and labor shares from different sources. The left panel shows that while the NBER and Census payroll shares are virtually identical, the BEA measure is shifted upwards. The right panel shows that the BLS measure of the manufacturing labor share is lower than that of the Census, which in turn is lower than the BEA measure. All series display a large decline, which is summarized in Table B.1. Despite the level differences, all measures have in common a substantial decline by more than 20 percentage points since the 1950s.

The BEA and the BLS both compute labor compensation based mainly on information from the Quarterly Census of Employment and Wages (QCEW). Total labor compensation is defined as wages and salaries plus supplements to wages and salaries. Wages and salaries include wages, salaries, commissions, tips, bonuses, severance payments and early retirement buyout payments, supplementary allowances, the exercising of nonqualified stock options, in-kind earnings, and supplements to wages and salaries. It specifically includes employees and corporate officers. Supplements to wages and salaries include employer contributions to employee pension and insurance funds and to government social insurance. The unit of analysis is a firm.

From the BLS, only total labor compensation is available, whereas the BEA data are broken down into wages and salaries and supplements to wages and salaries. The BLS adds a fraction of proprietor's income to total labor compensation. The compensation cost for labor services of proprietors is imputed based on the assumption that it is the same as that of the average employee in a sector. The BEA does not include earnings of the self-employed in total labor compensation.[A7]

Table B.1: Long-run changes in various labor share measures

	NIPA / BEA	BLS	Census	NBER
Labor share	-21.3	-20.2	-29.1	
Payroll share	-25.8		-29.4	-28.0

Changes are in percentage points between 1954 and 2011. The NBER data begin in 1958. Payroll share measures from the BLS and labor share measures from the NBER are not available. See definitions in the text.

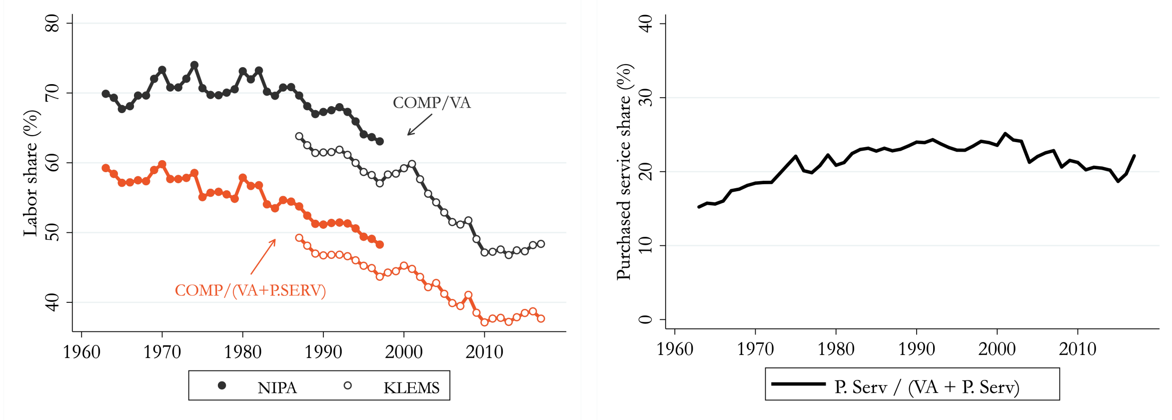
The Census data are based on mandatory report forms.[A8] It includes each establishment's total annual payroll, consisting of all forms of compensation paid, such as salaries, wages, tips and gratuities, commissions, bonuses, vacation allowances, sick leave pay, dismissal pay, and employee contributions to qualified pension plans. This measure excludes payments to proprietors. Fringe benefits are computed in a separate variable and include payroll taxes, employer-paid insurance premiums, pension plans, other employer-paid benefits, and profit or other compensation of proprietors or partners of unincorporated businesses. Stock options are included in fringe benefits in the manufacturing censuses. The unit of analysis is an establishment. This implies that compensation of employees in eventual separate headquarters is excluded.[A9]

Total payroll and total compensation are slightly higher in the BEA data compared to the other data sources, mainly due to the differences in industry definitions. Because the BEA's unit

[A7]For the manufacturing sector, the treatment of the self-employed is of little consequence in practice. Sector-level total compensation time series based on BLS and BEA data are virtually identical.

[A8]This applies to the Census of Manufactures (CMF) and the Annual Survey of Manufactures (ASM). It also applies to the NBER manufacturing database, which draws mainly on variables from the ASM.

[A9]The same data have recently been used in De Loecker et al. (2020) and Kehrig and Vincent (2021).



(a) BEA labor share measures

(b) Purchased services in value added

Figure B.2: Manufacturing value added: The role of purchased services
Panel (a): The black lines show the ratio of compensation to value added. The red lines show the ratio of compensation to value added plus purchased services. The connected x-markers use total compensation from the BEA's industry-level NIPA tables. The connected dots use total compensation data from the BEA's KLEMS data. Panel (b): Data come from the BEA KLEMS.

of analysis is a firm, not an establishment, remuneration to corporate headquarters is included in the BEA's measure. In addition, the population of manufacturing production sites need not fully overlap with that of the Census, as some manufacturing plants that are part of a firm that is classified in a different sector might be excluded from the BEA data and vice versa.

