Profit Puzzles and the Fall of Public-Firm Profit Rates

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Abstract

Why are aggregate profit rates and factor shares divorced from financial-market measures of the cost of capital? We propose a novel explanation: National accounts track all firms, while financial markets track public firms only. In contrast to stable aggregate profits rates, we show public-firm profit rates have fallen since 1980, matching financial markets and suggesting low market power. The public-firm share of capital is stable; implying private-firm profit rates have risen. Size and sector differences cannot explain the divergence, though R&D intensity or capital wedges might. Our results indicate substantial biases in extrapolating public-firm trends to the aggregate economy.

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Since 1980, a puzzling gap has emerged between stable profit rates and falling interest rates, as illustrated in Figure 1. This "profit puzzle" challenges standard growth models, as firms could exploit the gap by borrowing at low interest rates and investing at high profit rates.[1] The leading explanations for the puzzle are rising market power and rising risk premia, which differ greatly in their welfare implications and have gained increasing attention in macroeconomics and finance (Barkai, 2020; Karabarbounis and Neiman, 2019; Caballero et al., 2017; Farhi and Gourio, 2018; Eggertsson et al., 2021; Marx et al., 2021).

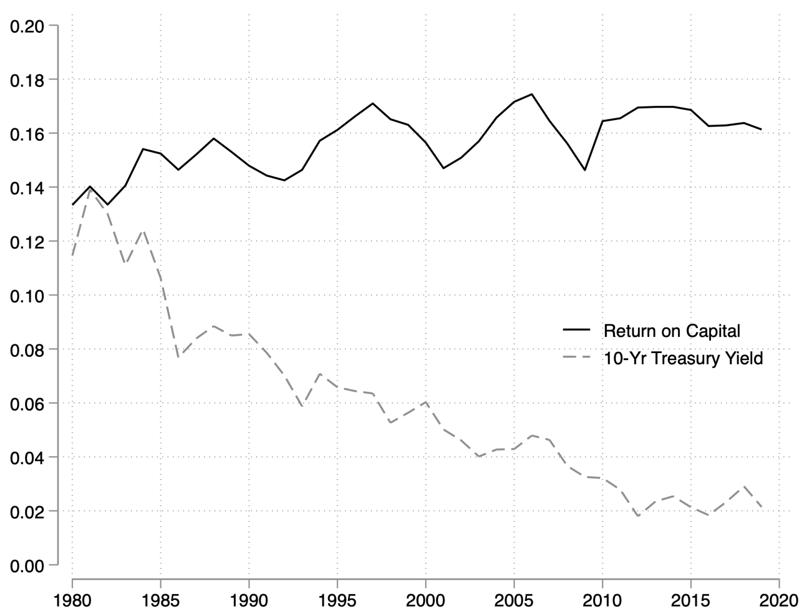

Figure 1: A Profit Puzzle

This figure plots the nonfinancial corporate return on capital from the national accounts against the 10-year Treasury yield. Source: Authors' calculations using the Integrated Macroeconomic Accounts from 1980 to 2019.

Current efforts using financial market data to distinguish between these intertwined explanations have only deepened the puzzle. Bond and stock returns imply rising market power, but also inexplicably prolonged periods of nega-

[1] The cost of capital adjusts the risk-free interest rate for inflation, depreciation, taxes, and risk premia. The gap between the return on capital and the cost of capital measures market power.

tive economic profits. They also imply unaccountably large swings in factor shares, with significant economic profits in the 1950s and 1970s. Why are factor shares divorced from financial market measures of the cost of capital? Is there a deeper lack of transmission between rates in financial markets and rates in investment decisions?

We propose a novel explanation: The puzzle results from a fundamental mismatch between the samples of underlying firms. Public and private firms differ in their characteristics in ways that vary over time (Fama and French, 2004; Davis et al., 2007; Ali et al., 2008; Kahle and Stulz, 2017; Keil, 2017; Traina, 2018). Bond and stock returns represent public firms only, and therefore may not accurately track the cost of finance for all firms. Furthermore, a large literature in finance documents higher returns for segments of private firms in recent years, indicating the private-firm return on capital has not followed the falling cost of capital in financial markets (Kaplan and Schoar, 2005; Harris et al., 2014; Phalippou, 2014; Korteweg and Nagel, 2016; Kaplan and Sensoy, 2015).

We begin by introducing descriptive evidence of falling profit rates since 1980 in Compustat. Even in the raw data, this fall varies from 30% to 50% across different profitability concepts in financial accounting. To our knowledge, this fall has yet to be documented in the literature. This fall is robust to whether we include financial firms or weight firms by their share of domestic activity, addressing concerns about the rising share of financial and foreign operations captured by public-firm financial statements. We show the rise in profit margins (profits over sales) in the literature is offset by a much larger fall in capital turnover (sales over capital).

To interpret these results, we build a model of investment with heterogeneous firms and economic profits. Using this framework, we clarify the measurement of the economic profit rate as the difference between the return on capital and the cost of capital. The return on capital is the accounting profit rate earned on the replacement value of the capital stock, while the cost of capital is the normal profit rate required by investors to provide capital. We also show why the cost of capital, which includes the expected return on equity, does not fully account for market power: This return only captures unexpected changes in the economic profit rate, not levels or expected changes. Furthermore, our model demonstrates how the return and cost of capital at the firm level aggregates to economy-wide measures and how public-firm profit rates can fall even when aggregate profit rates are stable if there are diverging trends in market power or risk premia. Finally, we re-cast our framework in terms of Tobin's Q to argue that a low return on capital is consistent with other patterns found in the data—namely an increase in Tobin's Q while investment growth remains low.

