Declining Labor and Capital Shares

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Abstract

This paper shows that the decline in the labor share over the past 30 years was not offset by an increase in the capital share. Capital costs are the product of the required rate of return on capital and the value of the capital stock, and the capital share is the ratio of capital costs to gross value added. The capital share is declining, driven by a large decline in the cost of capital. Measured in percentage terms, the decline in the capital share (30%) is much more dramatic than the decline in the labor share (10%). The profit share has increased by more than 12 percentage points. The value of this increase in profits amounts to over $1.1 trillion in 2014, or $14 thousand per employee. The decline in the capital share is unlikely to be driven by unobserved capital. In a standard model, a decline in competition is necessary to generate simultaneous declines in the labor and capital shares. A calibrated model shows that a decline in competition quantitatively matches the data. This paper provides reduced form empirical evidence that a decline in competition plays a significant role in the decline in the labor share. Increases in industry concentration are associated with declines in the labor share. These results suggest that the decline in the shares of labor and capital are due to a decline in competition and call into question the conclusion that the decline in the labor share is an efficient outcome.

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1 Introduction

Over the past 30 years we have witnessed a large decline in the labor share of gross value added (Elsby, Hobijn and Şahin (2013) and Karabarbounis and Neiman (2014)). Many existing explanations for the decline in the labor share, such as technological change, mechanization, capital accumulation, and a change in the relative price of capital, focus on tradeoffs between labor and capital. In these explanations, the decline in the labor share is offset by an increase in the capital share. Furthermore, these explanations view the shift from labor to capital as an efficient outcome. In this paper, I show that the shares of both labor and capital are declining and are jointly offset by a large increase in the share of profits.

In order to construct separate time series for the shares of capital and profits, I specify an ex-ante required rate of return on capital. There are two approaches to constructing capital costs and the capital share. The first approach, pioneered by Hall and Jorgenson (1967), specifies an ex-ante required rate of return on capital that is derived from the standard model of production theory. In this approach, capital costs are the product of the required rate of return on capital and the value of the capital stock. The second approach, often referred to as the ex-post approach, assumes that all dollars not paid to labor are capital costs. This second approach is equivalent to assuming that profits are zero and therefore it does not allow us to distinguish between changes in the capital share and changes in the profit share.

Following Hall and Jorgenson (1967), I compute a series of capital costs for the U.S. non-financial corporate sector over the period 1984–2014, equal to the product of the required rate of return on capital and the value of the capital stock. I consider three specifications of the required rate of return: the first assumes that firms finance capital with debt, the second assumes that firms finance capital with both debt and equity, and the third further accounts for the tax treatment of debt and capital. Over this time period, all measures of the cost of borrowing in financial markets (henceforth, *cost of capital*) show a large decline of 7 percentage points, or 50%. At the same time, measures of expected and realized inflation show no trend. The required rate of return on capital declines sharply, due to the large decline in the cost of capital.

The large decline in the required rate of return does not necessarily imply a decline in the capital share. In a typical model of firm production, firms respond to the decline in the required rate of return by increasing their use of capital inputs. If firms respond strongly enough, the increase in capital inputs is larger than the decline in the required rate of return, and as a result the capital share increases. Indeed, this is the common prediction of all the explanations for the decline in the labor share that focus on tradeoffs between labor and capital.

However, the U.S. non-financial corporate sector does not sufficiently increase its use of capital inputs to offset the decline in the required rate of return, and as a result the capital share declines. The decline in the risk-free rate and the lack of capital accumulation have been noted by Furman and Orszag (2015). Measured in percentage terms, the decline in the capital share (30%) is much more dramatic than the decline in the labor share (10%). Back in 1984, every dollar of expenditures on labor was accompanied by approximately 38¢ of expenditures on capital. By 2014, a dollar of expenditures on labor was accompanied by only 31¢ of expenditures on capital. Despite the decline in the labor share, expenditures on labor have increased faster than expenditures on capital.

As a share of gross value added, over the past 30 years firms have reduced expenditures on both labor and capital and increased profits. Consistent with earlier research, I find that profits were very small in the early 1980s. However, profits have increased dramatically over the past 3 decades. Across specifications, the profit share (equal to the ratio of profits to gross value added) has increased by more than 12 percentage points. To offer a sense of magnitude, the value of this increase in profits amounts to over $1.1 trillion in 2014, or $14 thousand for each of the approximately 81 million employees of the non-financial corporate sector.

One concern with the measurement of capital costs and profits is the possibility of omitted or unobserved capital. Past research has considered several forms of intangible capital that are not currently capitalized by the BEA and has argued that these are important for explaining asset valuations and cash flows. The inclusion of additional capital increases the capital share and decreases the profit share. At the same time, the effects of including additional capital on the time trends of the capital and profit shares are less clear. The large decline in the cost of capital equally affects the required rate of return on any additional form of capital. As a result, if this additional capital grows only at the rate of output then the additional capital costs will grow far slower than output. Thus, in order for this additional capital to have a mitigating effect on the measured trends of the shares of capital and profits, the stock of additional capital would need to grow significantly faster than output.

Existing measures of missing intangible capital are orders of magnitude too small and are growing too slowly to explain either the trends of the capital and profit shares or the level of profits. Measures of missing intangible capital can account for at most $31 billion of the $410 billion in profits in 1996; they can account for at most $57 billion of the $983 billion in profits in 2011. The growth in missing capital necessary to explain the observed trends of the capital and profit shares would result in a stock of intangible capital that is far larger than all observed capital (physical and intangible).

Turning to possible explanations for the simultaneous declines in the labor and capital shares, I present a standard general equilibrium model with imperfect competition. The model points to a decline in competition and an increase in markups as the explanation for the declines in the labor and capital shares. The growing gap between labor productivity and wages as well as the lack of capital accumulation in response to the decline in the required rate of return are features of declining competition. The degree of generality of the model allows us to consider a wide range of alternative explanations for the decline in the labor share, including a slowdown in TFP growth, capital-biased technological change, a change in relative prices, and a change in the supply of labor. With appropriate assumptions, each of these alternative explanations can cause a decline in the labor share. However, common to all of these explanations is the fact that any such decline in the labor share would have to be entirely offset by an increase in the capital share. Only a decline in competition can explain a simultaneous decline in the shares of labor and capital. In this sense, a decline in competition is necessary to match the data.

Using the model, I perform two sets of counterfactual exercises. The first set of counterfactual exercises are backward-looking: they ask how the labor share, capital share, and investment rate should have evolved from 1984 to 2014 in response to the decline in competition that is inferred from the data. The second set of model-based counterfactual estimates are forward-looking: they ask how output, wages, and investment can be expected to evolve from 2014 onward if competition were increased to its 1984 level. Looking backwards, in response to the decline in competition, the model predicts declines in the labor and capital shares over the period 1984–2014 that quantitatively match the observed declines. Looking forward, the model implies that an increase in competition would increase output (10%), wages (24%), and investment (19%).

Last, I provide reduced form empirical evidence that a decline in competition and an increase in markups have played a significant role in the decline in the labor share. I show that those industries that experience a larger increase in concentration also experience a larger decline in the labor share. Based on the estimated correlations and observed increase in industry concentration, the predicted decline in the labor share is of the same magnitude as the observed decline in the labor share. In this sense, the increase in industry concentration can account for most of the decline in the labor share. These results complement the aggregate findings, as (1) they rely on cross sectional rather than time series variation and (2) they do not rely on capital data and are therefore not subject to concerns about the measurement of capital. Taken as a whole, my results suggest that the declines in the shares of labor and capital are due to a decline in competition and they call into question the conclusion that the decline in the labor share is an efficient outcome.

2 Literature Review

There have been many recent empirical and theoretical contributions to the study of the decline in the labor share. Elsby, Hobijn and Şahin (2013) provide detailed documentation of the decline in the U.S. labor share and Karabarbounis and Neiman (2014) document a global decline in the labor share. Many possible explanations for the decline in the labor share have been put forward, including capital-augmenting technological change and the mechanization of production (Zeira (1998), Acemoglu (2003), Brynjolfsson and McAfee (2014), Summers (2013), Acemoglu and Restrepo (2016)), a decline in the relative price of capital (Jones (2003), Karabarbounis and Neiman (2014)), capital accumulation (Piketty (2014), Piketty and Zucman (2014)), globalization (Elsby, Hobijn and Şahin (2013)), a decline in the bargaining power of labor (Bental and Demougin (2010), Blanchard and Giavazzi (2003), Stiglitz (2012)), and an increase in the cost of housing (Rognlie (2015)). I contribute to this literature by documenting and studying the simultaneous declines in the shares of labor and capital and by emphasizing the role of declining competition and increasing markups.

Previous studies have considered the welfare implications of the decline in the labor share. Fernald and Jones (2014), drawing on Zeira (1998), show that a decline in the labor share that is due to the mechanization of production leads to rising growth and income. Karabarbounis and Neiman (2014) find that the decline in the labor share is due in part to technological progress that reduces the relative cost of capital, which leads to a substantial increase in consumer welfare, and in part to an increase in markups, which reduces welfare. The authors find that the increase in welfare due to the change in the relative price of capital is far greater than the decline that is due to the change in markups. Acemoglu and Restrepo (2016) present a model in which the labor share fluctuates in response to capital-augmenting technological change and show that the endogenous process of technology adoption, in the long run, restores the labor share to its previous level. Blanchard and Giavazzi (2003) present a model in which a decline in the bargaining power of labor leads to a temporary decline in the labor share and a long-run increase in welfare. By contrast, I find that the decline in the labor share is due to a decline in competition and an increase in markups, is accompanied by large gaps in output, wages, and investment, and that without a subsequent increase in competition, the labor share will not revert to its previous level.

The measurement of the capital share in this paper builds on the work of Karabarbounis and Neiman (2014) and Rognlie (2015). Karabarbounis and Neiman (2014) and Rognlie (2015) study the decline in the labor share and additionally provide an estimate of the capital share. Both papers find that the capital share does not sufficiently increase to offset the decline in the labor share and furthermore the capital share might decrease slightly.[1] Both papers use quantity–based measures to estimate the decline in the capital share: Karabarbounis and Neiman (2014) measure the percentage change in the capital share as the percentage change in the ratio of investment to gross value added, while Rognlie (2015) measures the percentage change in the capital share as the percentage change in the ratio of the value of the capital stock to gross value added. Unlike these papers, I use market prices to measure debt and equity costs of capital. The cost of capital halves over the period 1984–2014, which leads to a large decline in the required rate of return. The

[1] See Karabarbounis and Neiman (2014) Section IV.B and column 6 of Table 4; Rognlie (2015) Section II.B.

capital stock does not grow fast enough to offset the large decline in the required rate of return and as a result the capital share declines. Measures of the capital share that assume a constant required rate of return show no decline; measures of the capital share that incorporate market prices show a large decline. See Section 3.6 for further details.

The model that I use to study the decline in the shares of labor and capital is standard and essentially identical to the model that appears in Karabarbounis and Neiman (2014). The use of a standard model ensures that the model-based results are not due to novel modeling features, but rather are a direct consequence of the measurement of the capital share. Based on their measurement of the capital share (no decline), the model in Karabarbounis and Neiman (2014) attributes half of the decline in the labor share to an increase in markups and half of the decline to a decline in the relative price of capital. Furthermore, Karabarbounis and Neiman (2014) find that, on net, the decline in the labor share has been accompanied by large welfare gains. Based on my measurement of the capital share (large decline), the model in Section 4 attributes all of the decline in the labor share to a decline in competition and an increase in markups and further finds that the decline in the labor share has been accompanied by large gaps in output, wages, and investment. See Section 4.4 for further details.

This paper contributes to a large literature on the macroeconomic importance of competition and markups. Rotemberg and Woodford (1995) provide evidence suggesting that the share of profits in value added was close to zero in the period prior to 1987. Basu and Fernald (1997) find that U.S. industries had a profit share of at most 3 percent during the period 1959-1989. Theoretic research has argued that in a setting without profits, there are benefits to ex-post measurements of capital costs (realized value added less realized labor costs) instead of ex-ante capital costs (the product of the required rate of return on capital and the value of the capital stock).[2] Past empirical estimates of small economic profits together with the potential theoretical advantage of indirectly inferring capital costs have led many researchers to prefer the assumption of zero profits over the direct measurement of capital costs. Indeed, the seminal works of Jorgenson, Gollop and Fraumeni (1987) and Jorgenson and Stiroh (2000) that measure changes in U.S. productivity do not estimate capital costs,[3] and many subsequent studies follow in their path. By contrast, my findings overturn previous empirical measurements of profits. While I confirm previous estimates of low profits in the early 1980s, I show that profits have substantially increased over the past 30 years. Moreover, I show that the decline in competition that generates these profits are potentially large enough to generate large declines in the shares of labor and capital, as well as a large gaps in output, wages, and investment.

Last, this paper contributes to a recent and diverse literature on declining competition. Peltzman (2014)

[2]Hulten (1986) and Berndt and Fuss (1986) show that in settings without profits, ex-post measures of capital costs can properly account for cyclical patterns in capital utilization.

[3]See for example Jorgenson, Ho and Stiroh (2005), p. 157.

shows that concentration, which (on average) had been unchanged from 1963 to 1982, began rising after the Department of Justice Merger Guidelines adopted Robert Bork's "Rule of Reason." In unpublished work, Peltzman shows that those industries that experience larger increases in concentration also experience larger increases in prices. Recent studies of mergers and acquisitions (M&A) in manufacturing industries find evidence that consolidation has led to a decline in competition and consumer surplus. Kulick (2016) studies M&As in the quick-mix concrete industry and shows that horizontal mergers are associated with an increase in price and a decline in output, leading to a substantial decline in consumer surplus. Blonigen and Pierce (2016) study the effect of M&As in manufacturing industries and find that M&As are associated with increases in markups, but have little or no effect on productivity or efficiency.

Increases in profits are reflected in measures of corporate valuations and profitability. Lindenberg and Ross (1981) and Salinger (1984) provide theoretical and empirical support that relates Tobin's q, the ratio of the market value of a firm to the replacement value of assets, to market power and profits. Recent studies find evidence that increases in concentration and barriers to entry increase the market value of incumbent firms. Grullon, Larkin and Michaely (2016) show that the large increase in industry concentration has been driven by the consolidation of publicly traded firms into larger entities and that firms in industries with the largest increases in product market concentration have enjoyed higher profit margins, positive abnormal stock returns, and more profitable M&A deals. Bessen (2016) provides evidence that increases in federal regulation favor incumbent firms and lead to increases in market valuations and operating margins. Bessen concludes that increases in federal regulation and political rent seeking have increased corporate valuations by $2 trillion and annually transfer $200 billion from consumers to firms. Gonzalez and Trivın (2016) show in a panel of 41 countries that an increase in Tobin's q is associated with a decline in the labor share.

In addition to the increase in industry concentration, concentration of firm ownership is on the rise. Azar (2012) documents a large increase in the concentration of ownership. Fichtner, Heemskerk and Garcia-Bernardo (2017) find that, together, BlackRock, Vanguard, and State Street constitute the largest shareholder in 88 percent of S&P 500 firms. Recent work has linked the increase in common ownership to a decline in competition. Azar, Schmalz and Tecu (2016) show that increases in common ownership of airlines have increased prices by as much as 10%. Azar, Raina and Schmalz (2016) show that the increase in the concentration of bank ownership has led to higher fees, thresholds, and lower returns on savings.