The denominators of the labor and payroll share definitions differ across data sources, mainly due to the BEA's treatment of purchased services, which are subtracted from its value added measures, but not from those of the Census (and NBER).[A10] While the denominator in the BLS measure of the *aggregate* labor share is value added, to compute the manufacturing labor share, sectoral output (sales to final demand plus the intermediate goods sent to other industries) is used.

Panel (a) of Figure B.2 shows versions of the BEA labor share measures that include purchased services in value added and compare it to the original series. Including purchased services lowers the labor share but hardly affects the substantial decline of slightly above 20 percentage points between 1963 and 2019. Panel (b) shows the share of purchased services in value added including purchased services. The relative share increases from the 1960s until 1990 and declines after 2000. This hump-shaped pattern results in a smaller decline in the BEA manufacturing labor share at the beginning of our sample and an acceleration after 2000 relative to the Census measure.

Historical BEA data are based on the SIC industry classification system. The revisions to the historical series have, as of 2020, only been extended back to the year 1986. The revised

[A10] See also Appendix D.4 in Autor et al. (2020).

data are part of the BEA KLEMS data set, which is fully consistent with the BEA's industry-level NIPA data from 1997 on.

B.3 Patterns in Corporate Taxation and Labor Shares across Countries and US States

Trends in country-level statutory corporate tax rates together with manufacturing labor shares are shown in Figure B.3 for the countries in our sample. Countries with short panels (Estonia, Korea, Latvia, Lithuania, Luxembourg, Slovenia, and Slovakia) were excluded from the figure. These countries are included in the analysis in Section 2. Excluding them from our regressions does not affect our results.

Figure B.3: Trends in statutory corporate tax rates and labor shares by country

Trends in statutory corporate tax rate and labor's share of income in the manufacturing sector for each country. Corporate tax rates are shown on the right y-axis. Source: OECD and KLEMS.

Trends in state-level effective corporate tax rates together with manufacturing labor shares are shown in Figures B.4 and B.5.

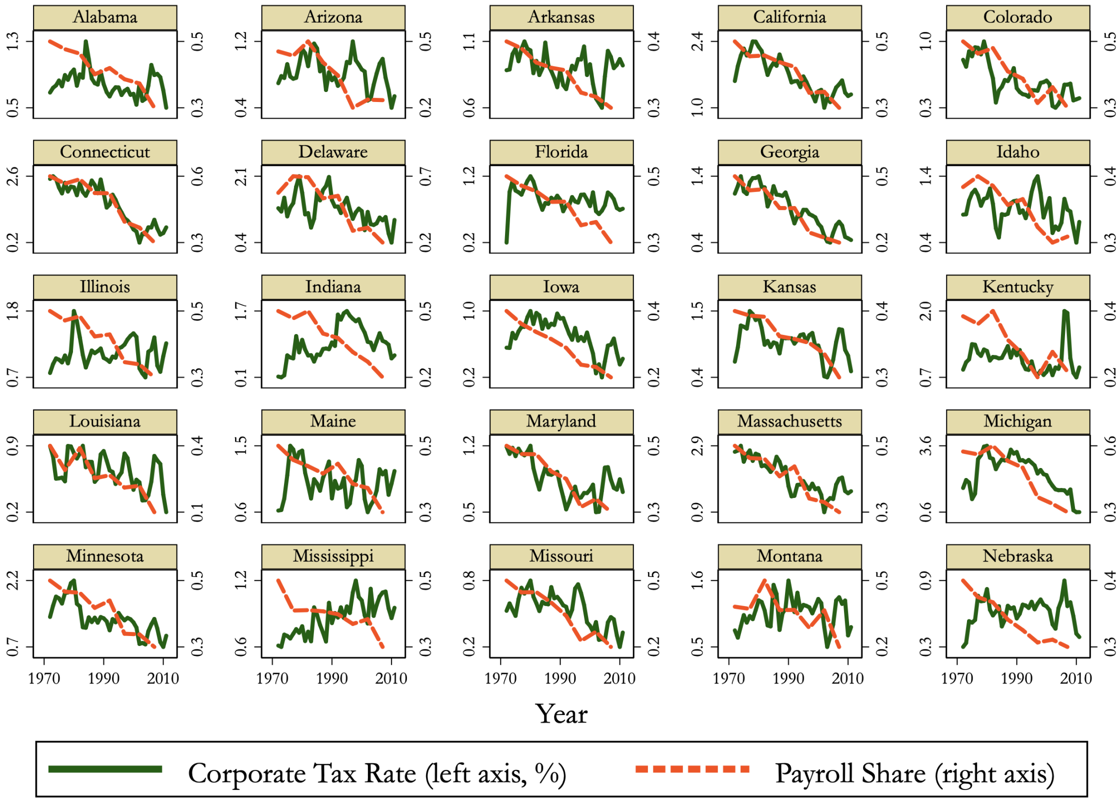


Figure B.4: Trends in effective corporate tax rates by state: Alabama - Nebraska

Effective tax rates are calculated as the ratio of total corporate tax revenue and gross operating surplus in a state and are taken from Saez and Zucman (2016).