We then quantify the prevailing economic profit rate using the Integrated Macroeconomic Accounts (IMAs). The aggregate return on capital for nonfinancial corporates exhibits considerable historical variation, with troughs in 1958 and 1980 at 13% and a peak in 1966 at 18%. Using a cost of capital measure based on bond yields and average equity premia following Hall and Jorgenson (1967) and Barkai (2020), we find the economic profit rate increases from -3% in 1980 to 2% in 2019, with respective economic profit shares -6% and 4%. This finding corroborates trends found by Rognlie (2016), Barkai (2020), and Karabarbounis and Neiman (2019), but also implies large losses for prolonged periods—a compelling case for mismeasurement.

Next, we verify the fall of the public-firm return on capital by harmonizing financial and national accounting concepts. This harmonization requires both capitalization and decapitalization of assets, which requires parallel adjustments of income (flows) and capital (stocks). Koh et al. (2020) describes both capitalization and decapitalization, which adheres to both the basic accounting principles of double-entry bookkeeping and economic principles of stock-flow consistency. We find the return on book capital in both Compustat and the IMAs is stable at about 21% until 1980; after that, the aggregate return remains stable, while the public-firm return falls to 11% in the late 2010s. Scaling different types of capital by their replacement-to-book ratios in the national accounts, we show the public-firm return on capital fell by about a third since 1980—matching trends in financial markets but diverging from aggregate profit rates. Accounting for their slightly higher tax rates and significantly lower depreciation rates, we find public firms have low and stable economic profit rates.

We investigate the implications of our findings for public versus private firms. We find public firms hold a relatively stable 56% of the aggregate capital stock from 1980 onward. Since the public-firm profit rate has fallen, while the aggregate profit rate has remained relatively stable, we infer the private-firm profit rate has almost doubled since 1980. Moreover, we find public-firm profit rates are similar across size and sector. This result points to differences that arise from alternative characteristics such as intangible intensity, or capital wedges such as financial access.

We contribute to the growing literature on macroeconomic puzzles. This literature documents a decrease in investment rates, despite an increase in Tobin's Q (Gutiérrez and Philippon, 2017); a decrease in the labor share (Elsby et al., 2013; Karabarbounis and Neiman, 2014) and capital share (Barkai, 2020); a decrease in interest rates, despite a stable return on capital (Caballero et al., 2017; Marx et al., 2021); among other puzzling findings (Piketty and Zucman, 2014; Clarke and Kopczuk, 2017; De Loecker et al., 2020; Smith et al., 2022). We add another item to the list: the divergence of public and private firm behavior. Building on the findings of Schlingemann and Stulz (2022) who document a falling public-firm share of employment, we find a stable public-firm share of capital, which implies public firms are now relatively more capital intensive. We also find public firms experienced a secular decline in profit rates, while private firms experienced an increase.

Our results also provide substantial context to related fields. One key question in financial economics is whether a stochastic discount factor that prices public assets can also price private assets, or whether differences between public and private firms create a wedge that undermines comparison. The body of research has found higher realized returns of private assets and has focused on selection biases and risk adjustments (Kaplan and Schoar, 2005; Harris et al., 2014; Phalippou, 2014; Kaplan and Sensoy, 2015; Korteweg and Nagel, 2016; Boyer et al., 2023; Chan et al., 1995). We contribute by documenting higher private-firm returns using a distinct approach which dates back to the 1950s and includes private companies not typically in private equity funds. Either private firms have become riskier, or they are now earning high levels of abnormal profits. While much of the literature focuses on nonrandom subsamples of private equity (e.g. leveraged buyout funds and venture capital), Moskowitz and Vissing-Jørgensen (2002) and Kartashova (2014) impute small business returns from self-reported values in the survey of consumer finances. They both find high private equity returns, consistent with our findings. Fleckenstein and Longstaff (2023) also argue that private businesses have higher returns, according to many estimates the private equity return is about double the well-known public equity risk premium. Our measurement advances the literature by presenting a long time series of private equity returns that is representative and not based on self-reported valuations.

Finally, we highlight the substantial biases that may arise when extrapolating trends from public firms to the aggregate economy. Our results explain why factor shares do not follow financial market measures of the cost of capital, and cast doubt on earlier measurements of aggregate markups based on public-firm extrapolation. Notably, the samples of underlying firms are fundamentally different.[2] When one measures the cost of capital using data from public firms and extrapolates it to the aggregate economy to recover economic profits, aggregate markups can be overestimated. The lack of a significant gap between the return on capital and the cost of capital in public firms rejects the hypothesis that public-firm market power is large and rising. The stable share of capital in public firms implies little reallocation from public to private capital, implying either low private-firm market power or a capital wedge that keeps firms private for longer.

[2]This difference might also help explain discrepancies in the literature. Basu (2019) and Syverson (2019) review market power estimates from national accounts and financial markets (Barkai, 2020), industry-level data (Hall, 2018), and Compustat (De Loecker et al., 2020; Traina, 2018), finding large discrepancies in magnitudes.

The rest of the paper is structured as follows. We show evidence and discuss the fall of public-firm profit rates in section 1. In section 2, we build our investment model that clarifies the key concepts in the paper. Section 3 shows how the public-private mismatch explains our motivating profit puzzle. Section 4 derives implications for private-firm profit rates and explores what might drive the public-private difference, and section 5 concludes.

1 The Fall in Public-Firm Profit Rates

This section investigates the significant fall in public-firm profit rates in recent decades, evidenced by financial accounting ratios. We describe our Compustat sample and our methodology for calculating profit rates. We then address potential concerns about the treatment of financial and foreign activity, demonstrating that differences in profit rates are relatively small. Lastly, we position our contribution to the academic discourse by juxtaposing profit rates with profit margins.