In the context of international trade, De Loecker and Van Biesebroeck (2016) show that incorporating market power changes the theoretical gains from trade, and that the net effect on welfare crucially depends on which firms take advantage of the decline in trade barriers. De Loecker and Warzynski (2012) provide evidence that measured productivity gains of Slovenian exporters are in fact the result of high markups. De Loecker et al. (2016) provide evidence that India's trade liberalization has led to increases in markups and as a result owners of firm profits received most of the gains from trade.

The past few decades have been marked by a secular decline in business dynamism. Statistics from the U.S. Census Bureau, Business Dynamics Statistics, show a secular decline in firm entry and firm exit rates. Davis and Haltiwanger (2014) document a decline in worker reallocation rates and argue that reduced fluidity has harmful consequences for productivity, real wages, and employment. Decker et al. (2016) show a secular decline in job creation and destruction rates since 1980. Since 2000, the decline in dynamism and entrepreneurship has been accompanied by a decline in young high-growth firms. Furthermore, much of the decline in business dynamism occurs within detailed industry, firm-size and firm-age categories. Recent White House publications[4] suggest that the decline in competition is responsible for the decline in business dynamism.

This paper contributes to the literature on declining competition in three ways. First, this paper provides an aggregate measure of profits. To the best of my knowledge no such measure exits for the past three decades. I show that profits in the U.S. non-financial corporate sector have reached approximately 16% of gross value added; in 2014, these profits amounted to \$1.35 trillion or \$17,000 per employee. Second, this paper highlights the macroeconomic implications of declining competition and increasing markups. Using a calibrated model, I find that a decline in competition quantitatively matches the decline in the labor share. Furthermore, an increase in competition to its 1984 level would lead to large increases in output (10%), wages (24%), and investment (19%). Third, this paper relates the increase in industry concentration to the decline in the labor share. My empirical results suggest that the increase in industry concentration can account for most of the decline in the labor share.

This paper is complementary to the independent and contemporaneous work of Gutiérrez and Philippon (2016) and Autor et al. (2017). Gutiérrez and Philippon (2016) show that a lack of competition and firm short-termism explain under-investment. Industries with more concentration and more common ownership invest less, even after controlling for current market conditions. The authors also find that those firms that under-invest spend a disproportionate amount of free cash flows buying back their shares. Autor et al. (2017) independently discovered a negative industry-level correlation between declining labor shares and increased industry concentration. Their work further uses firm-level data to provide evidence that reallocation across firms has contributed to the decline in the labor share. Taken together, the evidence shows that increases in industry concentration can explain the decline in the labor share, under-investment and a large rise in corporate profits.

[4] See Furman and Orszag (2015), Furman (2016), Council of Economic Advisers (2016*a*), and Council of Economic Advisers (2016*b*).

3 The Capital Share

This section documents a large decline in the capital share and a large increase in the profit share of the U.S. non-financial corporate sector over the period 1984–2014. Following Hall and Jorgenson (1967), I compute a series of capital costs equal to the product of the required rate of return on capital and the value of the capital stock. The required rate of return on capital declines sharply, driven by a large decline in the cost of borrowing in financial markets. At the same time, the ratio of capital to gross value added does not sufficiently increase to offset the decline in the required rate of return, and as a result the capital share declines. Measured in percentage terms, the decline in the capital share (30%) is much more dramatic than the decline in the labor share (10%). The shares of both labor and capital are declining and are jointly offset by an increase in the share of profits.

This section further considers the robustness of the decline in the capital share and the increase in the profit share to potentially omitted or unobserved intangible capital as well as alternative recorded measures of capital. I find that existing measures of missing intangible capital are orders of magnitude too small and growing too slowly to explain either the trends of the capital and profit shares or the level of profits. I also find that extending the BEA measures of capital by including real estate at market prices (instead of at replacement cost) and inventories strengthens the results.

3.1 Constructing Capital Costs

3.1.1 The Required Rate of Return

The construction of the required rate of return on capital follows Hall and Jorgenson (1967). I consider three specifications. In the first specification, the required rate of return on capital of type s is[5]

$$R_s = \left(i^D - \mathbb{E}\left[\pi_s\right] + \delta_s\right) \tag{3.1}$$

where i^D is the cost of debt borrowing in financial markets (henceforth, *cost of capital*), π_s is the inflation rate of capital of type s, and δ_s is the depreciation rate of capital of type s. The second specification accounts for both debt and equity financing

$$R_s = \left(\left(\frac{D}{D+E}i^D + \frac{E}{D+E}i^E\right) - \mathbb{E}\left[\pi_s\right] + \delta_s\right) \tag{3.2}$$

[5]The model of production presented in Section 4 has, in equilibrium, a required rate of return on capital equal to $R_s = (i - (1-\delta_s)\,\mathbb{E}\left[\pi_s\right] + \delta_s)$. The formula presented in Equation 3.1 is more widely used in the literature. In the data, the two versions yield similar results.

where D is the market value of debt, i^D is the debt cost of capital, E is the market value of equity, i^E is the equity cost of capital, and $\left(\frac{D}{D+E}i^D + \frac{E}{D+E}i^E\right)$ is the weighted average cost of capital. The third specification accounts for both debt and equity financing as well as the tax treatment of debt and capital.[6] Unlike compensation of employees, firms are unable to fully expense investment in capital and as a result the corporate tax rate increases the firm's cost of capital inputs. Since interest payments on debt are tax-deductible, the financing of capital with debt lowers the firm's cost of capital inputs. Once we account for the tax treatment of both capital and debt, the required rate of return on capital of type s is

$$R_s = \left(\left(\frac{D}{D+E}i^D(1-\tau) + \frac{E}{D+E}i^E\right) - \mathbb{E}[\pi_s] + \delta_s\right)\frac{1-z_s\tau}{1-\tau} \tag{3.3}$$

where τ is the corporate income tax rate, and z_s is the net present value of depreciation allowances of capital of type s.

3.1.2 Capital Costs

Given an asset-specific specification of the required rate of return, R_s, capital costs for capital of type s are

$$E_s = R_s P_s^K K_s \tag{3.4}$$

where K_s is the quantity of capital of type s, P_s^K is the price of capital of type s, and $P_s^K K_s$ is the nominal value of the stock capital of type s. Note that capital costs are measured in nominal dollars. Summing across the different types of capital, aggregate capital costs are

$$E = \sum_s R_s P_s^K K_s \tag{3.5}$$

We can decompose aggregate capital costs into an aggregate required rate of return on capital and the nominal value of the capital stock

$$\sum_s R_s P_s^K K_s = \underbrace{\sum_s \frac{P_s^K K_s}{\sum_j P_j^K K_j} R_s}_{R} \times \underbrace{\sum_s P_s^K K_s}_{P^K K} \tag{3.6}$$

The first term is the weighted average of the asset-specific required rates of return, where the weight on asset s is proportional to the nominal value of the stock of capital of type s. The second term is the nominal value

[6]For the tax treatment of capital and debt, see Hall and Jorgenson (1967), King and Fullerton (1984), Jorgenson and Yun (1991), and Gilchrist and Zakrajsek (2007). Past research has included an investment tax credit in the calculation of the required rate of return on capital; the investment tax credit expired in 1986. The results are robust to including the investment tax credit.

of the aggregate capital stock.

The capital share of gross value added is

$$S^K = \frac{\sum\limits_s R_s P_s^K K_s}{P^Y Y} \tag{3.7}$$

where $\sum\limits_s R_s P_s^K K_s$ are aggregate capital costs and $P^Y Y$ is nominal gross value added.

To clarify the terminology and units, consider a firm that uses 2000 square feet of office space and 100 laptops. The firm's cost of capital in financial markets is 6% per year. The sale value of the office space is \$880,000 at the start of the year, and the office space is expected to appreciate in price by 4% and depreciate at a rate of 3%. The required rate of return on the office space is 5% and the capital costs of the office space are $\$44,000 = 0.05 \times \$880,000$ (or \$22 per square foot). The sale value of the 100 laptops is \$70,000 at the start of the year, and the laptops are expected to appreciate in price by $(-10)\,\%$ and depreciate at a rate of 25%. The required rate of return on the laptops is 41% and the capital costs of the laptops are $\$28,700 = 0.41 \times \$70,000$ (or \$287 per laptop). Aggregate capital costs are \$72,700 and the value of the aggregate capital stock is \$950,000. The aggregate required rate of return on capital is $R = \frac{\$72{,}700}{\$950{,}000} \approx 0.08$. If we further assume that the firm's gross value added for the year is \$500,000, then the firm's capital share is $S^K = \frac{\$72{,}700}{\$500{,}000} \approx 0.15$.

3.1.3 National Accounting

I assume that the true model of accounting for the U.S. non-financial corporate sector in current dollars is

$$P_t^Y Y_t = w_t L_t + R_t P_{t-1}^K K_t + \Pi_t \tag{3.8}$$

where P_t^Y is the current dollar price of output and $P_t^Y Y_t$ is the current dollar value of gross value added, w_t is the current dollar wage rate and $w_t L_t$ is the total current dollar expenditures on labor, R_t is the required rate of return on capital, P_{t-1}^K is the price of capital purchased in period $t-1$, K_t is the stock of capital used in production in period t and is equal to the stock of capital available at the end of period $t-1$, and $R_t P_{t-1}^K K_t$ are current dollar capital costs, and Π_t are current dollar profits. This can be written in shares of gross value added as

$$1 = S_t^L + S_t^K + S_t^\Pi \tag{3.9}$$

where $S_t^L = \frac{w_t L_t}{P_t^Y Y_t}$ is the labor share, $S_t^K = \frac{R_t P_{t-1}^K K_t}{P_t^Y Y_t}$ is the capital share, and $S_t^\Pi = \frac{\Pi_t}{P_t^Y Y_t}$ is the profit share.

In the data, nominal gross value added $P^Y Y$ is the sum of expenditures on labor wL, gross operating surplus, and taxes on production and imports less subsidies. By separating gross operating surplus into capital costs $RP^K K$ and profits Π, we get

$$P^Y Y = wL + RP^K K + \Pi + \text{taxes on production and imports less subsidies} \tag{3.10}$$

Unlike taxes on corporate profits, it is unclear how to allocate taxes on production across capital, labor, and profits. As a share of gross value added, these taxes on production are nearly constant throughout the sample period. Consistent with previous research, I study the shares of labor, capital, and profits without allocating the taxes. Allocating these taxes across labor, capital, and profits yields similar results.

3.2 Data

3.2.1 Value Added and Capital

Data for the U.S. non-financial corporate sector are taken from the following sources. Data on nominal gross value added are taken from the National Income and Productivity Accounts (NIPA) Table 1.14 (line 17). Data on compensation of employees are taken from the NIPA Table 1.14 (line 20). Compensation of employees includes all wages in salaries, whether paid in cash or in kind and includes employer costs of health insurance and pension contributions. Compensation of employees also includes the exercising of most stock options;[7] stock options are recorded when exercised (the time at which the employee incurs a tax liability) and are valued at their recorded tax value (the difference between the market price and the exercise price). Compensation of employees further includes compensation of corporate officers. Data on taxes on production and imports less subsidies are taken from the NIPA Table 1.14 (line 23).

Capital data are taken from the Bureau of Economic Analysis (BEA) Fixed Asset Table 4.1. The BEA capital data provide measures of the capital stock, the depreciation rate of capital and inflation for three categories of capital (non-residential structures, equipment, and intellectual property products), as well as a capital aggregate. The 14th comprehensive revision of NIPA in 2013 expanded its recognition of intangible capital beyond software to include expenditures for R&D and for entertainment, literary, and artistic originals as fixed investments. Asset-specific expected capital inflation is constructed as a three-year moving average of realized capital inflation. The results are robust to using realized capital inflation instead of expected capital inflation.

[7]There are two major types of employee stock options: incentive stock options (ISO) and nonqualified stock options (NSO). An ISO cannot exceed 10 years, and options for no more than $100,000 worth of stock may become exercisable in any year. When the stock is sold, the difference between the market price and the exercise price of the stock options is reported as a capital gain on the employee's income tax return. The more common stock option used is the NSO. When the option is exercised, the employee incurs a tax liability equal to the difference between the market price and the exercise price (reported as wages); the company receives a tax deduction for the difference between the market price and the exercise price, which reduces the amount of taxes paid. Compensation of employees includes the exercising of NSO, but not the exercising of ISO. For further details see Moylan (2008).

The data cover the geographic area that comprises the 50 states and the District of Columbia. As an example, all economic activity by the foreign-owned Kia Motors automobile manufacturing plant in West Point, Georgia is included in the data and is reflected in the measures of value added, investment, capital, and compensation of employees. By contrast, all economic activity by the U.S.-owned Ford automobile manufacturing plant in Almussafes, Spain is not included in the data and is not reflected in the measures of value added, investment, capital, and compensation of employees.

The output and capital data do not include any residential housing. BEA Fixed Asset Table 5.1 indicates that, in addition to non-residential fixed assets (non-residential structures, equipment, and ipp), the corporate sector owns a small amount of residential housing. In all years, residential housing makes up a very small fraction of the value of the fixed assets owned by the U.S. non-financial corporate sector. In 2014, the corporate sector owned \$0.19 trillion of residential housing. In the same year, the non-financial corporate sector owned \$14.62 trillion of non-residential fixed assets (non-residential structures, equipment, and ipp). In addition, corporate-owned residential housing makes up a very small fraction of total U.S. residential housing. In 2014, the value of residential housing in the private economy was \$18.5 trillion. I have not included this stock of residential housing in the calculations. Similarly, the measure of gross value added does not include the \$1.66 trillion contribution of residential housing to the gross value added of the private sector. The results are robust to including the corporate-owned residential housing.

3.2.2 Debt, Equity, and Taxes

Data on the market value of debt and equity for the U.S. non-financial corporate sector are taken from the Integrated Macroeconomic Accounts for the United States, Table S.5.a (debt is the sum of lines 130 and 134, equity is line 140). Data on the corporate tax rate are taken from the OECD Tax Database and data on the capital allowance are taken from the Tax Foundation.

Data on the debt cost of capital are taken from the Federal Reserve Economic Data (FRED). All debt instruments available through FRED show a large decline in the debt cost of capital. In the main specification, the debt cost of capital is equal to the yield on Moody's Aaa bond portfolio. The results are robust to using alternative debt instruments, such as the yield on Moody's Baa bond portfolio or a fixed spread over LIBOR. Starting in 1997, the Bank of America Merrill Lynch provides a representative bond portfolio.[8] In the overlapping period 1997–2014, Moody's Aaa bond portfolio and the Bank of America Merrill Lynch

[8] The BofA Merrill Lynch US Corporate Master Effective Yield "tracks the performance of US dollar denominated investment grade rated corporate debt publically issued in the US domestic market. To qualify for inclusion in the index, securities must have an investment grade rating (based on an average of Moody's, S&P, and Fitch) and an investment grade rated country of risk (based on an average of Moody's, S&P, and Fitch foreign currency long term sovereign debt ratings). Each security must have greater than 1 year of remaining maturity, a fixed coupon schedule, and a minimum amount outstanding of \$250 million."

representative bond portfolio display similar levels and trends.[9]

Unlike the debt cost of capital, which is observable in market data, the equity cost of capital is unobserved. In the main specification, I construct the equity cost of capital as the sum of the yield on the ten-year U.S. treasury and a 5% equity risk premium. The results are robust to a range of alternative values of the equity risk premium: increasing the equity risk premium increases the level of the required rate of return and the capital share but leads to a similar trend in the capital share.