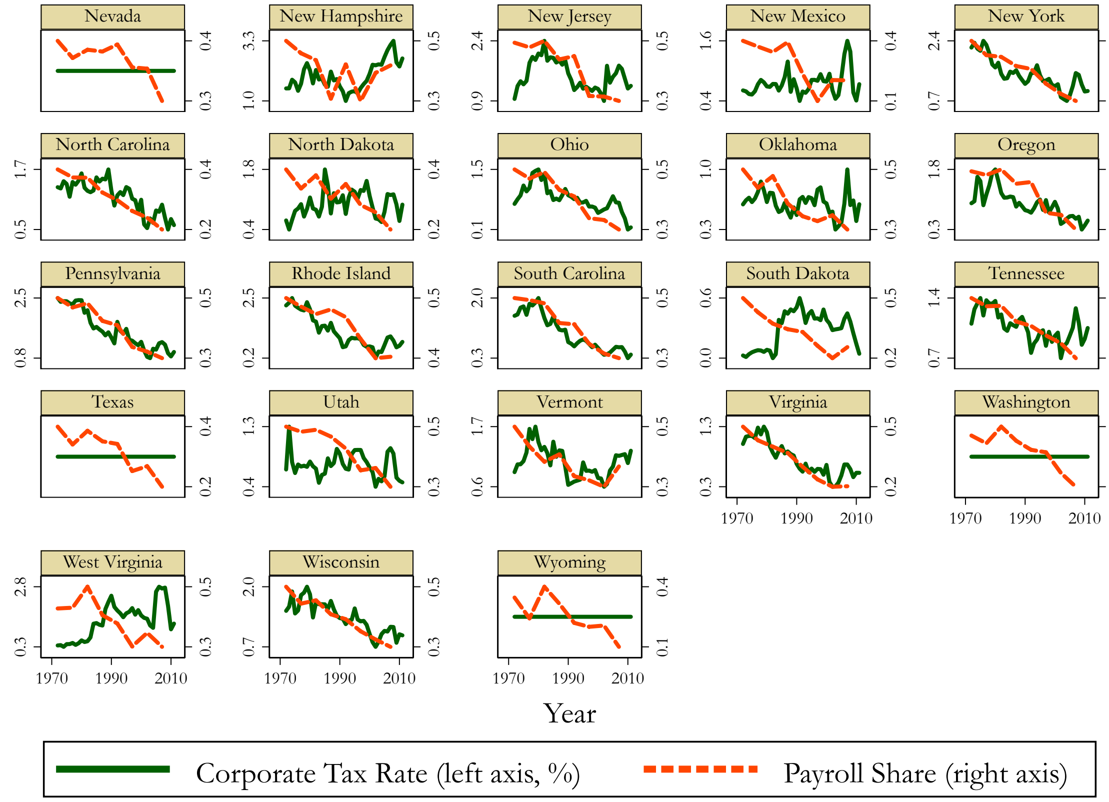


Figure B.5: Trends in effective corporate tax rates by state: Nevada - Wyoming

Effective tax rates are calculated as the ratio of total corporate tax revenue and gross operating surplus in a state and are taken from Saez and Zucman (2016).

C Model Calibration: Details for Section 6

In Section 6, we calibrate the model for a number of major economic sectors. To do so, we construct sector-specific moments from the Census BDS and Compustat around the initial year, 1985, when the sector-specific data on tax returns become available from the IRS. The Census BDS provides industry-specific statistics on exit rates, average firm size, and employment concentration and is available starting in 1987. We use the reported values for 1987 as calibration targets. The targets for the average labor share and the ratio of the value added weighted median labor share to the unweighted median labor share are computed in Compustat using data for the 10 years prior to 1985. We combine multiple years to ensure a sufficiently large sample size for the calculation of distributional moments of the firm-level labor shares.