1.1 Profit Rates Using Compustat Data

We source information on the financial statements of public firms from the CRSP/Compustat Merged Database, henceforth referred to as Compustat. Our sample comprises firms listed on the NYSE, AMEX, or NASDAQ. Compustat harmonizes information on firm balance sheets and income statements, enabling us to aggregate and compare across firms and time.

Profit rates are fundamentally ratios of profits to capital. We focus on profits generated by real economic activity, as measured by Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA). This measure is widely accepted in the literature (Covarrubias et al., 2020; Autor et al., 2020; Mitton, 2022). The Return on Assets (ROA) is EBITDA divided by total assets. The Return on Invested Capital (ROIC) is EBITDA divided by total capital invested in a firm's operations, which excludes non-interest-bearing liabilities that result from financial intermediation between firms (Fama and French, 1999). We define the return on nonfinancial assets as EBITDA divided by the sum of inventories, net property, plant, and equipment, intangibles, and other long-term fixed assets. These nonfinancial assets track invested capital, and exclude financial assets such as cash that do not generate operating income.

Many alternative measures of profit rates are not stock-flow consistent. For instance, an alternative definition of ROA that uses net income in the numerator is conceptually flawed because it compares the flow to equity only with the stock of all assets, thereby conflating profitability and leverage. Indeed, even the common definition of ROA has this issue because it includes only operating income in the numerator but both operating and financial assets in the denominator.[3] We plot ROA for comparability, but highlight the better ROIC and return on nonfinancial assets measures.

Our macroeconomic scope guides our aggregation and helps address common concerns. We first sum our measures of profits and capital and then calculate ratios, equivalent to calculating a denominator-weighted average of firm-level ratios and mitigating undue influence of outliers or small firms.[4] Idiosyncrasies in historical cost accounting, revenue recognition, and expense matching can affect reported profits and capital. However, when we aggregate across many firms and look over long horizons, these idiosyncrasies plausibly wash out.

1.2 Descriptive Evidence of Falling Profit Rates

Our first result indicates public-firm profit rates have fallen since 1980, mirroring trends in financial markets. Figure 2 presents this fall across our three broad measures: The return on invested capital, the return on total assets, and the return on nonfinancial assets. This trend could be due to globalization or technological change, discussed by Autor et al. (2020), intensifying the com-

[3]This issue could bias the level of our profit rates, and possibly the trend if the bias was changing over time. In our data, we still see a fall in the average profit rate if we add financial income to EBITDA to create a stock-flow consistent ROA. However, this approach causes a double-counting problem and thus isn't an aggregate profit rate, as discussed by Fama and French (1999). We reflect on this point in section 2.

[4]In section 2, we show this process is also the theoretically correct way to aggregate.

petitive landscape for public firms. This possibility is consistent with results in Farhi and Gourio (2018) who emphasize rising risk premia.

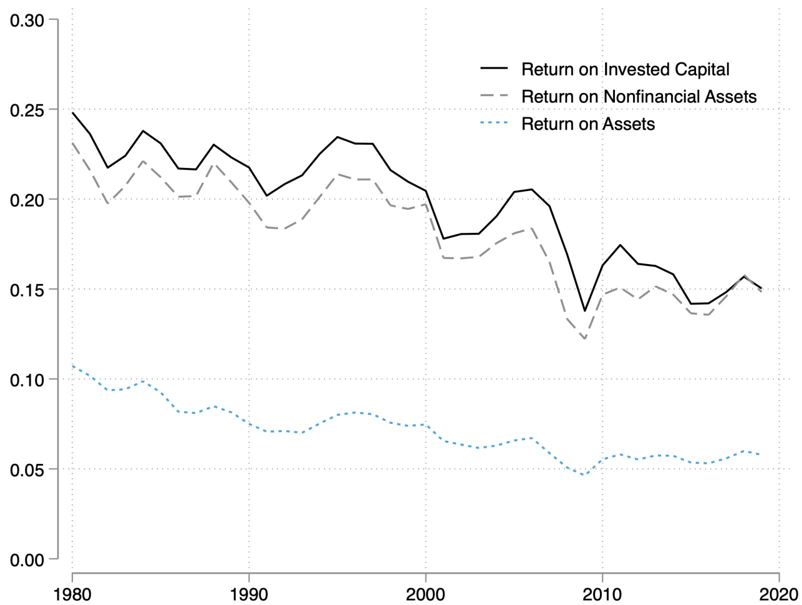

Figure 2: Falling Profit Rates

This figure plots the public-firm return on invested capital, return on assets, and return on nonfinancial assets following standard financial accounting definitions. Source: Authors' calculations using the CRSP/Compustat Merged Database from 1980 to 2019.

As evident from Figure 2, financial assets closely match non-interest-paying liabilities following financial management practices. Consider a manufacturer that accumulates substantial receivables from customers who buy on credit. At the same time, it may incur substantial payables to suppliers for unpaid materials. Efficient cash management typically balances these two, using incoming payments to settle outstanding debts.

1.3 Financial and Foreign Activity

We next explore the role of financial and foreign activity because these dimensions are related to the mismatch between financial markets and national accounts. Financial firms have a significant presence in financial market indices such as the Moody's Baa bond index and the S&P 500, which are often used to impute the aggregate cost of capital. However, financial firms are not in our national accounting measures of economic activity. Likewise, financial market measures include foreign economic activity, while national accounting measures do not. The rise of multinationals and globalization are trends that have been particularly pronounced among public firms. These trends have implications for profit rates, as firms may face different competitive dynamics and regulatory environments in foreign markets.

Despite these differences, we find remarkable consistency across three different sample adjustments for financial and foreign activity. Figure 3 illustrates this finding, starting with our benchmark that mirrors the composition of firms in financial market measures of the cost of capital. The first adjustment drops financial firms, the second adjustment drops firms incorporated outside the US, and the third adjustment reweights firms by their domestic share of pretax income, in the spirit of Schlingemann and Stulz (2022).