As an alternative to assuming a fixed equity premium, we can use a model of equity prices that relates observed financial market data to the unobserved equity cost of capital. One standard model for constructing the equity cost of capital is the Dividend Discount Model (DDM).[10] In the DDM[11] the equity cost of capital is the sum of the risk-free rate and the equity risk premium, and the risk premium is equal to the dividend price ratio. Constructing the equity cost of capital as the sum of the yield on the ten-year U.S. treasury and the dividend price ratio of the S&P 500 leads to a larger estimated decline in the capital share and a larger increase in the profit share.

3.2.3 Treatment of the Data

Negative values of the required rate of return on capital can and do appear in the data. There are periods in which the cost of capital is low and expected inflation is sufficiently high that the required rate of return is negative. In the BEA data this occurs for structures in 2006 and 2007 (when calculating expected inflation as a three-year moving average of realized inflation). I set the negative required rate of return to zero. The results are robust to allowing for negative required rates of return.

3.3 Results

Throughout this subsection, several time series are approximated by a linear or quadratic time trend. For a variable X, the fitted percentage point (pp) change in X is $\hat{X_{2014}} - \hat{X_{1984}}$, and the fitted percent (%) change in X is $\frac{\hat{X_{2014}} - \hat{X_{1984}}}{\hat{X_{1984}}}$.

[9]With the exception of the Great Recession, the Bank of America Merrill Lynch representative bond portfolio has a yield similar to or below the yield on Moody's Aaa bond portfolio. While Moody's Aaa has a higher grade than the representative portfolio, it also has a longer maturity and this can explain why the two portfolios have similar yields throughout the sample. The yield on Moody's Baa bond portfolio closely tracks the yield on Moody's Aaa bond portfolio, although the yields on the two portfolios have different levels.

[10]This model is based on Rozeff (1984). Campbell and Shiller (1988) and Fama and French (1988) provide empirical evidence that dividend yields predict future returns. Damodaran (2016) provides a survey of models of the equity risk premium.

[11]This result is based on the assumption that the growth rate of dividends is constant and is equal to the risk-free rate.

3.3.1 The Required Rate of Return

Figure 1 shows the components of the required rate of return on capital for the U.S. non-financial corporate sector over the period 1984–2014. Panel A shows three measures of the cost of capital: the debt cost of capital, equal to the yield on Moody's Aaa bond portfolio; the equity cost of capital, equal to the sum of the risk-free rate (the yield on the ten-year treasury) and the equity risk premium (5%); and the weighted average cost of capital, equal to the weighted average of the debt cost of capital and the equity cost of capital, where the weight on the debt cost of capital is the ratio of the market value of debt to the sum of the market values of debt and equity. All three measures of the cost of capital show a large decline over the period 1984–2014. Approximating each series by a linear time trend shows a decline of at least 7 percentage points: the cost of capital halves over this time period.

Panel B shows two measures of expected inflation: expected capital inflation, equal to a three-year moving average of realized capital inflation; and expected consumption inflation, equal to the median expected 12-month price change from the University of Michigan's Survey of Consumers. Both measures of expected inflation show no trend over the period 1984–2014. While realized inflation is more volatile than expected inflation, realized capital inflation and realized consumption inflation also show no trend over this period. Panel C shows the depreciation rate of capital. While there is variation over time in the depreciation rate, this variation is very small compared to the decline in the cost of capital.

Combining the trend of the cost of capital (large decline) with the trend of expected inflation (no decline) we conclude that there has been a large decline in the real cost of capital, on the order of magnitude of 7 or 8 percentage points over the period 1984–2014.

Panel D combines the cost of capital, expected capital inflation, and the depreciation rate of capital to show the first specification of the required rate of return on capital, which was presented in Equation 3.1. The figure shows a clear and dramatic decline in the required rate of return on capital. The decline in the required rate of return tracks the decline in the cost of capital. Approximating the required rate of return by a linear time trend, the required rate of return on capital declines by 39%. Table 1 reports the time trends of the required rate of return on capital for each of the three specifications presented in Equations 3.1–3.3. Across the three specifications, the required rate of return on capital declines between 31% and 39%.

3.3.2 Capital and Profits

Figure 2 shows the capital and profit shares of gross value added for the U.S. non-financial corporate sector over the period 1984–2014. Recall from Section 3.1.3 that capital costs are the product of the required rate of return on capital and the value of the capital stock, profits are gross value added less compensation of employees less capital costs less taxes on production and imports plus subsidies, the capital share is the ratio of capital costs to gross value added, and the profit share is the ratio of profits to gross value added. For the purpose of this figure, the required rate of return on capital is calculated in accordance with Equation 3.1.

Panel A shows the capital share of gross value added. The capital share shows a clear and dramatic decline. Approximating the capital share by a linear time trend shows a decline of 30%. The decline in the capital share (30%) is significantly larger than the decline in the labor share (10%).

Panel B shows the profit share of gross value added. The profit share shows a clear and dramatic increase. Consistent with previous research,[12] I find that profits were very small in the early 1980s. However, profits have increased dramatically over the past 3 decades. The fitted linear trend shows that profits increased from approximately 2.2% of gross value added in 1984 to 15.7% of gross value added in 2014, a more than sixfold increase of 13.5 percentage points.

Table 1 reports the trend of the capital and profit shares for each of the three specifications of the required rate of return on capital. Across the three specifications, the capital share declines between 20% and 30%. The decline in the capital share is at least twice as large as the decline in the labor share. Across the three specifications, the profit share increases between 12.2pp and 13.5pp.

3.4 Magnitude

The labor share measures the ratio of compensation of employees to labor productivity

$$\frac{wL}{P^Y Y} = \frac{w}{P^Y Y/L}$$

Over the period 1984–2014, labor productivity grew faster than labor compensation. The growing gap between labor productivity and labor compensation is not explained by an increase in expenditures on capital. Back in 1984, every dollar of expenditures on labor was accompanied by 38¢ of expenditures on capital. By 2014, a dollar of expenditures on labor was accompanied by only 31¢ of expenditures on capital. Despite the decline in the labor share, expenditures on labor have increased faster than expenditures on capital.

As a share of gross value added, over the past 30 years firms have dramatically reduced expenditures on both labor and capital and increased profits. Across specifications, the profit share has increased between 12.2pp and 13.5pp. The value of this increase in profits amounts to $1.1–$1.2 trillion in 2014, or $13.0–$14.4 thousand for each of the approximately 81 million employees of the non-financial corporate sector.

[12] See, for example, Rotemberg and Woodford (1995) and Basu and Fernald (1997).

3.5 Robustness

This subsection considers the robustness of the decline in the capital share and the increase in the profit share to potentially omitted or unobserved intangible capital as well as alternative recorded measures of capital. Before turning to alternative measures of capital, it is worth considering how the inclusion of additional forms of capital are likely to affect the measurement of the capital and profit shares as well as the time trends of the capital and profit shares.

To begin, the effect of including an additional form of capital unambiguously increases capital costs. Since the required rate of return on this additional capital is positive (or at least non-negative), the user of this capital incurs positive annual capital costs. Next, the inclusion of additional capital very likely increases gross value added. Current measures of value added exclude firm investment in this additional capital and therefore underestimate gross value added by the value of the investment. So long as investment in this capital is positive, gross value added is understated. The effect of profits is ambiguous: on the one hand capital costs are now a larger portion of recorded value added, and on the other hand recorded value added understates true value added. The inclusion of this additional capital will reduce profits if capital costs are larger than investment. A few lines of simple algebra show that so long as capital costs of this additional capital are larger than investment, accounting for this capital increases the capital share and decreases the profit share. For each of the types of capital that we do observe in the BEA Fixed Asset Tables, capital costs are always larger that investment. To summarize: under a modest condition that holds for the types of capital that we do observe, the inclusion of additional capital will increase capital costs, value added, and the capital share, and will reduce profits and the profit share.

While it is easy to work out the effect of including an additional form of capital on the level of the capital and profit shares, its effects on the time trends of the capital and profit shares are less clear. Over the past 30 years the required rate of return on all forms of capital declined sharply, due to a large decline in the cost of capital. This decline in the cost of capital equally affects the required rate of return on any additional form of capital. As a result, if the stock of additional capital grows only at the rate of output, then the additional capital costs will grow far slower than output. This will have the effect of further reducing the trend of the capital share and further increase the trend of the profit share. In order for this additional capital to have any mitigating effect on the trends of the shares of capital and profits, the stock of additional capital would need to grow significantly faster than output. In order for this additional capital to completely offset the observed trends of the shares of capital and profits, the stock of additional capital would need to grow far faster than output.

Existing measures of intangible capital do not show a stock that grows sufficiently fast relative to output and therefore the inclusion of these measures results in an even greater decline in the capital share and increase in the profit share. Furthermore, existing measures of missing intangible capital are orders of magnitude too small to account for even the level of profits. While these measures of intangible capital might be important for explaining differences in firm-level outcomes, they are not able to explain the secular changes to the shares of capital and profits, nor can they explain the level of profits.

Using data from the Integrated Macroeconomic Accounts for the United States, I extend the BEA measures of capital by including real estate at market prices instead of at replacement cost (the difference is often thought of as the value of land) and by including inventories. In both cases, the value of the additional capital does not grow sufficiently fast relative to output growth. As a result, inclusion of this additional capital results in an even greater decline in the capital share and increase in the profit share.

3.5.1 Unobserved Capital

The BEA measures of capital include physical capital, such as structures and equipment, as well as measures of intangible capital, such as R&D, software, and artistic designs. Despite the BEA's efforts to account for intangible capital, it is possible that there are forms of intangible capital that are not included in the existing BEA measures. Indeed, past research has considered several forms of intangible capital that are not currently capitalized by the BEA and has argued that these are important for explaining asset valuations and cash flows.[13] These additional forms of intangible capital include organizational capital, market research, branding, and training of employees.

Might the high level of profits and the large increase in the profit share measured in Section 3.3 reflect large and increasing cash flows that are the return to missing or unobserved capital? As discussed above, under a modest condition that holds for the types of capital that we do observe in the BEA data, the inclusion of additional capital will increase capital costs, value added, and the capital share, and will reduce profits and the profit share. However, in order to mitigate the measured trends in the shares of capital and profits, the stock of additional capital would need to grow significantly faster than output.

Setup

- The additional capital costs are equal to $R^X P^X X$, where $P^X X$ is the nominal value of the potentially omitted or unobserved stock of capital and R^X is the required rate of return on this capital stock. True capital costs are the sum of observed capital costs and unobserved capital costs $R^K P^K K + R^X P^X X$.

- True gross value added is equal to observed value added $P^Y Y$ and unobserved investment I^X.

[13]See, for example, Hall (2001), Atkeson and Kehoe (2005), Hansen, Heaton and Li (2005), Hulten and Hao (2008), Corrado, Hulten and Sichel (2009), McGrattan and Prescott (2010), and Eisfeldt and Papanikolaou (2013).

- True profits are observed profits, Π, less the net unobserved cash flows, which are equal to capital costs less reinvestment

$$\Pi^{TRUE} = \Big(\underbrace{P^Y Y + I^X}_{\text{gross value added adjustment}}\Big) - \Big(\underbrace{R^K P^K K + R^X P^X X}_{\text{capital costs adjustment}}\Big) - wL \tag{3.11}$$

$$= \Pi - \underbrace{\left(R^X P^X X - I^X\right)}_{\text{net unobserved cash flows}} \tag{3.12}$$

If we could observe for this additional capital (1) the nominal value of the stock (2) investment and (3) the required rate of return, then we could easily recalculate the capital and profit shares. Absent these data, we can make some progress by introducing several assumptions.

Assumptions

First, I assume that investment is at least as large as depreciation. Second, I assume that the required rate of return on this capital takes the form of the required rate of return on observed capital, presented in Equations 3.1–3.3. Last, I assume that expected inflation of the unobserved capital is equal to expected inflation on the observed intellectual property product capital that is accounted for in the BEA data.

With these assumptions, net unobserved cash flows are bounded above by net capital costs (net of depreciation)

$$\underbrace{R^X P^X X - I^X}_{\text{net cash flows}} \leq \underbrace{\underbrace{\left(R^X - \delta\right)}_{\text{net required rate of return}} P^X X}_{\text{net capital costs}} \tag{3.13}$$

Furthermore, we can express the net required rate of return (net of depreciation) as

$$R^X - \delta = i - \mathbb{E}\left[\pi^{ipp}\right] \tag{3.14}$$

where i is the cost of capital and $\mathbb{E}\left[\pi^{ipp}\right]$ is expected inflation of intellectual property products.

How reasonable are these assumptions? Recall that in order for this additional capital to mitigate in any way the trends of the shares of capital and profits, the stock of this additional capital would need to grow significantly faster than output. The only way that this is possible is if the ratio of investment-to-capital is strictly larger than the sum of the depreciation rate and the growth rate of output. In this sense, assuming that investment is larger than depreciation is mild and internally necessary. If in fact the ratio of investment-to-capital are at least as large as the sum of the depreciation rate and the growth rate of output, then a larger fraction of the cash flows generated by the unobserved capital are reinvested, reducing net cash flows. We can further evaluate this assumption by checking whether it holds for observed forms of intangible capital that appear in the BEA data. In each and every year since the start of the data in 1926, investment in intellectual property products has been greater than depreciation. Furthermore, when considering forms of physical capital, we see that in each and every year since 1945, with the exception of equipment in 2009, investment in equipment and structures has been greater than the depreciation of each of the assets.

The second assumption, on the required rate of return on capital, would fail if the cost of capital for the unobserved intangible capital were higher than the observed cost of firm borrowing. Indeed, the collateral value of this additional capital is undoubtedly lower than that of physical capital. Furthermore, the value of this additional capital could be more sensitive to market conditions (higher market β). Either of these explanations could increase the cost of financing this capital. I have explored specifications that assume a higher cost of financing and these do not qualitatively change the results: in order to explain the large trends in the capital and profit shares, unobserved capital would need to be growing much faster than output and would need to be significantly larger than all observed capital. Existing measures of intangible capital (Corrado et al. (2012) and Eisfeldt and Papanikolaou (2014)) are not growing fast enough and are orders of magnitude too small. Last, on an aggregate level, investment in the corporate sector is paid for out of retained earnings. Investment out of retained earnings would mitigate the concern of higher costs of borrowing due to lower collateral value.

The third assumption, that expected inflation of unobserved capital is equal to the expected inflation of the observed intellectual property product capital, appears to be mild. Over the past 30 years there has been no trend in overall inflation and a very mild trend in the rate of inflation of particular assets. I have explored alternative specifications that assume an expected inflation rate that is equal to either expected capital inflation, expected consumption inflation, or expected output inflation. These alternative specifications lead to very similar results.

Break-Even Value of Unobserved Capital

What value of unobserved capital can account for observed profits and offset the trends of the capital and profit shares? Recall that in each year true profits are equal to measured profits less the net cash flows of the unobserved capital (equal to capital costs less reinvestment). Under the assumptions laid out above, true profits are bounded above by measured profits less net capital costs. Let us define *break-even value of unobserved capital* as the minimal nominal value of unobserved capital that can account for profits. Since each dollar of unobserved capital has a net required rate of return of $i - \mathbb{E}\left[\pi^{ipp}\right]$ dollars, the break-even value of unobserved capital is equal to the ratio of measured profits to the net required rate of return $\frac{\Pi}{i-\mathbb{E}[\pi^{ipp}]}$.