Next, we calibrate our model for each sector, using the appropriate sector-specific empirical targets. The discount rate, the capital depreciation rate, and the span-of-control parameters are kept at the levels reported in Table 2. In our benchmark analysis of the manufacturing sector, we assumed that labor shares follow a symmetric triangular distribution across firms. Because several of the non-manufacturing sectors display non-symmetric labor share distributions, we introduce a new parameter, m, which controls the mode of the triangular distribution. In the symmetric case, the mode is given by $m = \frac{\gamma - \underline{\beta}}{2}$, where γ and $\underline{\beta}$ respectively define the minimum and maximum of the distribution. To calibrate m, we target an additional empirical moment: the ratio of the value-added weighted standard deviation of labor shares over the median value-added labor share. A lower mode m skews the distribution of labor shares toward low-labor-share firms and increases the standard deviation.[A11]

Table C.1: Sector-specific calibration results

Sector	Data						Model					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Manufacturing	0.604	0.924	0.104	54.0	0.528	0.309	0.616	0.869	0.104	54.0	0.529	0.326
Mining	0.408	0. 761	0.208	23.0	0.524	0.682	0.405	0.766	0.208	23.0	0.524	0.681
TCPU	0.706	0.986	0.129	24.0	0.537	0.191	0.712	1.00	0.129	24.0	0.537	0.191
Wholesale Trade	0.588	0.924	0.113	13.0	0.379	0.315	0.587	0.912	0.113	13.0	0.379	0.314
Retail Trade	0.610	0.950	0.135	13.0	0.370	0.200	0.644	0.937	0.135	13.0	0.370	0.209
Services	0.687	0.954	0.106	14.0	0.565	0.230	0.672	0.965	0.106	14.0	0.565	0.230

The moments are: (1) the average labor share, (2) the ratio of the value-added median labor shares over the unweighted median labor share, (3) the exit rate, (4) the average firm size in 1987, (5) the fraction of employment in the largest firms, (6) the ratio of the value-added weighted standard deviation of labor shares over the median value-added labor share.

The sector-specific tax rates are available from the IRS website in SIC format for the years 1985, 1990, 1995, 1996, and 1997 and in NAICS format from 1999–2013. We map the single-digit NAICS values to single-digit SIC values. Each sector is calibrated using the respective

[A11]For comparability, we also recalibrate the 1985 manufacturing sector level using the new empirical targets. Our results are quantitatively very similar if we do not recalibrate the mode of the triangular distribution for the manufacturing sector but leave it unchanged from the symmetric case.

1985 tax rate. The IRS only reports tax rates for an aggregate trade sector. We apply the same tax rate to firms in the wholesale and retail trade sectors.

To calibrate the model parameters for each sector, we minimize the difference between the six data moments in that sector and the corresponding values implied by the model. The results are listed in Table C.1. The associated parameter values are shown in Table C.2. The fit of the model is very high and is comparable to the results reported in the main text.

Table C.2: Sector-specific calibration results: Parameter values

Sector	Parameter					
	μ_ε	σ_ε	x	$\underline{\beta}$	m	c_e
Manufacturing	0.860	0.270	0.104	0.301	1.379	115.62
Mining	0.901	0.260	0.208	0.164	3.261	92.90
TCPU	0.863	0.268	0.129	0.414	1.143	36.88
Wholesale Trade	0.699	0.207	0.113	0.312	1.827	32.00
Retail Trade	1.102	0.198	0.135	0.431	1.739	37.10
Services	0.451	0.276	0.106	0.382	1.291	26.36

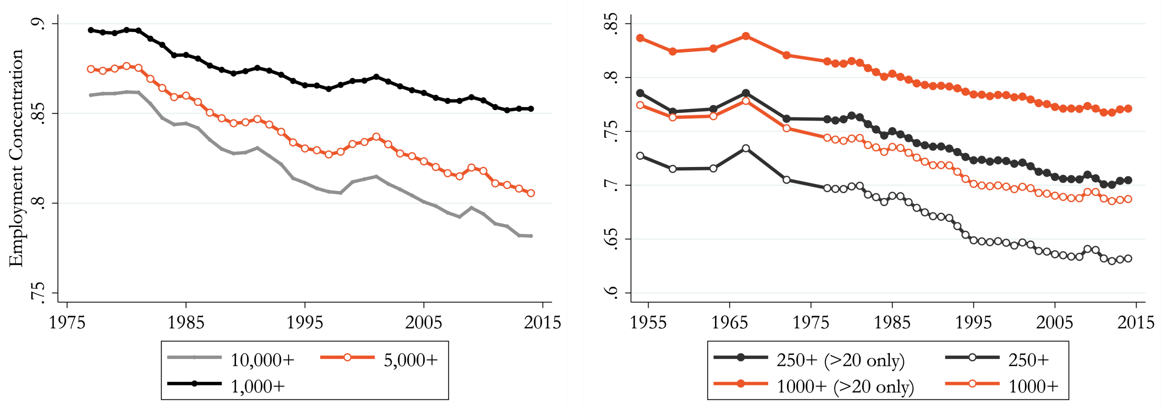
Table shows the calibrated parameter values for major sectors.

To construct Figure 5, we simulate a new steady state for each sector using its effective corporate tax rate in 2013 and compute the change in the labor share between steady states. We plot those changes against the actual decline, as reported by the BEA. To construct the data point for the actual change in the trade-sector labor share, we weight the wholesale and retail trade sectors by their value-added in 1985.