All adjustments exhibit similar downward trajectories, indicating the influence of financial firms or foreign operations on profit rates is not inordinate. It also underscores the robustness of our findings across different methods of isolating economic activity. The only difference we see is that nonfinancials had a flatter trend from the early 2000s to the early 2010s, but it then fell back down into the late 2010s.

1.4 Comparison with the Literature

Falling accounting profit rates may seem in stark contrast to recent evidence pointing to rising economic profit rates. However, this apparent contradiction hinges on the time series pattern of normal profit rates, which capture the user or opportunity cost of capital. For example, Barkai (2020) finds an increase in economic profit rates, inferred from the decline in the labor share and bond yields. This finding aligns with findings of aggregate markups in De Loecker et al. (2020) and Hall (2018), albeit with vast discrepancies in

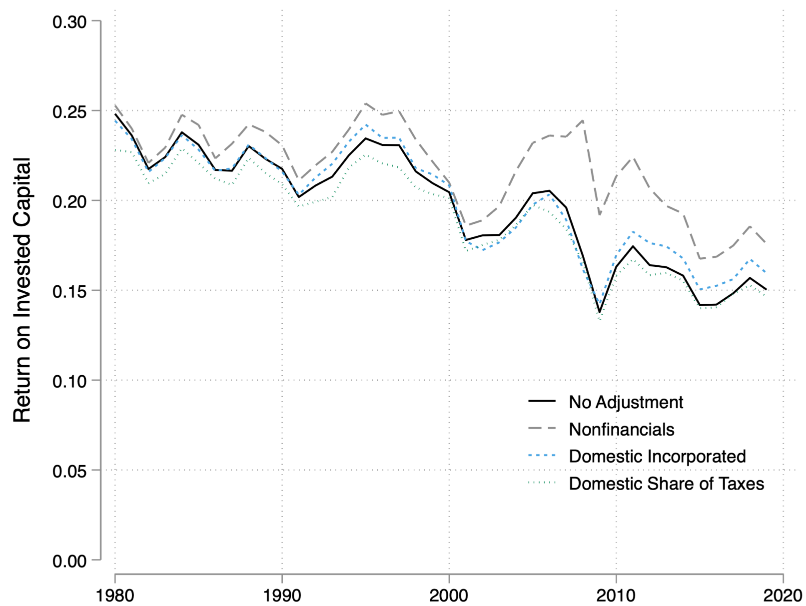

Figure 3: Financial and Foreign Activity

This figure plots the public-firm return on invested capital with different approaches to financial and foreign activity. Source: Authors' calculations using the CRSP/Compustat Merged Database from 1980 to 2019.

magnitudes (Basu, 2019). Thus, our findings offer a different perspective by focusing attention on accounting profit rates, which are considerably less prone to measurement issues.

While we focus on profit rates, which are ratios of profits to capital, other studies focus on profit margins, which are ratios of profits to sales. Interestingly, average profit margins have risen, as Figure 4 shows. The figure contrasts the rise in profit margins with the even larger fall in capital turnover, the ratio of sales to invested capital.

Profit rates and profit margins capture different economic forces. High capital turnover can mechanically result in high profit margins, even when profit rates are low. This insight is central to the DuPont framework that decomposes a firm's profit rates into profit margins and capital turnover, as in Figure 4.

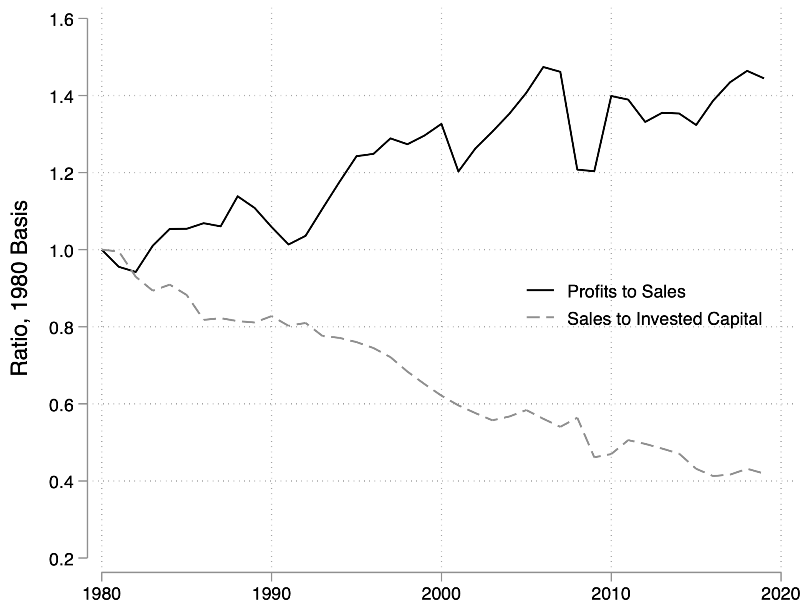

Figure 4: Profit Margins and Profit Rates

This figure plots the profits to sales ratio against the sales to invested capital ratios. Source: Authors' calculations using the CRSP/Compustat Merged Database from 1980 to 2019.

However, while informative about firm-level behavior, profit margins do not aggregate to the macroeconomic level because the sales of some firms are the costs of others, akin to gross output versus value added. Therefore, for our macroeconomic perspective, we focus on profit rates, which provide a consistent aggregate measure across firms and over time.

Which measure of profitability should we use? Which one corresponds to the return on capital in the national accounts? Which one corresponds to financial market measures of the cost of capital? How do economic profits and market power map into financial accounting data? To answer these questions, we next develop a model.