Measurement

Similar to the main measurement Section, I consider three specifications of the net required rate of return. The first assumes that firms finance capital with debt, the second assumes that firms finance capital with both debt and equity, and the third further accounts for the tax treatment of debt.[14] Figure 3 shows the break-even value of unobserved capital, reported as a fraction of gross value added, for the U.S. non-financial corporate sector over the period 1984–2014. Recall that the break-even value of unobserved capital is equal to the ratio of measured profits to the net required rate of return $\frac{\Pi}{i-\mathbb{E}[\pi^{ipp}]}$. The figure includes a fitted quadratic trend. For the purpose of this figure, I assume that firms finance capital with debt. In addition to the time series of break-even value of unobserved capital, the figure also shows (1) the ratio of BEA capital to gross value added for the U.S. non-financial corporate sector and (2) the ratio of non-BEA intangible capital to gross value added, as measured by Corrado et al. (2012), for the U.S. business sector. Much of the intangible capital considered by Corrado et al. (2012) is already included in the BEA Fixed Asset Tables and therefore already accounted for in the baseline measures of capital costs and profits that appear in Section 3.3. The category of intangible capital that was measured by Corrado et al. (2012) but not included in the BEA data is called "Economic Competencies" and includes the value of all market research, advertising, training, and organizational capital for the U.S. business sector.[15]

The figure shows that the break-even value of capital has increased dramatically over time. In order to account for the observed trends of the capital and profit shares, the missing stock of capital (measured as a share of gross value added) would need to increase by close to 500 percentage points. This increase, is valued at over $42 trillion in 2014. In order to explain the level of profits in 2014, the missing stock of capital would need to be over 5.5 times the value of gross value added, more than $50 trillion. The increase in the value of the missing stock of capital needed to explain the trends in the capital and profit shares, as well as the level of the missing stock of capital needed to explain the level of profits, are both much larger than the value of all capital recorded by the BEA. Indeed, the value of all BEA capital fluctuates between 1.35 and 1.85 times that of gross value added and the stock of capital was valued at $14 trillion in 2014.

The figure also shows that existing measures of non-BEA intangible capital are orders of magnitude too small and growing too slowly to explain either the trends of the capital and profit shares or the level of profits.[16] In the first year of data, 1996, multiplying the value of all non-BEA intangible capital ($584 billion) by the net required rate of return (5.3%) shows that measured non-BEA intangible capital could

[14] Since firms can expense all investment in intangible capital, the tax system does not distort the accumulation of such capital, other than through the tax shield of debt. Said differently, the depreciation allowance of intangible capital is 1.

[15] See Corrado et al. (2012) for complete details.

[16] The type of intangible capital measured by Eisfeldt and Papanikolaou (2014) is already included in the measures of Corrado et al. (2012). The estimated values of Eisfeldt and Papanikolaou (2014) are also orders of magnitude too small and growing too slowly to explain either the trends of the capital and profit shares of the level of profits.

account for at most $31 billion of the $410 billion in profits. In the last year of data, 2011, multiplying the value of all non-BEA intangible capital ($1.4 trillion) by the net required rate of return (4.1%) shows that measured non-BEA intangible capital could account for at most $57 billion of the $983 billion in profits.

Table 1 repeats this analysis for the three specifications of the net required rate of return. Across specifications, in order to account for the observed trends of the capital and profit shares, the missing stock of capital, measured as a share of gross value added, would need to increase between 232pp and 492pp. Across specifications, the increase in the value of the missing stock of capital needed to explain the trends in the capital and profit shares, as well as the level of the missing stock of capital needed to explain the level of profits, are both much larger than the value of all capital recorded by the BEA. Last, across specifications, existing measures of non-BEA intangible capital are unable to explain the trends in the capital and profit shares or level of profits.

3.5.2 Market Value of Real Estate and Inventories

Using data from the Integrated Macroeconomic Accounts for the United States, Table S.5.a, I extend the BEA measures of capital by including real estate at market prices instead of at replacement cost (the difference is often thought of as the value of land) and by including inventories. For each measure of capital, I repeat the measurement of capital costs, profits, as well as the break-even value of unobserved capital.

Table 2 presents the results of the analysis. Each column in Table 2 uses a different measure of capital. Column 1 uses the BEA measure of capital and the range of values in this column replicate Table 1. Column 2 values real estate at market prices instead of the BEA practice of valuing structures at replacement cost. Column 3 values real estate at market price and further includes inventories. Each cell in the table reports a range of values that correspond to the three specifications of the required rate of return on capital presented in Equations 3.1–3.3. It is easily noticeable from this table that including the additional measures of capital strengthens all of the results. The reason for this is straightforward and was described above: over the period 1984–2014 the value of the additional capital does not grow sufficiently fast relative to output growth. Since the required rate of return on capital is declining sharply, inclusion of this additional capital results in an even greater decline in the capital share and increase in the profit share.

3.6 Discussion

The measurement of the capital share in this paper builds on the work of Karabarbounis and Neiman (2014) and Rognlie (2015). Karabarbounis and Neiman (2014) and Rognlie (2015) study the decline in the labor share and additionally provide an estimate of the capital share. In both cases, the authors find that the capital share is not sufficiently increasing to offset the decline in labor and further the capital share might decrease slightly.

Karabarbounis and Neiman (2014) assume that the ratio of the nominal value of the capital stock to nominal investment is constant and that the required rate of return on capital is constant.[17] These assumptions lead the authors to measure the percentage change in the capital share as the percentage change in the ratio of investment to gross value added. Figure 4 plots the ratio of investment to gross value added in the U.S. corporate sector using the NIPA data. The figure shows that the ratio of investment to value added has no linear time trend: the estimated linear time trend is economically small and statistically zero.[18] Thus, the methodology of Karabarbounis and Neiman (2014), when applied to the U.S. non-financial corporate sector, does not suggest a decline in the capital share.

Rognlie (2015) provides two measures of the capital share.[19] In the first measure, the author assumes that the required rate of return on capital is constant. This assumption leads the author to measure the percentage change in the capital share as the percentage change in the ratio of the value of the capital stock to gross value added. Using this measure, Rognlie (2015) finds a slight increase in the capital share. These results are consistent with my findings: I find that the ratio of the value of the capital stock to gross value added is increasing slightly over the period 1984–2014. In the second measure, the author constructs a time series of the real interest rate from the market and book values of the U.S. corporate sector. This construction of the real cost of capital produces values that are inconsistent with observed market data. Most importantly, the construction does not match the observed decline in market prices. When combining NIPA data with the cost of capital presented in Rognlie (2015), I find no decline in the capital share.[20]

Similar to their work, this paper uses capital data to discipline the capital share. The point of departure from their work is the use of market prices to measure debt and equity costs of capital. As shown in Section 3.3, the cost of capital halves over the period 1984–2014 and the required rate of return on capital declines by 39%. The capital stock does not grow fast enough to offset the large decline in the required rate of return and as a result the capital share declines. Measures of the capital share that assume a constant required rate of return show no decline; measures of the capital share that incorporate market prices show a large decline.

[17] See Section IV.B of Karabarbounis and Neiman (2014) for their construction of the capital share, as well as their assumptions of a constant ratio of the nominal value of the capital stock to nominal investment and a constant required rate of return on capital.

[18] These results are not directly comparable to Karabarbounis and Neiman (2014), Figure IX. There are two main differences. First, Figure IX is constructed using GDP data rather than corporate data. The GDP data include investment in residential housing and the contribution of residential housing to GDP; see Rognlie (2015) for a detailed discussion of the role of residential housing. Second, Figure IX is constructed using data over the period 1975–2011. The ratio of U.S. non-financial corporate investment to gross value added has no time trend over the period 1975–2011.

[19] See Section II.B of Rognlie (2015) for the construction of the capital share.

[20] The cost of capital is presented in Rognlie (2015), Figure 7. The figure shows estimated constant, linear, and quadratic approximations to the cost of capital. The constant and quadratic approximations do not decline over the period 1984–2014. Thus, using these approximations leads to a slight increase in the capital share. The linear approximation shows a small decline in the cost of capital, equal to 2pp every 25 years. When I calculate the required rate of return on capital using this linear approximation to the real cost of capital I find no decline in the capital share.

While this paper focuses on the U.S. non-financial corporate sector, there is reason to believe that many other countries experience a decline in the capital share. Karabarbounis and Neiman (2014) show that the rate of investment does not increase in many advanced economies. At the same time, many advanced economies experience large declines in the cost of capital. Indeed, the large decline in the cost of capital and the constant investment rate suggest that the capital share may be declining globally. Further research is needed to study the capital share in other countries.

4 Model of the Corporate Sector

In this section I present a standard general equilibrium model of monopolistic competition to study the decline in the shares of labor and capital. The model in this section is standard in order to ensure that the results are not due to novel modeling features, but rather are a direct consequence of the measurement of the capital share.

The model allows for changes in technology, preferences, relative prices, and competition. While changes to preferences, technology, and relative prices can cause firms to shift from labor to capital, and as a consequence can cause the labor share to decline at the expense of the capital share, these mechanisms cannot cause a simultaneous decline in the shares of both labor and capital. An decline in competition and increase in markups is necessary to match a simultaneous decline in the shares of labor and capital.

I calibrate the model to the U.S. non-financial corporate sector and show that the decline in competition inferred from the data can quantitatively match the decline in the shares of both labor and capital. Using the calibrated model, I further explore the welfare implications of the decline in competition. Across a range of parameter values, the model finds that the decline in competition has led to large gaps in output (8.3% to 10%), wages (18.9% to 19.5%), and investment (14.1% to 19.8%).

4.1 Model

4.1.1 Final Goods Producer

The corporate sector is made up of a unit measure of firms, each producing a differentiated intermediate good. The final good is produced in perfect competition as a CES aggregate of the intermediate goods

$$Y_t = \left(\int_0^1 y_{i,t}^{\frac{\varepsilon_t - 1}{\varepsilon_t}} di \right)^{\frac{\varepsilon_t}{\varepsilon_t - 1}} \tag{4.1}$$

where $\varepsilon_t > 1$ is the elasticity of substitution between goods. The profits of the final goods producer are $P_t^Y Y_t - \int_0^1 p_{i,t} y_{i,t} di$, where P_t^Y is the exogenous price level of output and $p_{i,t}$ is the endogenous price of intermediate good i. The solution to the cost minimization problem, together with the zero profit condition of the final goods producer, leads to the following demand function for intermediate good i:

$$D_t(p_{i,t}) = Y_t \left(\frac{p_{i,t}}{P_t^Y} \right)^{-\varepsilon_t} \tag{4.2}$$

4.1.2 Firms

Firm i produces intermediate good $y_{i,t}$ using the constant return to scale production function

$$y_{i,t} = f_t(k_{i,t}, l_{i,t}) \tag{4.3}$$

where $k_{i,t}$ is the amount of capital used in production and $l_{i,t}$ is the amount of labor used in production. In period $t-1$ the firm exchanges one-period nominal bonds for dollars and purchases capital $k_{i,t}$ at the nominal price P_{t-1}^K. In period t the firm hires labor in a competitive spot market at the nominal wage rate w_t and produces good $y_{i,t}$, which is sold at price $p_{i,t}(y)$. After production the firm pays the face value of its debt and sells the undepreciated capital at the nominal price P_t^K. The firm's nominal profits are

$$\begin{aligned} \pi_{i,t} &= \max_{k_{i,t}, l_{i,t}} p_{i,t} y_{i,t} - (1+i_t) P_{t-1}^K k_{i,t} - w_t l_{i,t} + (1-\delta_t) P_t^K k_{i,t} \\ &= \max_{k_{i,t}, l_{i,t}} p_{i,t} y_{i,t} - R_t P_{t-1}^K k_{i,t} - w_t l_{i,t} \end{aligned} \tag{4.4}$$

where $R_t = i_t - (1-\delta_t) \frac{P_t^K - P_{t-1}^K}{P_{t-1}^K} + \delta_t$ is the required rate of return on capital.

The profit maximization problem of the firm determines the demand for labor and capital inputs, as well as profits, as a function of the current period nominal interest rate, the current period nominal wage rate, and aggregate output. The first-order condition for capital is $p_{i,t} \frac{\partial f}{\partial k} = \mu_t R_t P_{t-1}^K$, where $\mu_t = \frac{\varepsilon_t}{\varepsilon_t - 1}$ is the equilibrium markup over marginal cost. Similarly, the first-order condition for labor is $p_{i,t} \frac{\partial f}{\partial l} = \mu_t w_t$. Integrating demand across firms determines the corporate sector demand for labor and capital inputs, as well as profits, as a function of the nominal interest rate, the nominal wage rate, and aggregate output.

4.1.3 Households

A representative household is infinitely lived and has preferences over its consumption $\{C_t\}$ and its labor $\{L_t\}$ that are represented by the utility function

$$\sum_t \beta^t U\left(C_t, L_t\right) \tag{4.5}$$

The economy has a single savings vehicle in the form of a nominal bond: investment of 1 dollar in period t pays $1 + i_{t+1}$ dollars in period $t+1$. In addition to labor income and interest on savings, the household receives the profits of the corporate sector. The household chooses a sequence for consumption $\{C_t\}$ and labor $\{L_t\}$ to maximize utility subject to the lifetime budget constraint

$$a_0 + \sum_t q_t \left[w_t L_t + \Pi_t\right] = \sum_t q_t P_t^Y C_t \tag{4.6}$$

where a_0 is the initial nominal wealth of the household, $q_t = \prod_{s \leq t} \left(1 + i_s\right)^{-1}$ is the date zero price of a dollar in period t, w_t is the nominal wage in period t, Π_t are nominal corporate profits in period t, and P_t^Y is the price of a unit of output in period t.

The utility maximization problem of the household determines the supply of labor and nominal household wealth as a function of the path of nominal interest rates, the path of nominal wage rates, and the net present value of nominal corporate profits. The inter-temporal first-order condition of the household [Euler equation] is $1 = \beta \left(1 + i_{t+1}\right) \left(1 + \frac{P_{t+1}^Y - P_t^Y}{P_t^Y}\right)^{-1} \frac{U_c(C_{t+1}, L_{t+1})}{U_c(C_t, L_t)}$ and the intra-temporal first-order condition [MRS] is $U_l\left(C_t, L_t\right) = -\frac{w_t}{P_t^Y} U_c\left(C_t, L_t\right)$. The nominal wealth of the household follows the path

$$a_{t+1} = \left(1 + i_t\right) a_t + w_t L_t + \Pi_t - P_t^Y C_t \tag{4.7}$$

4.1.4 Capital Creation

I assume that all agents in the model have free access to a constant returns to scale technology that converts output into capital at a ratio of $1 : \kappa_t$. I further assume that this technology is fully reversible.[21] Arbitrage implies that, in period t, κ_t units of capital must have the same market value as 1 unit of output. This pins down the relative price of capital

$$\frac{P_t^K}{P_t^Y} = \kappa_t^{-1} \tag{4.8}$$

[21] Without this assumption, the relative price of capital is pinned down so long as investment is positive. In the data, investment in each asset is positive in each period. Moreover, the data show no substantial movement in the relative price of capital over the sample period.