D Additional Results and Sensitivity

D.1 Employment Concentration in the US

Figure D.1 shows the trends in manufacturing employment concentration at the firm level (panel a) and at the establishment level (panel b). The concentration measures at the firm level come from the BDS data, and show a downward trend regardless of the employment cutoff used to measure concentration. To compute the concentration measures for a longer horizon, we supplement the BDS data, available starting in 1977, with establishment-level data from the quinquennial Census of Manufactures for the years 1954–1972. The trends in manufacturing establishment-level employment concentration mirror those of firm-level concentration. Conditioning the concentration measures to establishments with at least 20 employees does not change the patterns.



(a) Firm-level

(b) Establishment-level

Figure D.1: Manufacturing employment concentration

Concentration is defined by the inverse of the Pareto index implied by the share of employment among the largest firms (establishments). Letting s_x denote the share of firms (establishments) with more than x employees, and e_x their share in total employment, the Pareto index is computed by $\iota_P = \log s_x / (\log s_x - \log e_x)$. Panel (a) shows the concentration among firms with more than 1,000, 5,000, and 10,000 employees. Panel (b) shows the concentration among establishments with more than 250 and 1000 employees. The lines labeled (> 20) only show the respective indices conditioning on establishments with at least 20 employees. Sources: BDS and Census of Manufacturers.

D.2 Capital-Labor Ratios Across Countries

We test for the effects of corporate taxes on capital investment by linking aggregate K/N ratios from Penn World Table v9.1 to corporate tax rates for a subset of countries in our sample. We compute K/N by dividing the total capital services in a country by the total number of hours worked. Figure D.2 shows the changes in aggregate capital-labor ratios against the changes in the corporate tax rates between 1981 and 2007. The plot includes a fitted line from robust estimation and shows a negative relationship.

Table D.1 shows a formal test of this relationship. The dependent variable is the log of K/N and the regressors are listed in the rows. Column (1) shows that countries where tax rates fell by more saw an increase in their aggregate capital intensity. Column (2) controls for capital costs and total factor productivity. Because the Czech Republic and Luxembourg are visible outliers in Figure D.2, we re-estimated these regressions using a robust estimation method in Columns (3)-(4). The results are broadly similar, with slightly lower but more precise tax elasticities.[A12] Overall, the estimated tax elasticities are in the -0.3 to -0.5 range depending on specification. Columns (5)-(8) include controls for country-specific trends. These estimates assume that the long-run association between tax rates and the capital-labor ratio is attributable to factors outside the model that affect tax rates and capital per worker at the same time. As a result, they reflect a short-to-medium run response of the capital-labor ratio to taxes. The estimated size

[A12]Following Karabarbounis and Neiman (2013), we use the 'rreg' command in Stata to perform these estimations. The two-step GLS estimates yield similar results.

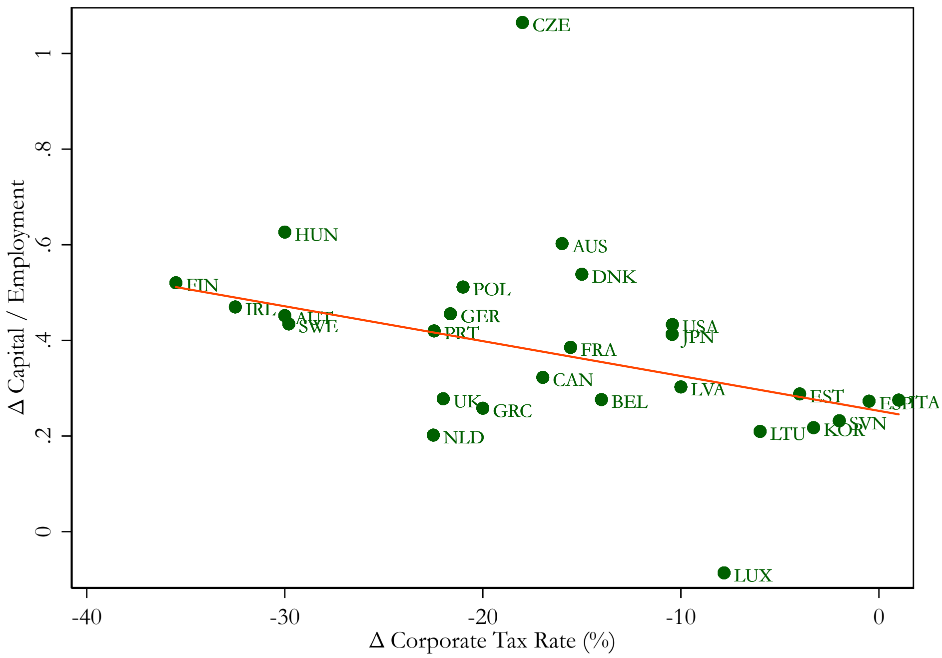


Figure D.2: Corporate taxes and capital-labor ratios: 1981–2007
Figure shows the change in aggregate log capital-labor ratio between 1981 and 2007 against the change in the corporate tax rate (in percentage points). Source. OECD and Penn World Table v9.1.

effects are qualitatively consistent with the model, but are quantitatively smaller. Considering that time-to-build can be long for capital stock, we view these shorter-run responses as a lower bound on capital's response in the long run.