2 A Model of Profits and Capital

This section introduces a model featuring heterogeneous firms and market power, providing a structured framework for our analysis of profits and capital. The model defines key concepts like the return on capital, the cost of capital, and the economic profit rate, and illustrates how these concepts aggregate from individual firms to national accounts. We derive measurement implications for each of these concepts and discuss their interpretation.

2.1 Model Setup

Consider the decision problem of firm j at time t. In the beginning of the period, the firm has productivity $\alpha_{j,t}$, market power $\theta_{j,t}$, and capital $k_{j,t}$. These state variables inform the firm's production and investment decisions, extending the classical version of the q-theory of investment by incorporating firm-specific market power. The firm chooses labor $l_{j,t}$ and investment $i_{j,t}$ to maximize the net present value of its profits, influencing its current income and future capital stock.

The benefits of the firm's choices are reflected in its production function, the residual demand for its output, and the continuation value of its capital stock. We characterize the firm's production by $y_{j,t} \equiv f(k_{j,t}, l_{j,t}; \alpha_{j,t})$, where f has constant returns to scale. Firms face an inverse residual demand given by $p^y_{j,t} \equiv p(y_{j,t}; \theta_{j,t})$, which depends on their production output and market power. Capital depreciates at rate $\delta_{j,t}$, accumulating according to the law of motion $k_{j,t+1} = i_{j,t} + (1 - \delta_{j,t})k_{j,t}$.

The costs of the firm's choices are reflected in factor prices and taxes. The unit price of labor is w_t and that of capital is $p^k_{j,t}$, both taken as given by the firm. We allow capital prices to vary by firm to account for financial frictions that might affect the price of financing.[5] We also introduce a corporate income

[5] An equivalent way of thinking about this formulation is to assume that there is a market price for capital, p^k_t, but that some firms face a wedge $\omega_{j,t}$ due to restricted access to financial markets. The relevant price for the firm would be $p^k_{j,t} = p_t(1 + \omega_{j,t})$.

tax rate $\tau_{j,t}$, which can again vary at the firm level to account for different tax regimes that firms might face. Following Hall and Jorgenson (1967) and Hayashi (1982), depreciation is deductible from the corporate income tax.

The firm's problem is:

$$\begin{aligned} V_{j,t} = \max_{i_{j,t}, l_{j,t}} \quad & (1-\tau_{j,t})(p^y_{j,t} y_{j,t} - w_t l_{j,t}) - p^k_{j,t} i_{j,t} + \delta_{j,t}\tau_{j,t} p^k_{j,t} k_{j,t} + E_t[M_{t+1} V_{j,t+1}] \\ \text{s.t.} \quad & k_{j,t+1} = i_{j,t} + (1-\delta_{j,t}) k_{j,t} \end{aligned}$$

where $V_{j,t} \equiv V(k_{j,t}; \alpha_{j,t}, \theta_{j,t})$ is the value function and M_t is the stochastic discount factor. The value function represents the net present value of the firm's profits, and the stochastic discount factor adjusts for time preference and risk. Relative to many other models in the literature, ours incorporates firm-specific risk and market power while making minimal assumptions on how firms operate. Our notion of risk is also fairly general, summarized by a discount rate that captures both firm-specific and market-wide shocks. Other capital wedges not explicitly modelled would map into those discount rates.

2.2 The Return on Capital and the Cost of Capital

The return on capital is a measure of the accounting profit rate earned on the replacement value of the capital stock. At the firm level, it is:

$$r_{j,t} = \frac{p^y_{j,t} y_{j,t} - w_t l_{j,t}}{p^k_{j,t-1} k_{j,t}}. \tag{1}$$

where the numerator is the firm's profit after paying for labor, but before paying for net taxes or current investment. The denominator is the current cost of replacing the capital stock. In our model, this ratio can vary across firms because of differences in productivity, market power, and capital stock.

The cost of capital is the return required by investors to provide capital. From the firm's perspective, this return is the marginal cost of capital, which we derive from the first-order and envelope conditions of the firm's problem:

$$\frac{\mathbb{E}_t[MRPK_{j,t+1}]}{p^k_{j,t}} = \left[\bar{\rho}_{j,t} - \underbrace{\frac{\mathbb{E}_t[p^k_{j,t+1}] - p^k_{j,t}}{p^k_{j,t}}}_{\bar{\nu}_{j,t}} + \underbrace{\delta_{j,t+1}(1-\tau_{j,t+1})\frac{\mathbb{E}_t[p^k_{j,t+1}]}{p^k_{j,t}}}_{\bar{\delta}_{j,t}}\right]\frac{1}{1-\tau_{j,t+1}} \tag{2}$$

where $MRPK_{j,t} \equiv \frac{\partial p^y_{j,t}}{\partial y_{j,t}}\frac{\partial y_{j,t}}{\partial k_{j,t}}y_{j,t} + p^y_{j,t}\frac{\partial y_{j,t}}{\partial k_{j,t}}$ is the marginal revenue product of capital for firm j at time t. The left-hand side of the equation is thus the marginal benefit of capital for the firm, expressed at capital prices.