4.1.5 Equilibrium

In equilibrium three markets will need to clear: the labor market, the capital market, and the market for consumption goods. The labor market clearing condition equates the household supply of labor with the corporate sector demand for labor. The capital market clearing condition equates the nominal value of household savings a_{t+1} with the nominal value of the corporate sector demand for capital $P_t^K K_{t+1}$. The aggregate resource constraint of the economy, measured in nominal dollars, can be written as

$$P_t^Y Y_t = P_t^Y C_t + P_t^K \left[K_{t+1} - (1-\delta) K_t\right] \tag{4.9}$$

By Walras's law, the aggregate resource constraint of the economy holds if the labor and capital markets clear and the households are on their budget constraint. An equilibrium[22] is a vector of prices $(i_t^*, w_t^*)_{t\in\mathbb{N}}$ that satisfy the aggregate resource constraint and clear all markets in all periods. Since all firms face the same factor costs and produce using the same technology, in equilibrium[23] they produce the same quantity of output $y_t = Y_t$ and sell this output at the same per-unit price $p_{i,t} = P_t^Y$.

4.2 The Roles of Technology, Preferences, Relative Prices, and Markups

Proposition 1. *When markups are fixed, any decline in the labor share must be offset by an equal increase in the capital share.*

Proof. In equilibrium, a marginal allocation plan of labor across firms $\{dl_{i,t}\}_i$ increases aggregate output by $\int_0^1 \mu_t \frac{w_t}{P_t^Y} dl_{i,t} di = \mu_t \frac{w_t}{P_t^Y} \int_0^1 dl_{i,t} di$. Since the aggregate output response to a marginal allocation plan depends only on the aggregate increase in labor $\left(dL_t = \int_0^1 dl_{i,t} di\right)$, we have a well-defined notion of the aggregate marginal productivity of labor that is equal to $\frac{\partial Y_t}{\partial L_t} = \mu_t \frac{w_t}{P_t^Y}$. Similarly, for any marginal allocation plan of capital across firms we have $\frac{\partial Y_t}{\partial K_t} = \mu_t R_t \frac{P_{t-1}^K}{P_t^Y}$. Rearranging these equations we have the following expressions for the labor and capital shares of gross value added

$$S_t^L = \mu_t^{-1} \times \frac{\partial \log Y_t}{\partial \log L_t} \tag{4.10}$$

$$S_t^K = \mu_t^{-1} \times \frac{\partial \log Y_t}{\partial \log K_t} \tag{4.11}$$

[22]Firm optimization requires that firms have beliefs over aggregate output Y_t and house optimization requires that households have beliefs over corporate profits Π_t. Equilibrium further requires that firm beliefs and household beliefs hold true.

[23]With a constant returns to scale production technology and the specified market structure there is no indeterminacy in the firm's maximization problem. In more general cases, indeterminacy may arise, in which case there can exist non-symmetric equilibria. With appropriate regularity conditions, it is possible to select an equilibrium by assuming that for a given level of profits firms will choose to maximize their size.

Summing across the shares of labor and capital we have

$$S_t^K + S_t^L = \mu_t^{-1} \times \underbrace{\left(\frac{\partial \log Y_t}{\partial \log L_t} + \frac{\partial \log Y_t}{\partial \log K_t} \right)}_{\text{scale of production=1}} \tag{4.12}$$

The combined shares of labor and capital are a function of markups alone. Thus, holding markups fixed, any decline in the labor share must be offset by an equal increase in the capital share. □

The proof of the proposition relies on firm optimization. The proposition holds in equilibrium, not just in steady state. The proof of the proposition is under an assumption of constant returns to scale; more generally, if production is homogeneous of degree γ then the combined shares of labor and capital are equal to $S_t^K + S_t^L = \mu_t^{-1} \times \gamma$.

No assumptions of household behavior, firm ownership, or the functional form of the production function are needed. The degree of generality of this proposition allows us to evaluate several alternative explanations for the decline in the labor share. In all of the following cases, the capital share needs to adjust to perfectly offset the decline in the labor share. Since the data show a decline in the capital share, these explanations alone are unable to match the data.

1. **TFP.** Consider the production function

$$f_t(k, l) = A_t f(k, l)$$

   where f is homogeneous of degree 1 (or any other constant degree) in capital and labor. A decline in productivity A_t or a decline in the growth rate of productivity does not affect the combined shares of labor and capital.

2. **Capital Biased Technological Change.** Consider the production function

$$f_t(k, l) = \left(\alpha_K \left(A_{K,t} k \right)^{\frac{\sigma-1}{\sigma}} + (1 - \alpha_K) \left(A_{L,t} l \right)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

   Biased technological change, which can be measured as a change to the ratio $\frac{A_{K,t}}{A_{L,t}}$, can cause firms to shift from one input to the other, but does not affect the combined shares of labor and capital.

3. **Relative Prices.** A decline in the price of capital, whether due to improvements in the technology of capital creating or due to an increase in the supply of capital, reduces the price of capital relative to labor. With appropriate assumptions on the elasticity of substitution between labor and capital,

the decline in the relative price of capital can cause the labor share to decline, but does not affect the combined shares of labor and capital.

Many other explanations can fit into this simple framework, including changes in the supply of labor and heterogeneous labor and capital inputs. With appropriate assumptions, each of these alternative explanations can cause a decline in the labor share, but does not effect the combined shares of labor and capital.[24] In this sense, a decline in competition, which is measured as a decline in ε and results in the increase in markups, is necessary to match a simultaneous decline in the shares of labor and capital.

4.3 Model-Based Counterfactual and Welfare

In this subsection I calibrate the model to the U.S. non-financial corporate sector. I show that a simultaneous decline in the real interest rate and decline in competition can quantitatively match the decline in the shares of both labor and capital. In addition, I calculate the gaps in output, investment, and wages due to the decline in competition inferred from the data. Across a range of parameter values, the model finds that the decline in competition, which is measured as a decline in ε and results in the increase in markups, leads to large gaps in output (8.3% to 10%), wages (18.9% to 19.5%), and investment (14.1% to 19.8%).

4.3.1 Functional Form Specifications

I assume that firms produce using a CES production function

$$y_{i,t} = \left(\alpha_K \left(A_{K,t} k_{i,t}\right)^{\frac{\sigma-1}{\sigma}} + (1-\alpha_K)\left(A_{L,t} l_{i,t}\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}} \tag{4.13}$$

where σ is the elasticity of substitution between labor and capital. In equilibrium, aggregate output is a CES aggregate of labor and capital with parameters that are identical to the firm-level production function

$$Y_t = \left(\alpha_K \left(A_{K,t} K_t\right)^{\frac{\sigma-1}{\sigma}} + (1-\alpha_K)\left(A_{L,t} L_t\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}} \tag{4.14}$$

[24]We can separate the firm's optimization problem into cost minimization and profit maximization. The first-order condition of cost minimization equates the labor share of costs to the elasticity of output to labor. The alternative explanations discussed above share a common prediction: the decline in the labor share of value added perfectly tracks a decline in the labor share of costs. In the data, the capital share is declining faster than the labor share and as a consequence the labor share of costs is increasing.

The first-order conditions of firm optimization are

$$\alpha_K A_{K,t}^{\frac{\sigma-1}{\sigma}} \left(\frac{Y_t}{K_t}\right)^{\frac{1}{\sigma}} = \mu_t R_t \frac{P_{t-1}^K}{P_t^Y} \tag{4.15}$$

$$(1-\alpha_K) A_{L,t}^{\frac{\sigma-1}{\sigma}} \left(\frac{Y_t}{L_t}\right)^{\frac{1}{\sigma}} = \mu_t \frac{w_t}{P_t^Y} \tag{4.16}$$

where $\mu_t = \frac{\varepsilon_t}{\varepsilon_t - 1}$ is the equilibrium markup. I assume that household preferences over consumption $\{C_t\}$ and labor $\{L_t\}$ are represented by the utility function

$$\sum_t \beta^t \left[\log C_t - \gamma \frac{\theta}{\theta+1} L_t^{\frac{\theta+1}{\theta}}\right] \tag{4.17}$$

The intra-temporal first-order condition [MRS] is $\gamma L_t^{\frac{1}{\theta}} = \frac{w_t}{P_t^Y} C_t^{-\eta}$ and the inter-temporal first-order condition of the household [Euler equation] is $1 = \beta\left(1 + i_{t+1}\right)\left(1 + \frac{P_{t+1}^Y - P_t^Y}{P_t^Y}\right)^{-1}\left(\frac{C_{t+1}}{C_t}\right)^{-\eta}$.

4.3.2 Model Parameter Values

The model has two capital parameters: the relative price of capital, which I normalize to 1, and the depreciation rate, which I match to the average depreciation rate of capital in the BEA data. The model has four production parameters: I consider values of the elasticity of substitution between labor and capital σ between 0.4 and 0.7; I calibrate the remaining three parameters (α_K, A_K, A_L) to match the labor share and the capital to output ratio in 1984 and to equate the level of output across the different specifications of the elasticity of substitution. The model has three preference parameters: I calibrate the rate of time preference β to match the real interest rate; I set the Frisch elasticity of labor supply θ to 0.5;[25][26] and I normalize the disutility of labor parameter γ to equate the steady-state supply of labor across the different specifications.

4.3.3 Forcing Variables

The equilibrium conditions of the model imply that the cost share of gross value added is equal to the inverse of the markup $\mu_t^{-1} = \frac{w_t L_t + R_t P_{t-1}^K K_t}{P_t^Y Y_t}$. In the data the markup increase from 2.5% in 1984 to 21% in 2014. I vary competition (measured as the elasticity of substitution between goods) in order to match this increase

[25] This value is consistent with both micro and macro estimates of the Frisch elasticity of labor supply. See Shimer (2010) and Chetty (2012) for a discussion of micro and macro estimates of the Frisch elasticity.

[26] In unreported results, I consider values of the Frisch elasticity of labor supply θ between 0.5 and 4. Given the preference and technology specifications of the model, the value of the Frisch elasticity affects the level of output, capital, labor, profits, and investment, but does not affect the shares of labor, capital, profits, or investment. As a consequence, the choice of Frisch elasticity does not affect the shock to competition needed to match this increase in markups, nor does the choice of Frisch elasticity affect the ability of the shock to match the decline in the shares of labor and capital. The choice of Frisch elasticity does have consequences for the gaps in output and investment: the gaps in output and investment are increasing in the value of the Frisch elasticity. In this sense, Table 3 reports lower bounds on the gaps in output and investment. Results based on alternative values of the Frisch elasticity are available from the author upon request.

in markups. I assume that at the start of the sample the economy is in a steady state with a markup of 2.5% $\left(\varepsilon = \frac{1.025}{1.025-1}\right)$ and at the end of the sample the economy is in a steady state with a markup of 21% $\left(\varepsilon = \frac{1.21}{1.21-1}\right)$. I vary the rate of time preference in order to match the observed change in the real interest rate. I assume that at the start of the sample the economy is in a steady state with a real interest rate of 8.5% $\left(\beta = 1.085^{-1}\right)$ and at the end of the sample the economy is in a steady state with a real interest rate of 1.25% $\left(\beta = 1.0125^{-1}\right)$.

4.3.4 Results

This subsection presents two sets of model-based counterfactual estimates. The first set of model-based counterfactual estimates, which appear in rows 1–3 of Table 3, are backward-looking: they ask how the labor share, capital share, and investment rate should have evolved from 1984 to 2014 in response to a decline in competition (the elasticity of substitution between goods) and a decline in the real interest rate. The second set of model-based counterfactual estimates are forward-looking: they ask how output, wages, and investment can be expected to evolve from 2014 onward if competition increases to its 1984 level, but at the same time interest rates remained low. I report all comparative statics for a range of values of the elasticity of substitution between labor and capital σ between 0.4 and 0.7.

Rows 1–3 of Table 3 present the percentage changes in the labor share, the capital share, and the ratio of investment to output across steady state – all in response to the decline in competition and the decline in the real interest rate. In this counterfactual exercise I vary the degree of competition (the elasticity of substitution between goods) in order to match the increase in markups from 2.5% to 21% and I vary the rate of time preference in order to match the observed change in the real interest rate from 8.5% to 1.25%. The model successfully matches the empirically measured declines in the shares of both labor and capital. Across the range of values of the elasticity of substitution between labor and capital the model predicts a decline in the labor share ranging from 9.5% to 12.2% and a decline in the capital share ranging from 23% to 31%. In the data, the labor share declines by 10.3% and across empirical specifications the capital share declines between 19.3% and 28.8%. The model over-predicts the change in the investment rate: compared to the observed increase in investment of 7%, the model predicts an increase that ranges from 14.2% to 26.2%.

In this first exercise, competition varies in order to match the change in the share of profits. Thus, the counterfactual exercise relies on the measurement of capital costs of Section 3. Since the shares of labor, capital, and profits sum to one, by matching the change in the share of profits the model will perfectly match the change in combined shares of labor and capital. At the same time, the shares of labor and capital are free to individually vary: a 15 percentage point increase in the share of profits is consistent with both (a) a 20 percentage point decline in the share of labor and a 5 percentage point increase in the share of capital, and (b) a 7.5 percentage point decline in the share of labor and a 7.5 percentage point decline in the share of capital. In this sense the model is successful in matching a free moment of the data.

An alternative exercise can help explain the free moment that the model is able to match. Fix the elasticity of substitution between labor and capital at 0.5 (this matches column 2 of Table 3). We can calibrate the change in competition to match the change in the labor share. This alternative exercise does not require data on capital costs or profits; instead it assumes that the decline in the labor share is the result of a decline in competition. In order to match a decline in the labor share of 10.4%, in addition to the decline in the real interest rate, the economy would need to move from the 1984 steady state with a markup of 2.5% $\left(\varepsilon = \frac{1.025}{1.025-1}\right)$ to a steady state with a markup of 21% $\left(\varepsilon = \frac{1.21}{1.21-1}\right)$. Without using any data on profits or capital to discipline the model, the model predicts that this decline in competition will be accompanied by a 28.2% decline in the capital share.

Rows 4–6 of Table 3 present the gap in output, wages, and investment that are due to the decline in competition. In this counterfactual exercise I vary competition (the elasticity of substitution between goods) in order to decrease markups from 21% back down to 2.5% while holding the rate of time preference constant to match the steady state real interest rate of 1.25%. I refer to the steady state of the economy with a 2.5% markup and 1.25% real interest rate as the potential steady state. For a variable X, I compute the gap in X as $\frac{X-X^*}{X^*}$ where X^* is the value of X in the potential steady state. Across the range of values of the elasticity of substitution between labor and capital the model predicts large gaps in output (8.3% to 10%), wages (18.9% to 19.5%), and investment (14.1% to 19.8%). Said differently, the model predicts large improvements to the economy in response to an increase in competition to its 1984 level: we would see large increase in output (9.1% to 11%), investment (16% to 25%), and wages (23% to 24%).

Taken together, this evidence suggests that the decline in competition and increase in markups inferred from the data can explain the bulk of the decline in the shares of both labor and capital and that the decline in the shares of labor and capital is an inefficient outcome.

4.4 Discussion

This section presented a standard general equilibrium model of monopolistic competition and provided three sets of results. First, a decline in competition is necessary to match a joint decline in the shares of labor and capital. While changes to preferences, technology, and relative prices can cause firms to shift from labor to capital, and as a consequence can cause the labor share to decline at the expense of the capital share, these mechanisms cannot cause a simultaneous decline in the shares of both labor and capital. Second, the decline in competition and increase in markups inferred from the data can explain the bulk of the decline in the shares of both labor and capital that we observe in the data from 1984–2014. Last, the model suggests that the decline in competition inferred from the data causes large gaps in output, wages, and investment.