Table D.2 shows results from the difference specification using 10-year differences (Columns 1 and 3) and 20-year differences (Columns 2 and 4) controlling for fixed year effects. Columns 3 and 4 additionally include changes in the relative price of capital and TFP as control variables. Consistent with the levels specification, results show a negative association between the capital-labor ratio and the tax rate with an elasticity of around 0.5 percent across specifications.

D.3 Difference Regressions

This section presents estimation results from additional specifications. In the main text, we reported results from regressions in levels of the variables of interest with fixed effects for states (or industries) and years. Those specifications are superconsistent for long-run relationships between variables. Versions of those specifications with state-specific, or industry-specific trends are identified by shorter-run variations instead. They resulted in different coefficient estimates for variables that theoretically display different reactions in the long-run and the short-run. For example, the investment-to-capital ratio temporarily increases in the short-run in response to a lower tax rate, but reverts back to its initial level in the long-run. Here, we report

Table D.1: Corporate tax cuts and capital-labor ratio: OECD 1981–2007

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Corporate tax rate	-0.48	-0.54	-0.34	-0.29	-0.18	-0.20	-0.07	-0.07
	(0.16)	(0.20)	(0.04)	(0.04)	(0.12)	(0.13)	(0.03)	(0.03)
Price of capital		-0.13		-0.09		-0.10		0.00
		(0.09)		(0.02)		(0.11)		(0.02)
TFP		-0.03		0.10		-0.14		0.00
		(0.12)		(0.03)		(0.10)		(0.02)
N	579	579	579	579	579	579	579	579

The dependent variable is the aggregate capital-labor ratio. Standard errors are clustered at the country level in Columns (1)-(2). Columns (3)-(4) employ a robust estimation method to correct for outliers. All regressions control for fixed country and year effects.

Table D.2: Corporate tax cuts and capital-labor ratio: OECD 1981–2007

	(1)	(2)	(3)	(4)
Δ Tax Rate (x100)	-0.50	-0.49	-0.54	-0.52
	(0.20)	(0.17)	(0.23)	(0.15)
N	318	119	318	119

The dependent variable is the change in the aggregate capital-labor ratio over 10 years in Columns 1 and 3, and over 20 years in Columns 2 and 4. All specifications include fixed year effects. Columns 2 and 4 also include the change in the price of capital and TFP as controls. Standard errors are clustered at the country level.

results from difference specifications. Note that difference regressions mechanically eliminate long-run, co-integrating relationships. Because our focus is on those long-run relationships, we try to circumvent this issue by taking differences over 10 years, which we assume are sufficiently long for short-run dynamics to have play out.

Tables D.3 to D.6 show the estimates from difference specifications for regressions in Tables 1, 8, 9, and 10 in the main text. The coefficient estimates are qualitatively consistent with the estimates reported in the main text. In most cases, the point estimates are close to those reported from the levels specifications, and, therefore, are statistically comparable. One exception is the tax elasticity of capital-per-worker in Table D.5, which is 0.02 (0.08) in 10-year differences, whereas the levels estimate in Table 9 is -0.25 (0.09). This is somewhat surprising given that the tax elasticity of investment is significantly negative, both in the level- and difference specifications. One would expect higher investment expenditures in response to lower taxes to manifest in a higher capital stock over time. A possibility is that 10 years may not be sufficiently long to recover the long-run relationship between taxes and the capital stock in difference form. Indeed, because K/N is highly persistent in the data, with an annual persistence of 0.95, the half-life of a shock to the capital stock is about 20 years. Therefore, in Table D.6, we report results from a difference specification over 20 years. The estimated coefficient on the corporate tax rate is -0.30 (0.12) in this case, close the -0.25 (0.09) in Table 9.

Table D.7 shows the estimates in Columns 1 and 2 of Table 11 for all concentration measures, defined by the value added shares of the top 4, 8, 20 and 50 firms in the industry. Concentration measures that rely on a larger number of firms generally yield smaller standard errors and larger size effects in response to tax changes. Table D.8 shows the same regressions estimated in difference form. The coefficient estimates are comparable to those from the levels specification in Table D.7. Table D.9 shows the difference specification results for sales-based concentration measures for varying sampling periods. The estimates are consistent with the estimates from the levels specifications reported in Table 11.

In the main text, we did not report results from a specification that allows for industry-specific trends in value-added concentration. Because the underlying data is quinquennial, there are four data points for each industry during the 1997–2012 period, which is too few to estimate the fixed effects, trends and tax elasticities in a statistically robust manner. Here, we attempt to control for industry trends by combining *sales-based* measures of concentration at the SIC-4 level between 1972 and 2012, which gives 8 data points for each industry. All estimates should be interpreted subject to that caveat.