The cost of capital for firm j is given by:

$$\bar{r}^c_{j,t} = \frac{\bar{\rho}_{j,t} - \bar{\nu}_{j,t} + \bar{\delta}_{j,t}}{1-\tau_{j,t+1}} \tag{3}$$

which has a few noteworthy components. The first term $\bar{\rho}_{j,t}$ is a firm-specific real discount rate:

$$\bar{\rho}_{j,t} = r^f_t - (1+r^f_t)\mathrm{Cov}_t\left(M_{t+1}, \frac{(1-\tau_{j,t+1})MRPK_{j,t+1} + [1-\delta_{j,t+1}(1-\tau_{j,t+1})]\, p^k_{j,t+1}}{p^k_{j,t}}\right), \tag{4}$$

which diverges from the risk-free rate, $r^f_t \equiv 1/\mathbb{E}_t[M_{t+1}] - 1$, because of aggregate and firm-specific risk. This risk is captured by co-movements between the stochastic discount factor, factor prices (which include the effect of financial frictions), and firm-specific variables like market power and productivity. Next, $\bar{\nu}_{j,t}$ is the expected capital inflation faced by each firm between t and $t+1$, and $\bar{\delta}_{j,t}$ is the expected depreciation rate. Last, $\frac{1}{1-\tau_{j,t+1}}$ adjusts the firm's marginal cost by the tax rate. In sum, the cost of capital can differ across firms due to at least three factors: Different risk profiles, captured by $\bar{\rho}_{j,t}$ and correlated with firm characteristics; different exposures to market access/financial frictions, captured by factor prices; or different depreciation and tax rates.

The expected cost of capital is the return that investors anticipate they will earn on their investment in a firm's capital, based on factors such as the firm's risk profile and market conditions. Typically, we observe only the realized cost of capital, which we denote by $r^c_{j,t}$. This is the actual return investors receive on their investment, and can differ from the expected cost of capital because of unexpected events or changes in market conditions.

Our framework so far has dealt only with the expected cost of capital. To link this expected cost with its realized counterpart, we use an analogue of equation (2) and define the realized cost of capital as

$$r^c_{j,t} = \frac{MRPK_{j,t}}{p^k_{j,t-1}} \quad \text{or} \quad r^c_{j,t} = \underbrace{\mathbb{E}_{t-1}[r^c_{j,t}]}_{\bar{r}^c_{j,t-1}} + \varepsilon_{j,t},$$

where the residual $\varepsilon_{j,t}$ is unexpected returns and $\mathbb{E}_{t-1}[\varepsilon_{j,t}] = 0$. Combining these two expressions, we find

$$\bar{r}^c_{j,t-1} = \frac{MRPK_{j,t}}{p^k_{j,t-1}} - \varepsilon_{j,t}. \tag{5}$$

A firm's cost of capital is often equated to the weighted average cost of its financial securities (see the discussion in Fama and French (1999)). A simple no-arbitrage argument implies an investment in physical capital should have the same return as an investment in the financial value of the firm.[6]

One important caveat with this measure is that it is typically only available for public firms. Consequently, many researchers impute this measure of the cost of capital to private firms as well, which can lead to biases given the potential differences discussed here.

A natural question arises: Since the cost of capital includes the return on equity and thus residual profits, does it fully absorb all gains from market power? The answer is no. Anticipated income attributable to a firm's market power is already included in the current price of equity, and therefore does not

[6]This measure is also justified by equation (3), which equates the firm's cost of capital to its expected marginal return on capital (i.e., the return on investment adjusted for taxes, depreciation, and inflation).

affect returns. However, unanticipated income does affect the return on equity for incumbent owners.

To illustrate, note the price of equity in firm j at time t is

$$p^e_{j,t} = \sum_{k=t+1}^{T-1} \mathbb{E}_t[M_k \Pi_{j,k}] + \mathbb{E}_t[M_T p^e_{j,T}]$$

where $\Pi_{j,k}$ are profit flows. Consider a firm whose profits unexpectedly but permanently increase by a factor of κ after period t^*. If $t^* > t$, the price in period t remains unaffected, as the increase in profits is unexpected. But if the investor keeps their shares beyond t^*, they will experience a higher return. If $t^* < t$, the equation above changes to

$$p^{e,*}_{j,t} = (1+\kappa) \sum_{k=t+1}^{T-1} \mathbb{E}_t[M_k \Pi_{j,k}] + \mathbb{E}_t[M_T p^{e,*}_{j,T}].$$

Clearly $p^{e,*}_{j,t} = (1+\kappa)p^e_{j,t}$ for all t, which means the expected return on equity remains unchanged after t^*, even though the firm is now more profitable. This increase in market power will not affect the cost of capital, as it is already in the price of equity.

In contrast, the same argument does not hold for the return on capital. The return on equity depends on expectations about future dividends and prices; the return on capital is fundamentally a profit rate. In the latter case, market power gains are not priced in because capital is not firm-specific and all firms purchase capital at the same price. Investors can't sell capital at a higher price to firms that have market power; however, firms that have market power can sell equity at a higher price to investors.

In summary, the value added of a firm can flow to three sources: (1) labor, (2) incumbent owners, and (3) owners of newly issued financial capital. In this general model with market power, measuring positive economic profits is the same as showing that incumbent owners have higher returns on capital than the investors of newly issued financial capital. This occurs through the classic asset pricing logic that future expected market power is priced into current financial securities.

2.3 Aggregation of Heterogeneous Firms

We can use our framework to map firm-level quantities to factor shares in aggregate data. We start with the accounting identity that decomposes value added into payments to labor and capital. $P_t Y_t = w_t L_t + R_t p^k_{t-1} K_t$, where $L_t = \sum_j l_{j,t}$ is total labor, $p^k_{t-1} K_t = \sum_j p^k_{j,t-1} k_{j,t}$ is the value of the aggregate capital stock, and $P_t Y_t = \sum_j p^y_{j,t} f_{jt}$ is aggregate value added. The aggregate return on capital is then

$$R_t = \frac{P_t Y_t - w_t L_t}{p^k_{t-1} K_t} = \sum_j r_{j,t} \frac{p^k_{j,t-1} k_{j,t}}{p^k_{t-1} K_t}, \tag{6}$$

which is the capital-weighted average of firm returns as in equation (1).