The contribution of a decline in competition to the decline in the labor share depends crucially on our measurement of the capital share. To understand this point it is worth considering three different measurements of the capital share:

1. **Increasing Capital Share.** Consider the case in which the labor share is declining and the capital share increases to fully offset the decline in the labor share. In this case, the model will attribute all of the decline in the labor share to changes in preferences, technology, and relative prices and will attribute none of the decline in the labor share to a decline in competition.[27] If we indirectly infer the capital share as 1 minus the labor share then we are necessarily attributing the decline in the labor share to preferences, technology, and relative prices.

2. **Flat Capital Share.** Consider the case in which the labor share is declining, the capital share does not change, and the profit share increases and offsets the decline in the labor share. In this case, the model will attribute part of the decline in the labor share to changes in preferences, technology, and relative prices and will attribute part of the decline in the labor share to a decline in competition. Changes in preferences, technology, and relative prices alone would have caused the capital share to increase; changes in competition alone would have caused the capital share to decline. If we were to measure the capital share under the assumption of a constant required rate of return then we would find that the capital share has remained flat and we would conclude that preferences, technology, and relative prices and competition both contributed substantially to the decline in the labor share. As discussed in Section 3.6, this is precisely the measurement assumption of Karabarbounis and Neiman (2014) and Rognlie (2015). Indeed, based on this measurement assumption Karabarbounis and Neiman (2014) attribute half the decline in the labor share to changes in relative prices and half to an increase in markups.[28]

3. **Declining Capital Share.** Consider the case in which the labor share is declining, the capital share is declining, and the profit share is increasing and offsets the decline in the shares of both labor and capital. In this case, the model will attribute much of the decline to a decline in competition. A precise calibration of the model is needed to determine just how much of the decline in the labor share is due

[27] Further data and modeling assumptions are needed to quantify the separate contributions of preferences, technology, and relative prices.

[28] Table 4 of Karabarbounis and Neiman (2014) presents a specification in which markups increase and relative prices remain constant. In this specification, the shares of both labor and capital decrease. Based on their measurement of the capital share – which assumes a constant required rate of return and finds that the capital share is flat – they conclude that an increase in markups alone is a poor fit for the data.

to a decline in competition; the range of calibrations that I considered attribute the bulk of the decline to the decline in competition.

The magnitude of the decline in the capital share is of central importance for understanding why the labor share has declined. Existing research has already documented an increase in the share of profits. In addition to the work of Karabarbounis and Neiman (2014) and Rognlie (2015), Hall (2016) documents a growing wedge between the return to capital and the risk-free real interest rate, suggestive of an increase in profits. An increase in the share of profits is not sufficient to determine the cause of the decline in the share of labor; we need a direct measurement of the profit share. Measuring the capital share and using market prices of debt and equity to determine the required rate of return lead us to conclude that (1) the capital share declined (2) a decline in competition inferred from the data can explain the bulk of the decline in the shares of both labor and capital that we observe in the data from 1984–2014 (3) the decline in the labor share is accompanied by increasing gaps in output, wages, and investment.

5 Labor Share and Industry Concentration

In this section I provide reduced form empirical evidence to support the hypothesis that a decline in competition plays a significant role in the decline in the labor share. In the data I am unable to directly measure competition and markups. Instead, I assume that an increase in concentration captures declines in competition and increases in markups. This assumption is true in standard models of imperfect competition and is supported by Salinger (1990) and Rotemberg and Woodford (1991). Using cross-sectional variation I show that those industries that experience larger increases in concentration also experience larger declines in the labor share. Univariate regressions suggest that the increase in industry concentration can account for most of the decline in the labor share.

5.1 Data

I use census data on industry payrolls, sales, and concentration. Payroll includes all wages and salaries in cash and in kind, as well as all supplements to wages and salaries. The data provide four measures of industry concentrations, namely, the share of sales by the 4, 8, 20, and 50 largest firms. The data are available for the years 1997, 2002, 2007, and 2012 and cover all sectors of the private economy, with the exceptions of agriculture, mining, construction, management of companies, and public administration.

In order to construct changes in the labor share and concentration, I match industries across census years.[29] I construct a sample of all industries that are consistently defined over time and that have data on

[29]There have been minor revisions the NAICS industry classification in every census since 1997. I

sales, payroll, and at least one measure of concentration. In several sectors, the census separately reports data for tax-exempt firms and it is not possible to construct an industry measure of concentration. Instead, I consider only firms subject to federal income tax. The results are robust to dropping these sectors. In total, the sample consists of 750 six-digit NAICS industries. As a share of the sectors covered by the census, the matched sample covers 76% of sales receipts in 1997 and 86% of sales receipts in 2012. As a share of the U.S. private economy,[30] the matched sample covers 66% of sales receipts in 1997 and 76% of sales receipts in 2012.

Table 4 provides descriptive statistics of the labor share (the payroll share of sales) and the four census measures of industry concentration for the matched sample. The labor share of sales declines on average by 1.19 percentage points, or 10%. The sales share of the 4 largest firms increases on average by 5.28 percentage points, or 21%. Almost all of the increase in the share of the 50 largest firms is due to the increase of the 4 largest firms: the shares of the largest 4, 8, 20 and 50 firms all show similar increases when measured in percentage points. Since the share of the 50 largest firms in 1997 is more than double that of the 4 largest firms, the percentage increase in the share of the 50 largest firms is less than half of the percentage increase in the share of the 4 largest firms.

5.2 Empirical Specification

I consider two reduced form empirical specifications that relate the increase in concentration to the decline in the labor share.[31] The first empirical specification is a regression in first differences

$$S^L_{j,t} - S^L_{j,t-5} = \alpha_t + \beta \left(C^{(n)}_{j,t} - C^{(n)}_{j,t-5} \right) + \varepsilon_{j,t} \tag{5.1}$$

where $S^L_{j,t} - S^L_{j,t-5}$ is the change in the labor share of sales in industry j from year $t-5$ to year t, and $C^{(n)}_{j,t} - C^{(n)}_{j,t-5}$ is the change in the concentration of sales in industry j from year $t-k$ to year t, measured as the change in the share of sales by the 4, 8, 20, and 50 largest firms. The second empirical specification is a

map NAICS industries across the censuses using the census-provided concordances, which are available at https://www.census.gov/eos/www/naics/concordances/concordances.html

[30]The data on sales and payroll for the U.S. private economy are taken from Statistics of U.S. Businesses. All U.S. business establishments with paid employees are included in the Statistics of U.S. Businesses reports and tables. All NAICS industries are covered, except crop and animal production; rail transportation; National Postal Service; pension, health, welfare, and vacation funds; trusts, estates, and agency accounts; private households; and public administration. Most government establishments are excluded.

[31]A previous version of this paper reported results of regressions of changes in the labor share on changes in industry concentration using a single cross section (changes from 1997 to 2012). There was a mistake in the calculation of standard errors: once the standard errors were corrected, several of the regression coefficients were statistically insignificant. To increase power, I now use all of the 5-year changes in the labor share and concentration. As reported in the previous version, the estimated coefficients are similar across the two specifications. Therefore, the results and their interpretation remain the same. I want to thank Tony Fan and Austan Goolsbee for pointing out the error.

regression in log differences

$$\log S^L_{j,t} - \log S^L_{j,t-5} = \alpha_t + \beta\left(\log C^{(n)}_{j,t} - \log C^{(n)}_{j,t-5}\right) + \varepsilon_{j,t} \tag{5.2}$$

In both specifications, I weight each observation by its share of sales in year t and standard errors are clustered by 3-digit NAICS industry.

In order to provide a sense of the magnitude of the decline in the labor share that is predicted by the increase in concentration, I report the observed and predicted decline in the labor share. In the first difference specification, the observed decline is the sales-weighted average change in the labor share $\sum_j w_{j,2012}\left(S^L_{j,2012} - S^L_{j,1997}\right)$, where $w_{j,t} = \frac{\text{sales}_{j,t}}{\sum_j \text{sales}_{j,t}}$ is industry j's share of sales in year t and $S^L_{j,t} = \frac{\text{payroll}_{j,t}}{\text{sales}_{j,t}}$ is the labor share of sales in industry j in year t. Note that this is the within-industry decline in the labor share in the standard variance decomposition.[32] The predicted decline is the sales-weighted average predicted change in the labor share, namely, $\sum_j w_{j,2012}\beta\left(C^{(n)}_{j,t} - C^{(n)}_{j,t-5}\right)$. In the log-difference specification, the observed decline is the sales-weighted average change in the log-labor share and the predicted decline is the sales-weighted average predicted change in the log-labor share.

5.3 Results

Table 5 presents the results of regressions of the change in the labor share on the change in industry concentration, as specified in Equation 5.1. Columns 1–4 show the results of weighted regressions of the change in the labor share on the change in industry concentration, measured as the share of sales by the 4, 8, 20, and 50 largest firms. The table shows that those industries that experience larger increases in concentration of sales also experience larger declines in the labor share. The slope coefficient is negative and statistically significant in each of the regressions. Based on the estimated coefficient and observed increase in the concentration, the predicted decline in the labor is similar in magnitude to observed decline in the labor share. The slope coefficient remains stable across the specifications – this is expected since almost all of the increase in the share of the 50 largest firms is due to the increase of the 4 largest firms. Table 6 presents the results of the log specification. The slope coefficient is negative and statistically significant in each of the regressions. In this specification, the predicted decline is between 33% and 40% of the observed decline in the log-labor share. In the log specification the slope coefficient is increase in absolute value across the specifications: the percentage increase in the share of the 50 largest firms is less than half of the percentage

[32] The decline in the labor share is the sum of the between-industry decline and the within-industry decline $S^L_{2012} - S^L_{1997} = \sum_j \left(w_{j,2012} - w_{j,1997}\right) S^L_{j,1997} + \sum_j w_{j,2012}\left(S^L_{j,2012} - S^L_{j,1997}\right)$. In the data, The within-industry term accounts for 72% of the aggregate decline in the labor share of sales. A similar decomposition of industry concentration finds that the entire increase in industry concentration is due to the increase in the within-industry component.

increase in the share of the 4 largest firms and the slope coefficient of the 50 largest firms is close to double that of the 4 largest firms. Taken together, the results suggest that the increase in concentration can account for most of decline in the labor share.

5.4 Robustness

The census data do not properly capture foreign competition and likely overestimate concentration in product markets for tradable goods. To the extent that foreign competition has increased over time, the census data likely overestimate increases in concentration in product markets for tradable goods. To address this concern I repeat the analysis excluding all tradable industries.[33] I find that excluding tradable industries does not alter the results. Furthermore, in the sample of tradable industries there is only a very small cross sectional relationship between changes in measured concentration and changes in the labor share. In the sample of tradable industries, the regressions predict almost no decline in the labor share. These results are reported in columns 2 and 3 of Table 7.

Second, in several sectors the census measures concentration separately for tax-exempt firms. This introduces measurement error in the concentration variable. Column 4 of Table 7 repeats the analysis after excluding sectors in which tax-exempt firms make up a large fraction of sales (health care and social assistance, and other services). I find that excluding these sectors does not alter the results.

Last, an increase in the importance of intangible capital could cause a decline in the labor share and an increase in concentration that is unrelated to decline in competition. Column 5 of Table 7 repeats the analysis after excluding R&D intensive industries.[34] I find that excluding these industries does not alter the results.

5.5 Discussion

The results of this section show that the decline in the labor share is strongly associated with an increase in concentration. This is consistent with the hypothesis that a decline in competition plays a significant role in the decline in the labor share. Unlike the aggregate results of Section 3, the results of this section do not rely on capital data and are not subject to concerns about the measurement of capital. Using alternative sources of data and variation, this section complements the aggregate findings.

The aggregate results of Section 3 and the industry results of this section are consistent with several

[33] I use the industry classification provided by Mian and Sufi (2014).

[34] Data on R&D by industry are taken from the NSF R&D survey. I exclude Chemical Manufacturing (NAICS 325), Computer and Electronic Product Manufacturing (NAICS 334), Transportation Equipment Manufacturing (NAICS 336), Software Publishers (NAICS 5112), Computer Systems Design and Related Services (NAICS 5415), and Scientific R&D Services (NAICS 5417).

price-setting mechanisms. First, the results are consistent with a model in which firms face barriers to entry, and prices are the result of Cournot competition. An increase in barriers to entry results in higher concentration driven by a decline in the number of firms, higher markups driven by an increase in prices, and a decline in the labor share. This model predicts a within-firm decline in the labor share and no correlation between changes in the labor share and changes in productivity.

The results are also consistent with a model of a dominant firm and a competitive fringe, where prices are equal to the marginal cost of the firms in the competitive fringe. In such a model, an increase in the productivity of the dominant firm also results in higher concentration driven by the growth of the dominant firm, higher markups driven by a decline in production costs of the dominant firm, and a decline in the labor share. This model predicts a decline in the labor share that is mostly due to a reallocation across firms that is positively correlated with changes in productivity.

Hartman-Glaser, Lustig and Zhang (2016) and Autor et al. (2017) provide evidence that reallocation across firms has contributed to the decline in the labor share. The authors offer explanations for the decline in the labor share that focus on productivity (Autor et al. (2017)) and insurance and intangible capital (Hartman-Glaser, Lustig and Zhang (2016)). These explanations, on their own, predict an equally sized correlation between increased concentration and declining labor share in both tradable and non-tradable industries – the data show almost no correlation in tradable industries. These explanations could be consistent with industry data if they lead to a reallocation of resources toward firms that charge higher markups. Moreover, a reallocation of resources toward firms that charge higher markups is necessary to match the aggregate decline in the capital share and increase in the profit share.

6 Conclusion

Labor compensation in the U.S. economy used to track labor productivity. Up until the 1980s, every increase in labor productivity was accompanied by an equally sized increase in labor compensation. The decline in the labor share over the past 30 years measures the growing gap between labor productivity (which has continued to grow) and compensation (which has stagnated).

The existing literature on the decline in the labor share is focused on tradeoffs between labor and capital. Whether due to technological change, globalization, or a change in relative prices, the existing literature argues that firms have replaced expenditures on labor inputs with expenditures on capital inputs. The literature further views this shift away from labor toward capital as efficient. This paper shows that expenditures on labor have not been replaced by expenditures on capital. Instead, measured as a share of gross value added, over the past 30 years firms have reduced expenditures on both labor and capital and increased profits.

This paper takes a direct approach to measuring capital costs and the capital share. Following Hall and Jorgenson (1967), I compute a series of capital costs for the U.S. non-financial corporate sector over the period 1984–2014, equal to the product of the required rate of return on capital and the value of the capital stock. Using this method, past research studied the period leading up to the 1980s and found very small profits. While I confirm past estimates of capital costs and profits in the early 1980s, I find large and striking changes to the U.S. economy over the past 30 years.

Direct measures of capital costs show that the capital share is declining. Measured in percentage terms, the decline in the capital share (30%) is larger than the decline in the labor share (10%). Despite the decline in the labor share, expenditures on labor have in fact increased faster than expenditures on capital. Offsetting the large declines in the labor and capital shares is a large increase in the profit share. The value of this increase in profits amounts to over $1.1 trillion in 2014, or $14 thousand per employee (nearly half of median personal income in the U.S.).