We start by revisiting the levels specifications (without industry trends) for the combined sample period. Columns 1 through 4 of Table D.10 shows the sales concentration regressions for the full sample for all sales-based concentration measures (top 4, 8, 20 or 50 firms). These estimates do not control for industry-specific trends and are comparable to the results reported in Table 11 for all sales-based concentration measures. The results are qualitatively similar: lower effective tax rates in an industry are associated with higher market concentration. The coefficient estimates are somewhat lower in this combined sample (1972–2012 period) than in each of the sub-period reported in Table 11, namely the 1972–1992 period and the 1997–2012 period. A possible explanation for this is the change in the industrial classification system in the data between 1992 and 1997. The crosswalk we use between the two industrial classifications could be a source of measurement error in the combined sample, resulting in attenuated coefficient estimates. To account for that possibility, Panels c) and d) interact the fixed industry effects with an indicator variable for post-1992 data. Accounting for the classification changes results in coefficient estimates that are comparable in magnitude to those in Table 11.

The results from specifications with industry-specific trends in sales concentration are reported in Columns 5-8 of Table 11. Once again, the results are consistent with a negative relationship between the tax rates and concentration, as also indicated by the levels specifications reported in Columns 1-4. The point estimates are somewhat lower, suggesting that the response of sales concentration to tax rates builds slowly over time, leading to larger elasticities in the long-run than in the short-run.

Table D.3: Changes in corporate taxation and labor share across countries

	(1) Manufacturing	(2) Aggregate	(3) Manufacturing	(4) Aggregate
Δ Corporate tax rate	0.29	0.12	0.16	0.10
	(0.09)	(0.04)	(0.07)	(0.05)
Country trend effects	no	no	yes	yes
N	309	309	309	309

The dependent variable is the change in labor's share of income in a country over 10 years. All specifications control for fixed year effects. Specifications (3)-(4) control for fixed country (trend) effects. Standard errors in parentheses are clustered at the country level. Source: OECD and KLEMS.

Table D.4: Changes in corporate taxation and the labor share across US states

	(1)	(2)	(3)	(4)	(5)	(6)
Δ Corporate tax rate	2.02	1.73	2.53	2.22	3.03	2.79
	(0.79)	(1.09)	(0.79)	(1.09)	(1.01)	(1.35)
Δ log wage			0.12	0.17	0.12	0.16
			(0.04)	(0.05)	(0.05)	(0.08)
Δ Unemployment rate					0.36	0.24
					(0.19)	(0.20)
State trend effects	no	yes	no	yes	no	yes
N	288	288	288	288	240	240

The dependent variable is the change in payroll share of value added in the manufacturing sector of a state over 10 years. Corporate tax rate denotes the average corporate tax rate in a state. All specifications control for fixed year effects. Columns 2, 4 and 6 include fixed state (trend) effects. Standard errors in parentheses are clustered at the state level. Data come from the Annual Survey of Manufactures 1972–2012, the BEA, and Saez and Zucman (2016). The last two columns cover the 1977 to 2012 period. Standard errors in parentheses.

Table D.5: Capital deepening, sector size, and labor share in US manufacturing

	(1) $\Delta\log(K/N)$	(2) $\Delta\log(I/N)$	(3) $\Delta\log(I/K)$	(4) $\Delta\log(estabs.)$
		Panel (a)		
Δ Labor Share	0.17	-1.05	-1.22	-0.26
	(0.08)	(0.13)	(0.16)	(0.10)
		Panel (b)		
Δ Tax Rate (x100)	0.02	-0.10	-0.12	-0.33
	(0.08)	(0.09)	(0.12)	(0.10)

Δ denotes differences over 10 years. All specifications control for fixed year effects (4-digit SIC). Standard errors in parentheses are clustered by sector. Data come from the NBER Manufacturing Industry Database 1958–2011. Data on the number of establishments by industry (specification (3)) come from County Business Patterns and covers the 1974 to 2011 period. An industry's corporate tax rate is the establishment-weighted average of effective state corporate tax rates. See text for details.

Table D.6: Capital deepening, sector size, and labor share in US manufacturing

	(1) $\Delta \log(K/N)$	(2) $\Delta \log(I/N)$	(3) $\Delta \log(I/K)$	(4) $\Delta \log(estabs.)$
		Panel (a)		
Δ Labor Share	-0.09	-1.07	-0.98	-0.28
	(0.15)	(0.16)	(0.17)	(0.17)
		Panel (b)		
Δ Tax Rate (x100)	-0.30	-0.23	0.07	-0.46
	(0.12)	(0.10)	(0.13)	(0.13)

Δ denotes differences over 20 years. All specifications control for fixed year effects (4-digit SIC). Standard errors in parentheses are clustered by sector. Data come from the NBER Manufacturing Industry Database 1958–2011. Data on the number of establishments by industry (specification (3)) come from County Business Patterns and covers the 1974 to 2011 period. An industry's corporate tax rate is the establishment-weighted average of effective state corporate tax rates. See text for details.