Because we only observe the total amount of taxes paid in national accounts data, we adopt the following approximation in the firm-level cost of capital,

$$\bar{r}^c_{j,t} \approx \bar{\rho}_{j,t} + \bar{\delta}_{j,t} - \bar{\nu}_{j,t} + \tau_{j,t+1},$$

where tax flows enter additively into the cost of capital expression.[7]

Using this approximation and defining the aggregate expected cost of capital in analogous fashion to the aggregate return on capital, we find

$$\bar{R}^c_t \equiv \sum_j \bar{r}^c_{j,t} \times \frac{p^k_{j,t} k_{j,t+1}}{p^k_t K_{t+1}} = \bar{\rho}_t + \bar{\delta}_t - \bar{\nu}_t + \tau_{t+1}, \tag{7}$$

where $\bar{\rho}_t$, $\bar{\delta}_t$, and τ_{t+1} are the capital-weighted averages of their respective firm-

[7] This is motivated by $\log(1+x) \approx x$ for x close to zero. From equation (3)

$$\begin{aligned} \bar{r}^c_{j,t} - 1 &\approx \log(\bar{r}^c_{j,t}) = \log(\bar{\rho}_{j,t} + \bar{\delta}_{j,t} - \bar{\nu}_{j,t}) - \log(1 - \tau_{j,t+1}) \\ &\approx (\bar{\rho}_{j,t} + \bar{\delta}_{j,t} - \bar{\nu}_{j,t} - 1) + \tau_{j,t+1} \end{aligned}$$

level counterparts. We use the capital shares in $t+1$, since capital in $t+1$ is chosen in period t.

2.3.1 Public and Private Firms

We can also aggregate separately for public and private firms. This process recovers the average public and private costs and returns to capital, $(\bar{R}_t^{c,pub}, \bar{R}_t^{c,prv})$ and $(\bar{R}_t^{pub}, \bar{R}_t^{prv})$. In addition, we have from equation (6) that

$$R_t = s_t^K R_t^{pub} + (1 - s_t^K) R_t^{prv}, \tag{8}$$

where $s_t^K = \frac{q_{t-1}^{pub} K_t^{pub}}{p_{t-1}^k K_t}$ is the share of capital held in public firms. This equation allows us to recover the return on capital for private firms – typically not observable – only from data on public firms and national accounts. The same relationship also holds for the cost of capital and the rate of economic profits.

2.4 Economic Profits

An important consequence of this framework is the existence of aggregate economic profits—revenue that cannot be attributed to the costs of productive factors. To illustrate this result, consider the following:

$$\begin{aligned}
P_t Y_t - & w_t L_t - p_{t-1}^k K_t \bar{R}_{t-1}^c \\
&= \sum_j \left[p_{j,t}^y y_{j,t} - w_t l_{j,t}\right] - p_{t-1}^k K_t \sum_j \bar{r}_{j,t-1}^c \frac{p_{j,t-1}^k k_{j,t}}{p_{t-1}^k K_t} \\
&= \sum_j \left[p_{j,t}^y y_{j,t} - w_t l_{j,t} - MRPK_{j,t} k_{j,t} + p_{j,t-1}^k k_{t,j} \varepsilon_{j,t}\right] \\
&= \sum_j \left\{ p_{j,t}^y y_{j,t} - p_{j,t}^y \left[l_{j,t} \frac{\partial y_{j,t}}{\partial l_{j,t}} + k_{j,t} \frac{\partial y_{j,t}}{\partial k_{j,t}} \right] \left[\frac{\partial p_{j,t}^y}{\partial y_{j,t}} \frac{y_{j,t}}{p_{j,t}^y} + 1 \right] \right\} + \mathcal{E}_t.
\end{aligned} \tag{9}$$

where $\mathcal{E}_t = \sum_j p^k_{j,t-1} k_{t,j} \varepsilon_{j,t}$. The first equality uses equation (7) while the second equality uses equation (5). The third equality uses the FOC from the firm's problem to replace w_t and $MRPK_{j,t}$. Under the additional assumption that $f(k,l)$ is homogeneous of degree 1, $l_{j,t}\frac{\partial y_{j,t}}{\partial l_{j,t}} + k_{j,t}\frac{\partial y_{j,t}}{\partial k_{j,t}} = y_{j,t}$ and the expression above simplifies to

$$P_t Y_t - w_t L_t - p^k_{t-1} K_t \bar{R}^c_{t-1} = -\sum_j \frac{\partial p^y_{j,t}}{\partial y_{j,t}} y^2_{j,t} + \mathcal{E}_t \equiv p^k_{t-1} K_t R^\pi_t \tag{10}$$

where R^π_t is the economic profit rate.

Economic profits have two components: The first term captures market power in the economy, measured by the extent to which firms can affect the prices of the goods that they sell. If firms take demand as given, then $\frac{\partial p^y_{j,t}}{\partial y_{j,t}} = 0$ for all firms j and this term is zero.

The second component, $\mathcal{E}_t$, represents unexpected payments to capital: Since $\mathbb{E}_{t-1}[\varepsilon_{j,t}] = 0$ for all j and $\varepsilon_{j,t}$ is uncorrelated with $p^k_{j,t-1} k_{j,t}$, the term $\mathcal{E}_t$ should average out to zero. As a result, any long-run trend in the economic profit rate is necessarily driven by changes in market power.[8]

In sum, we can split the aggregate return on capital into the expected cost of capital and the economic profit rate:

$$R_t = \bar{R}^c_{t-1} + R^\pi_t. \tag{11}$$

A similar relationship holds with the expected return on capital, $\bar{R}_t = \bar{R}^c_t + \bar{R}^\pi_t$, where $\bar{R}^\pi_t = \mathbb{E}_t\left[-\sum_j \frac{\partial p^y_{j,t}}{\partial f_{j,t+1}} f^2_{j,t+1}\right]$ are the expected gains from market power.