This paper draws on a standard general equilibrium model and industry data to argue that the decline in the shares of labor and capital are the result of a decline in competition. The degree of generality of the model allows us to consider a wide range of alternative explanations for the decline in the labor share, including: a slowdown in TFP growth, technological change, and a change in the supply of labor. Only a decline in competition can explain a simultaneous decline in the shares of labor and capital. In this sense, a decline in competition is necessary to match the data. A calibrated version of the model shows that a decline in competition quantitatively matches the data. Turning to industry data, I find that increases in industry concentration are associated with declines in the labor share. Taken as a whole, my results suggest that the decline in the shares of labor and capital are due to a decline in competition and call into question the conclusion that the decline in the labor share is an efficient outcome.

Several recent papers have focused attention on the increase in industry concentration. Gutiérrez and Philippon (2016) show that a lack of competition and firm short-termism explain under-investment. Industries with more concentration and more common ownership invest less, even after controlling for current market conditions. The authors also find that those firms that under-invest spend a disproportionate amount of free cash flows buying back their shares. Grullon, Larkin and Michaely (2016) show that firms in industries that are growing more concentrated enjoy higher profit margins, positive abnormal stock returns, and more profitable M&A deals. A decline in the demand for labor inputs (which results in a decline in the labor share) and a simultaneous decline in demand for capital inputs (which results in under-investment) are distinctive traits of declining competition.

This paper is not arguing that technology, automation, and globalization have played no part in the decline in the labor share. It may well be the case that the forces of technological change and globalization favor dominant firms and are causing the decline in competition. The causes of the decline in competition are left as an open question for future research.

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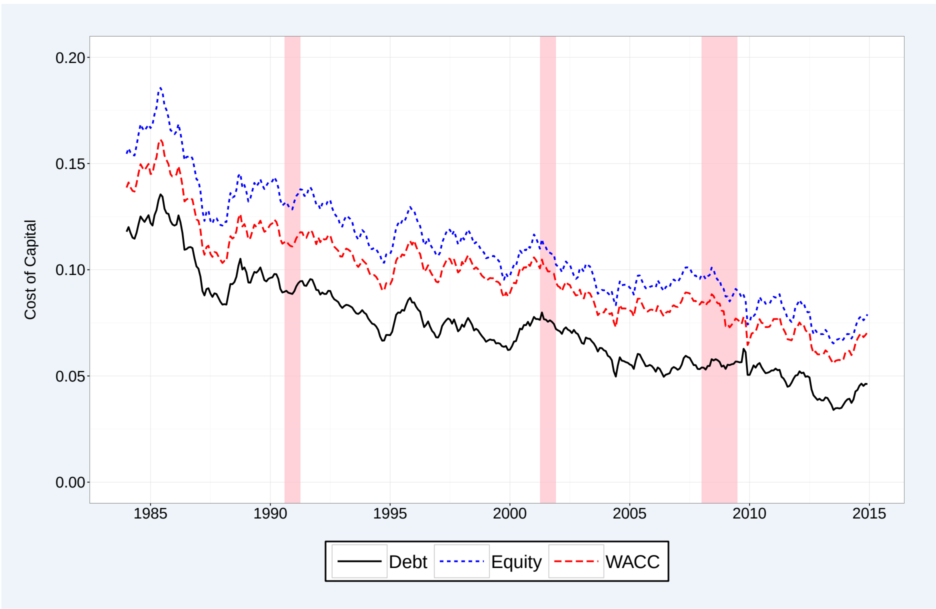
Figure 1: **The Required Rate of Return on Capital**
The figure shows the components of the required rate of return on capital for the U.S. non-financial corporate sector over the period 1984–2014. Panel A: the debt cost of capital is set to the yield on Moody's Aaa bond portfolio and the equity cost of capital is set to the sum of the risk-free rate (yield on the ten-year treasury) and the equity risk premium (5%). Panel B: expected capital inflation is calculated as a three-year moving average of realized capital inflation and expected consumption inflation is the median expected 12-month price change from the University of Michigan's Survey of Consumers. Panel C: the depreciation rate of capital is taken from the BEA Fixed Asset Tables. Panel D: the required rate of return on capital is calculated as the yield on Moody's Aaa less expected capital inflation plus the depreciation rate of capital, $R = \left(i^D - \mathbb{E}\left[\pi\right] + \delta\right)$; the figure includes a fitted linear trend. See Section 3 for further details.

(a) Cost of Capital



(b) Expected Inflation

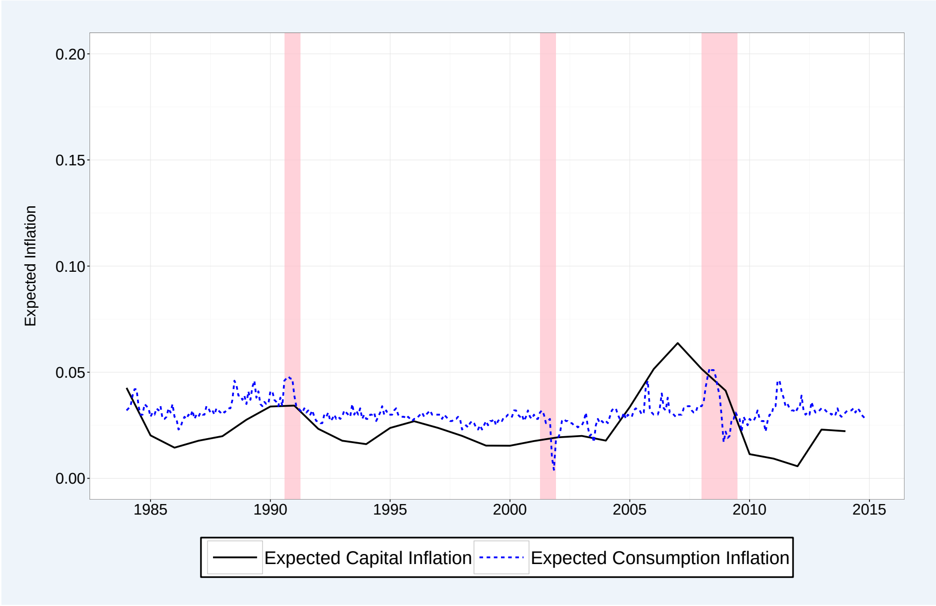
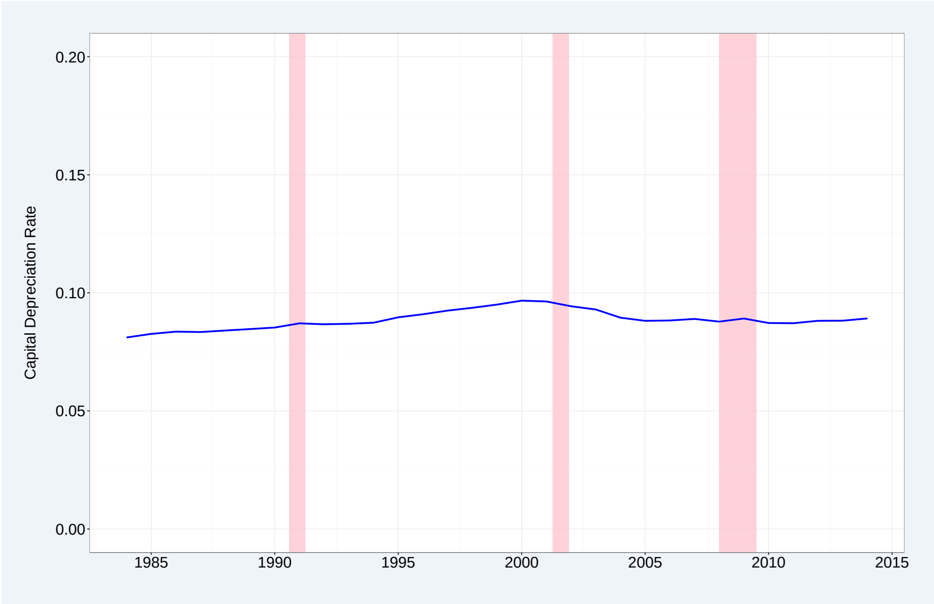


Figure 1: **The Required Rate of Return on Capital** (continued from previous page)

(c) Depreciation Rate



(d) Required Rate of Return

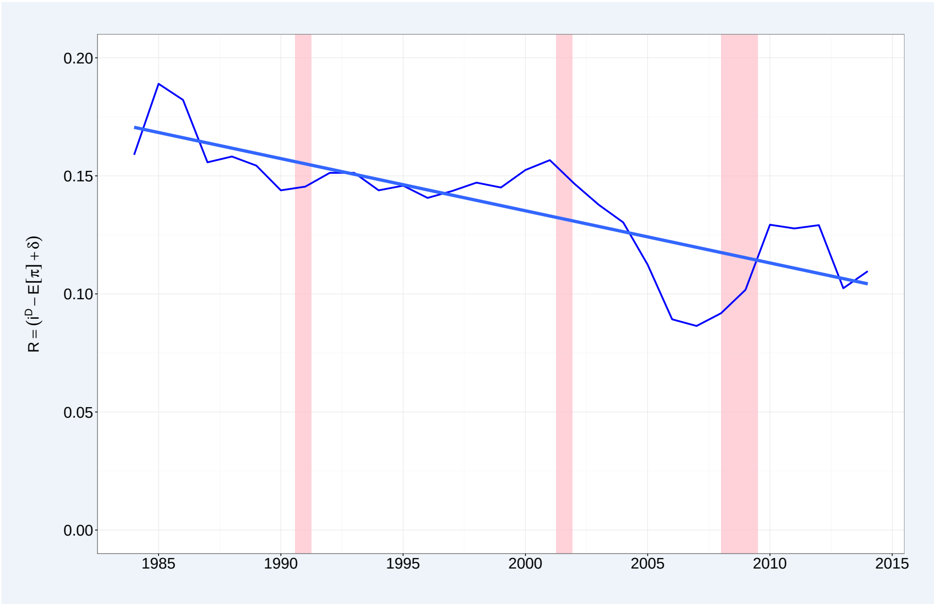
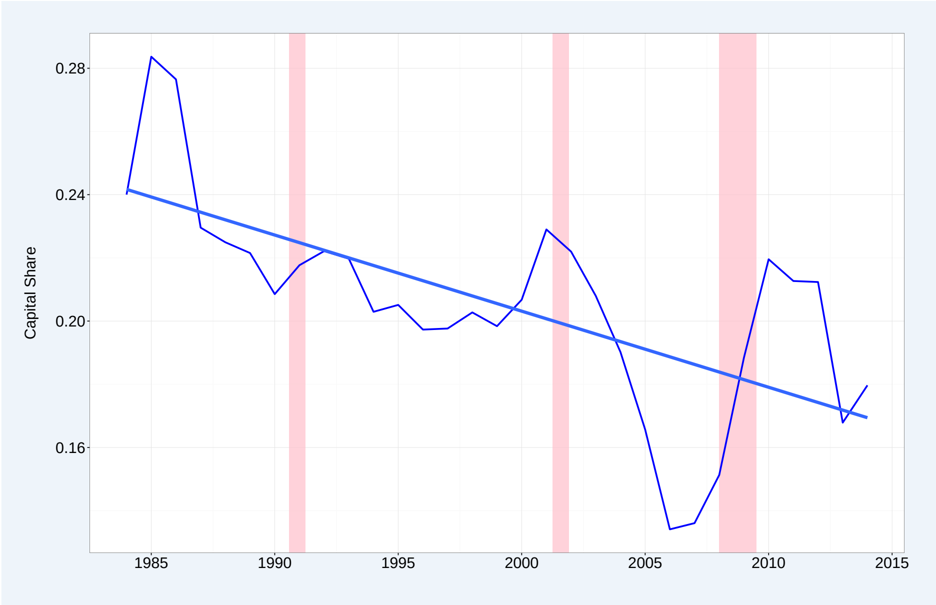


Figure 2: **Capital and Profit Shares**

The figure shows the capital share and profit share of gross value added for the U.S. non-financial corporate sector over the period 1984–2014. Capital costs are the product of the required rate of return on capital and the value of the capital stock. The required rate of return on capital is calculated as the yield on Moody's Aaa less expected capital inflation plus the depreciation rate of capital, $R = \left(i^D - \mathbb{E}[\pi] + \delta\right)$. Expected capital inflation is calculated as a three-year moving average of realized capital inflation. Profits are gross value added less compensation of employees less capital costs less taxes on production and imports plus subsidies, $\Pi = P^Y Y - wL - RP^K K -$ taxes on production and imports less subsidies. Panel A: the capital share is the ratio of capital costs to gross value added. Panel B: the profit share is the ratio of profits to gross value added. Both figures include a fitted linear trend. See Section 3 for further details.

(a) Capital Share



(b) Profit Share

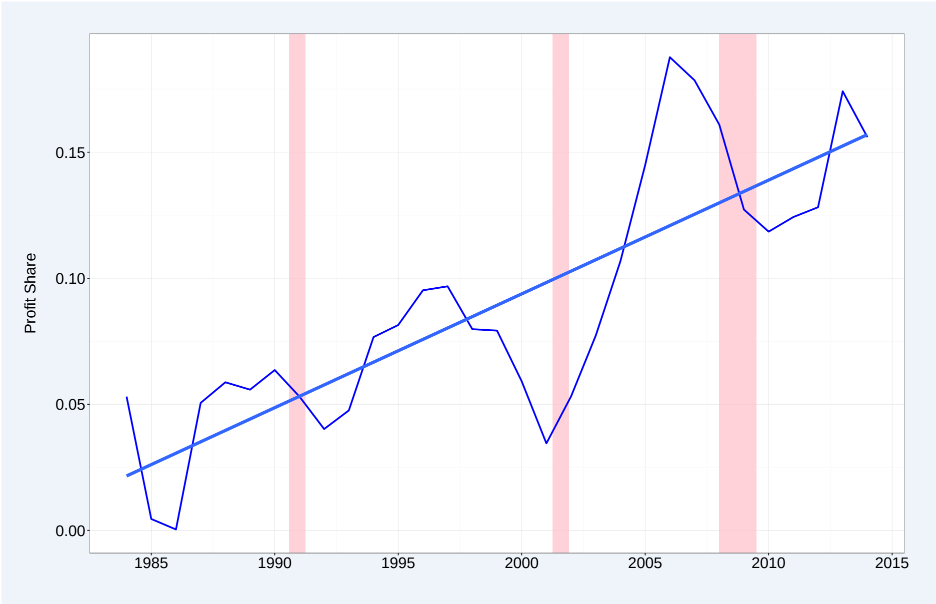


Figure 3: **Break-Even Value of Unobserved Capital**
This figure shows the ratio of the break-even value of omitted or unobserved capital to gross value added for the U.S. non-financial corporate sector over the period 1984–2014. The break-even value of unobserved capital is the ratio of profits to the net required rate of return. The figure includes a fitted quadratic trend. The figure also shows the ratio of capital to gross value added for the U.S. non-financial corporate sector and the ratio of Economic Competencies to gross value added for the U.S. business sector. Data on economic competencies are taken from IntanInvest and include the value of all market research, advertising, training, and organisational capital for the U.S. business sector. See Section 3.5.1 for further details.