Table D.7: Value added concentration and taxes in US manufacturing

Dependent Variable	con-4	con-8	con-20	con-50
		Panel (a)		
Labor Share	-0.20	-0.16	-0.13	-0.08
	(0.09)	(0.07)	(0.05)	(0.03)
		Panel (b)		
Tax Rate (x100)	-0.77	-2.15	-5.14	-6.86
	(3.40)	(3.05)	(2.47)	(3.06)

The measure of concentration is the inverse of the Pareto index implied by the share of value added among the top 4, 8, 20 or 50 firms in the industry. An industry's corporate tax rate is the establishment-weighted average of effective state corporate tax rates. Each cell represents a separate regression and all specifications include industry and year fixed effects. Standard errors are clustered at the sector level.

Table D.8: Value added concentration and taxes in US manufacturing

Dependent Variable	Δcon-4	Δcon-8	Δcon-20	Δcon-50
		Panel (a)		
Δ Labor Share	-0.22	-0.19	-0.16	-0.11
	(0.09)	(0.07)	(0.05)	(0.04)
		Panel (b)		
Δ Tax Rate (x100)	1.77	-0.42	-5.27	-7.72
	(3.62)	(3.33)	(2.80)	(3.75)

Δ denotes differences over 10 years. The measure of concentration is the inverse of the Pareto index implied by the share of value added among the top 4, 8, 20 or 50 firms in the industry. The explanatory variable of interest is reported in the first column. An industry's corporate tax rate is the establishment-weighted average of effective state corporate tax rates. Each cell represents a separate regression and all specifications include year fixed effects. Standard errors are clustered at the sector level.

Table D.9: Sales concentration and taxes in US manufacturing

Dependent Variable	Δcon-4	Δcon-8	Δcon-20	Δcon-50
		Panel (a): 1972–1992		
Δ Labor Share	-0.05	-0.03	-0.04	-0.03
	(0.05)	(0.03)	(0.01)	(0.02)
		Panel (b): 1972–1992		
Δ Tax Rate (x100)	-0.30	-2.24	-3.35	-3.56
	(1.99)	(1.53)	(1.13)	(0.80)
		Panel (c): 1997–2012		
Δ Labor Share	-0.17	-0.15	-0.12	-0.10
	(0.07)	(0.06)	(0.04)	(0.04)
		Panel (d): 1997–2012		
Δ Tax Rate (x100)	1.96	0.63	-4.02	-6.75
	(3.23)	(3.05)	(2.44)	(3.33)
		Panel (e): 1972–2012		
Δ Labor Share	-0.11	-0.10	-0.08	-0.06
	(0.04)	(0.03)	(0.02)	(0.02)
		Panel (f): 1972–2012		
Δ Tax Rate (x100)	1.08	-0.29	-1.73	-2.64
	(1.36)	(1.13)	(0.91)	(0.87)

Δ denotes differences over 10 years. The measure of concentration is the inverse of the Pareto index implied by the share of sales among the top 4, 8, 20 or 50 firms in the industry. The explanatory variable of interest is reported in the first column. An industry's corporate tax rate is the establishment-weighted average of effective state corporate tax rates. Each cell represents a separate regression and all specifications include year fixed effects. Standard errors are clustered at the sector level.

Table D.10: Sales concentration, labor share and taxes in US manufacturing

	con-4	con-8	con-20	con-50	con-4	con-8	con-20	con-50
				Panel (a)				
Labor Share	-0.11	-0.08	-0.06	-0.05	-0.08	-0.07	-0.06	-0.04
	(0.04)	(0.04)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)	(0.01)
				Panel (b)				
Tax Rate (x100)	2.44	0.13	-1.02	-1.58	1.01	-0.58	-1.55	-2.23
	(1.62)	(1.42)	(1.18)	(0.99)	(1.70)	(1.44)	(1.12)	(0.90)
				Panel (c)				
Labor Share	-0.11	-0.09	-0.07	-0.06	-0.07	-0.06	-0.05	-0.03
	(0.04)	(0.03)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)	(0.01)
				Panel (d)				
Tax Rate (x100)	-1.53	-3.21	-4.21	-4.19	0.89	-0.54	-1.52	-2.53
	(1.50)	(1.36)	(0.98)	(0.90)	(1.73)	(1.46)	(1.14)	(1.05)
Industry Trends	no	no	no	no	yes	yes	yes	yes

The measure of concentration is the inverse of the Pareto index implied by the share of sales among the top 4, 8, 20 or 50 firms in the industry. An industry's corporate tax rate is the establishment-weighted average of effective state corporate tax rates. Each cell represents a separate regression and all specifications include industry and year fixed effects. Panels (c) and (d) interact fixed industry effects with an indicator for post-1992 surveys to account for the change in industrial classification systems in the data. Columns (4)-(8) include industry-specific trends. Standard errors in parentheses are clustered at the sector level.