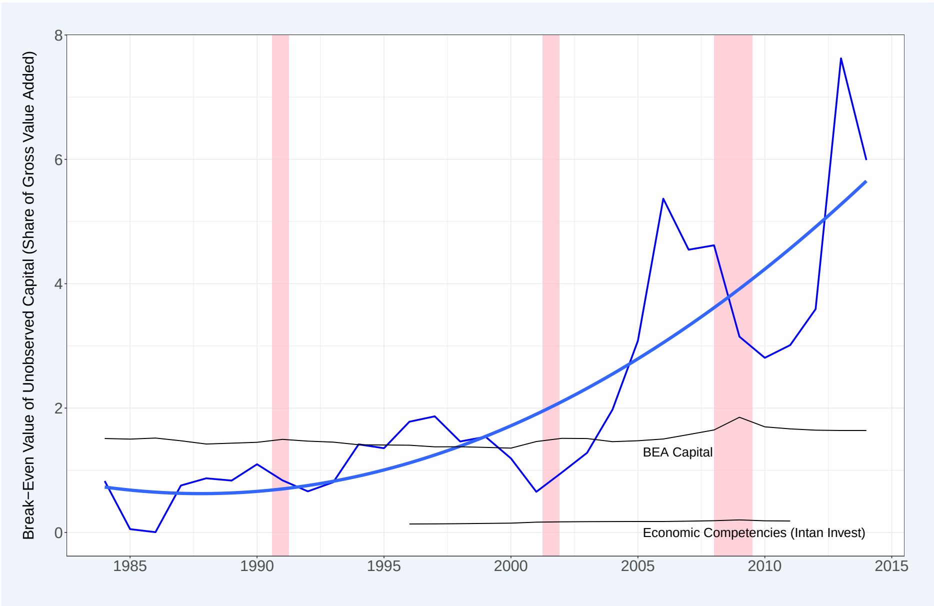


Figure 4: **Ratio of Investment to Gross Value Added**
This figure shows the ratio of investment to gross value added for the U.S. non-financial corporate sector over the period 1984–2014. See Section 3.6 for further details.

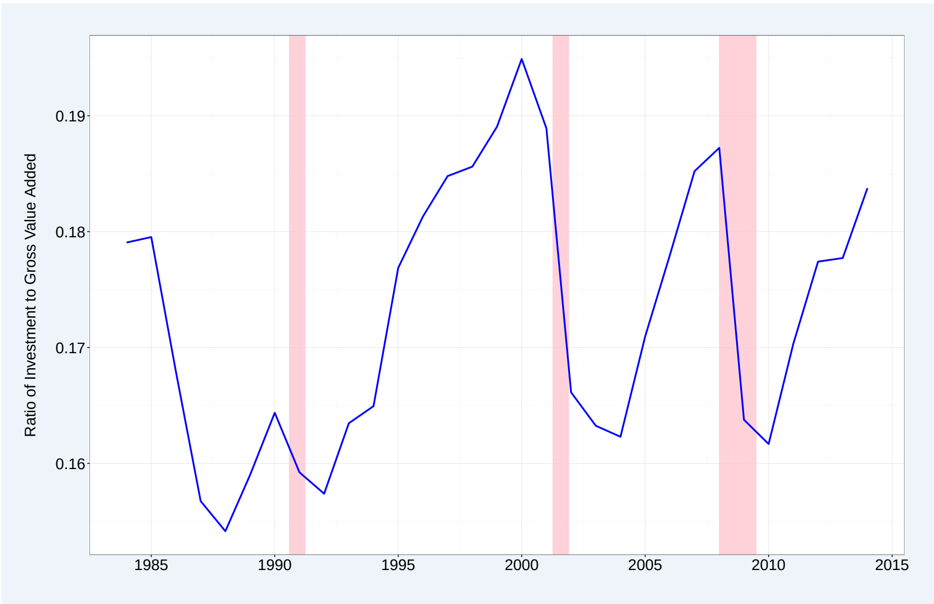


Table 1: **Time Trends of Labor, Capital and Profits**

The table reports time trends for the U.S. non-financial corporate sector over the period 1984–2014. Capital costs are the product of the required rate of return on capital and the value of the capital stock. The required rate of return on capital is specified in each column of the table. Expected capital inflation is calculated as a three-year moving average of realized capital inflation. Profits are gross value added less compensation of employees less capital costs less taxes on production and imports plus subsidies, $\Pi = P^Y Y - wL - RP^K K - \text{topils}$. The break-even value of omitted or unobserved capital is the ratio of profits to the net required rate of return. The labor share is the ratio of compensation of employees to gross value added. The capital share is the ratio of capital costs to gross value added. The profit share is the ratio of profits to gross value added. The break-even capital-to-output ratio is the ratio of the break-even value of omitted or unobserved capital to gross value added. For a variable X, the fitted percentage point (pp) change in X is $\hat{X_{2014}} - \hat{X_{1984}}$, and the fitted percent (%) change in X is $\frac{\hat{X_{2014}} - \hat{X_{1984}}}{\hat{X_{1984}}}$. The increase in profits per employee is the fitted percentage point change in the profit share multiplied by gross value added in 2014 and divided by the number of employees in 2014. The value of the increase in break-even capital is the fitted percentage point change in the break-even capital-to-output ratio multiplied by 2014 gross value added. See Section 3 for further details.

	Required Rate of Return		
	(1)	(2)	(3)
Decline in Labor Share	10%	10%	10%
Decline in Required Rate of Return	39%	34%	31%
Decline in Capital Share	30%	25%	20%
Increase in Profit Share	13.5pp	13.1pp	12.2pp
Increase in Profits per Employee	\$14.4 (thousand)	\$13.9 (thousand)	\$13.0 (thousand)
Increase in Break-even Capital-to-Output	492pp	235pp	232pp
Value of Increase in Break-Even Capital	\$42.5 (trillion)	\$20.3 (trillion)	\$20.0 (trillion)

(1) $R = \left(i^D - \mathbb{E}\left[\pi\right] + \delta\right)$

(2) $R = \left(\left(\frac{D}{D+E} i^D + \frac{E}{D+E} i^E\right) - \mathbb{E}\left[\pi\right] + \delta\right)$

(3) $R = \left(\left(\frac{D}{D+E} i^D \left(1-\tau\right) + \frac{E}{D+E} i^E\right) - \mathbb{E}\left[\pi\right] + \delta\right) \frac{1 - z \times \tau}{1-\tau}$

Table 2: **Time Trends: Robustness to Alternative Measures of Capital**
The table reports time trends for the U.S. non-financial corporate sector over the period 1984–2014. The table extends the analysis of Table 1 by considering alternative measures of capital. Capital data for column 1 are from the BEA Fixed Asset Tables. Capital data for column 2 are taken from the Integrated Macroeconomic Accounts for the United States, Table S.5.a, where real estate is valued at market prices instead of at its replacement cost. Capital data in column 3 are taken from the Integrated Macroeconomic Accounts for the United States, Table S.5.a, and include both real estate valued at market prices and inventories. For each measure of capital, the table reports the time trends of each variable across the three specifications of the required rate of return. See notes to Table 1 for variable definitions. See Section 3.5.2 for further details.

	Measure of Capital		
	(1)	(2)	(3)
Decline in Labor Share	10%	10%	10%
Decline in Required Rate of Return	31% – 39%	34% – 38%	35% – 40%
Decline in Capital Share	20% – 30%	32% – 36%	35% – 40%
Increase in Profit Share	12.2pp – 13.5pp	15.8pp – 17.6pp	18.3pp – 20.2pp
Increase in Profits per Employee	\$13.0 – \$14.4 (thousand)	\$16.7 – \$18.6 (thousand)	\$19.4 – \$21.4 (thousand)
Increase in Break-Even Capital-to-Output	232pp – 492pp	291pp – 530pp	308pp – 553pp
Value of Increase in Break-even Capital	\$20.0 – \$42.5 (trillion)	\$25.1 – \$45.8 (trillion)	\$26.6 – \$47.7 (trillion)

(1) BEA Fixed Asset Tables.

(2) Integrated Macroeconomic Accounts for the United States, Table S.5.a; real estate is valued at market prices.

(3) Integrated Macroeconomic Accounts for the United States, Table S.5.a; real estate is valued at market prices and inventories are included.

Table 3: **Model-Based Counterfactuals (Percentage Change Across Steady State)**
σ is the elasticity of substitution between labor and capital. Rows 1–3 present steady state changes in response to the increase in markups and the decline in the real interest rate. Rows 4–6 present the gaps in output, wages, and investment that are due to the increase in markups. See Section 4.3 for further details.

	$\sigma = 0.4$	$\sigma = 0.5$	$\sigma = 0.6$	$\sigma = 0.7$	Data
Labor share	-9.5	-10.4	-11.3	-12.2	-10.3
Capital share	-30.6	-28.2	-25.8	-23.3	-30.0
Investment-to-output	14.2	18.1	22.1	26.2	7.0
Output gap	-8.3	-8.8	-9.4	-10.0	
Wage gap	-18.9	-19.1	-19.3	-19.5	
Investment gap	-14.1	-16.0	-17.9	-19.8	

Table 4: **Descriptive Statistics**
The table reports descriptive statistics of the matched sample of census industries. Data on industry payrolls, sales and concentration are taken from the economic census. The unit of observation is a six-digit NAICS industry. See Section 5.1 for further details.

	N	Median	Mean	S.D.
Value in 1997				
Labor Share	750	19.80	21.47	11.87
Sales Share of 4 Largest Firms	748	25.95	30.57	20.87
Sales Share of 8 Largest Firms	747	37.40	40.09	24.62
Sales Share of 20 Largest Firms	750	52.15	52.13	27.31
Sales Share of 50 Largest Firms	749	67.00	63.02	27.85
Value in 2012				
Labor Share	750	17.70	20.28	12.88
Sales Share of 4 Largest Firms	748	32.50	35.85	21.78
Sales Share of 8 Largest Firms	747	44.10	45.86	24.72
Sales Share of 20 Largest Firms	750	60.05	57.84	26.47
Sales Share of 50 Largest Firms	749	75.50	68.22	26.42
Change in Value (1997–2012)				
Labor Share	750	-1.41	-1.19	5.90
Sales Share of 4 Largest Firms	748	4.15	5.28	12.10
Sales Share of 8 Largest Firms	747	4.70	5.77	11.80
Sales Share of 20 Largest Firms	750	4.10	5.71	10.93
Sales Share of 50 Largest Firms	749	3.20	5.20	9.86
Log-Change in Value (1997–2012)				
Labor Share	750	-0.08	-0.10	0.28
Sales Share of 4 Largest Firms	748	0.17	0.21	0.46
Sales Share of 8 Largest Firms	747	0.13	0.18	0.38
Sales Share of 20 Largest Firms	750	0.09	0.14	0.30
Sales Share of 50 Largest Firms	749	0.05	0.11	0.23

Table 5: **Labor Share on Industry Concentration – Regression in First Differences**
The table reports results of regressions of changes in the labor share on changes in industry concentration. The unit of observation is a six-digit industry. Observations are weighted by an industry's share of sales. Standard errors are clustered by three-digit NAICS industry. Data on industry payrolls, sales, and concentration are taken from the economic census. The observed decline is the sales-weighted average change in the labor share. The predicted decline is the sales-weighted average predicted change in the log-labor share. See Section 5.2 for further details.

	Dependent variable:			
	$S^L_{j,t} - S^L_{j,t-5}$			
	(1)	(2)	(3)	(4)
$C^{(4)}_{j,t} - C^{(4)}_{j,t-5}$	-0.113^{***}			
	(0.029)			
$C^{(8)}_{j,t} - C^{(8)}_{j,t-5}$		-0.108^{***}		
		(0.028)		
$C^{(20)}_{j,t} - C^{(20)}_{j,t-5}$			-0.125^{***}	
			(0.031)	
$C^{(50)}_{j,t} - C^{(50)}_{j,t-5}$				-0.133^{***}
				(0.036)
Year FE	Yes	Yes	Yes	Yes
R^2 (Within)	0.07	0.06	0.07	0.06
Observations	2,224	2,232	2,229	2,235
Observed Decline	-0.81	-0.84	-0.81	-0.80
Predicted Decline	-0.84	-0.98	-1.25	-1.24
Note:			*p<0.1; **p<0.05; ***p<0.01	

Table 6: **Labor Share on Industry Concentration – Regression in Log Differences**
The table reports results of regressions of log-changes in the labor share on log-changes in industry concentration. The unit of observation is a six-digit industry. Observations are weighted by an industry's share of sales. Standard errors are clustered by three-digit NAICS industry. Data on industry payrolls, sales, and concentration are taken from the economic census. The observed decline is the sales-weighted average change in the log-labor share. The predicted decline is the sales-weighted average change in the predicted change in the log-labor share. See Section 5.2 for further details.

	Dependent variable:			
	$\log S^L_{j,t} - \log S^L_{j,t-5}$			
	(1)	(2)	(3)	(4)
$\log C^{(4)}_{j,t} - \log C^{(4)}_{j,t-5}$	-0.215^{***}			
	(0.079)			
$\log C^{(8)}_{j,t} - \log C^{(8)}_{j,t-5}$		-0.242^{**}		
		(0.110)		
$\log C^{(20)}_{j,t} - \log C^{(20)}_{j,t-5}$			-0.318^{**}	
			(0.151)	
$\log C^{(50)}_{j,t} - \log C^{(50)}_{j,t-5}$				-0.424^{**}
				(0.197)
Year FE	Yes	Yes	Yes	Yes
R^2 (Within)	0.07	0.06	0.06	0.06
Observations	2,224	2,232	2,229	2,235
Observed Decline	-0.22	-0.22	-0.22	-0.22
Predicted Decline	-0.07	-0.08	-0.08	-0.09
Note:		*p<0.1; **p<0.05; ***p<0.01		

Table 7: **Labor Share on Industry Concentration – By Subsample**
The table reports results of regressions of changes in the labor share on changes in industry concentration. The unit of observation is a six-digit NAICS industry. Observations are weighted by an industry's share of sales. Standard errors are clustered by three-digit NAICS industry. Data on industry payrolls, sales, and concentration are taken from the economic census. The observed decline is the sales-weighted average change in the labor share. The predicted decline is the sales-weighted average predicted change in the labor share. The classification of tradable industries is taken from Mian and Sufi (2014). Column 4 excludes Health Care and Social Assistance (NAICS 62) and Other Services (NAICS 81). The classification on R&D industries is based on the NSF R&D survey. See Section 5.4 for further details.

	Dependent variable:				
	$S^L_{j,t} - S^L_{j,t-5}$				
	Full Sample	Excluding Tradable Industries	Tradable Industries	Excluding Sectors with Non-Profit Firms	Excluding R&D Industries
	(1)	(2)	(3)	(4)	(5)
$C^{(4)}_{j,t} - C^{(4)}_{j,t-5}$	-0.113^{***}	-0.131^{***}	-0.036^{*}	-0.119^{***}	-0.125^{***}
	(0.029)	(0.033)	(0.022)	(0.029)	(0.031)
Year FE	Yes	Yes	Yes	Yes	Yes
R^2 (Within)	0.07	0.08	0.02	0.08	0.09
Observations	2,224	1,503	721	2,008	2,011
Observed Decline	-0.81	-0.48	-2.30	-0.75	-0.72
Predicted Decline	-0.84	-1.04	-0.18	-0.93	-1.01

Note: *p<0.1; **p<0.05; ***p<0.01