The focus of this paper is measuring the return on capital $\bar{R}_t$ on the left-hand side, which we show for public, private, and aggregate firms. In section 1, we presented suggestive evidence that this return fell for public firms, which stands somewhat in contrast to claims of rising economic profits $\bar{R}^\pi_t$. Measuring the economic profit rate requires a model of the discount rate component $\bar{\rho}_t$ of the

[8]This point is only true when the production function is homogeneous of degree 1. See the discussion in (Basu, 2019).

cost of capital $\bar{R}^c_t$.

2.5 Q-theory

A related macroeconomic "puzzle" is the observation Tobin's Q has increased over the past decades, but investment growth has underpreformed (Gutiérrez and Philippon, 2017). Is this consistent with the fact that the return on capital for public firms has decreased? To answer this question, we re-cast the model in terms of Tobin's Q, defined as the market value of a firm divided by the replacement cost of its capital, $Q_{j,t} = \frac{V_{j,t}}{p^k_{j,t-1}k_{j,t}}$. By dividing both sides of the firm's problem (section 2.1) by the replacement cost of capital in $t-1$, we get

$$\frac{V_{j,t}}{p^k_{j,t-1}k_{j,t}} = \max_{k_{j,t+1},l_{j,t}} (1-\tau_{j,t})\frac{p^y_{j,t}y_{j,t} - w_t l_{j,t}}{p^k_{j,t-1}k_{j,t}} - \frac{p^k_{j,t}k_{j,t+1}}{p^k_{j,t-1}k_{j,t}} + \frac{p^k_{j,t}}{p^k_{j,t-1}}\left(1-\delta_{j,t}+\delta_{j,t}\tau_{j,t}\right)$$
$$+\mathbb{E}_t\left[M_{t+1}\frac{V_{j,t+1}}{p^k_{j,t}k_{j,t+1}} \times \frac{p^k_{j,t}k_{j,t+1}}{p^k_{j,t-1}k_{j,t}}\right].$$

Under the optimal labor and investment values, the firm's problem implies

$$Q_{j,t} = (1-\tau_{j,t})r_{j,t} - \Delta k_{j,t+1} + (1+\nu_{j,t})\left(1-\delta_{j,t}+\delta_{j,t}\tau_{j,t}\right) + \mathbb{E}_t\left[M_{t+1}Q_{j,t+1}\right]\Delta k_{j,t+1},$$

where $\Delta k_{j,t+1} = \frac{p^k_{j,t}k_{j,t+1}}{p^k_{j,t-1}k_{j,t}}$ is the ratio between the firm's value of capital in periods $t+1$ and t (note there are no expectations over this term as $k_{j,t+1}$ is known in period t). Rearranging, we find

$$\frac{\Delta k_{j,t+1}}{1+r^f_t}\mathbb{E}_t\left[Q_{j,t+1}\right] - Q_{j,t} =$$
$$-(1-\tau_{j,t})r_{j,t} + \Delta k_{j,t+1} - (1+\nu_{j,t})\left(1-\delta_{j,t}+\delta_{j,t}\tau_{j,t}\right) - \mathrm{Cov}_t(M_{t+1}, Q_{j,t+1}).$$

This equation relates expected "changes" in Q (the LHS) to the return on capital, as well changes in the value of capital, inflation, depreciation, taxes, and risk.[9] In a static model, where $Q_{j,t}$, $k_{j,t}$, and prices are fixed over time,

[9] A similar relationship can be derived using only accounting identities, as shown in Remark 1 in Cho et al. (2023).

we would find that the *level* of a firm's Tobin's Q is negatively related to the return on capital. This result conforms with the intuition that a large value of Q should increase investment, pushing the demand for capital up, and thus reducing the return on capital.

In a dynamic model, however, this intuition no longer holds. In fact, data suggests that Tobin's Q has been increasing over the past decades, while investment has been flat or falling. The equation above shows that an *increase* in Tobin's Q is perfectly consistent with a low/falling return on capital. Indeed, in a low inflation, low interest, and low investment environment (i.e., $\nu_{j,t}, r_t^f \approx 0, \Delta k_{j,t+1} \approx 1$)—not a bad description of the US between 2000 and 2020—the expression above reduces to

$$\mathbb{E}_t \left[Q_{j,t+1}\right] - Q_{j,t} = (1 - \tau_{j,t})(\delta_{j,t} - r_{j,t}) - \mathrm{Cov}_t(M_{t+1}, Q_{j,t+1}).$$

In this scenario, an expected increase in Tobin's Q can only be observed if the return on capital is low (smaller than depreciation), or risk (captured by the covariance term) is low. Intuitively, a higher return on capital increases the value of Tobin's Q *today*; everything else constant, the expected *change* in Tobin's Q for the following period is smaller. Of course, both the return on capital and Tobin's Q are endogeneous to the investment decisions of firms, so such an argument can only be made in terms of equilibrium outcomes. However, this relationship shows that patterns documented by Gutiérrez and Philippon (2017) (low investment, increasing values of Tobin's Q) are not inconsistent with low returns on capital—in fact, low returns on capital should be expected based on those findings.

3 Implications for Economic Profits

This section presents our key empirical result: When appropriately measured, both the return on capital and the cost of capital of public firms have moved synchronously. This synchronicity reveals a fundamental flaw in applying financial market measures to national accounts data to conclude economic profit rates have been rising for decades. It also explains why investment decisions and factor shares may seem divorced from financial markets. These real economic variables represent the entire economy, while bond yields and stock returns represent public firms only.

We delve into the motivation, methods, and robustness behind this key result. We start by drawing on series from the Integrated Macroeconomic Accounts to quantify the prevailing economic profit rate that's widely discussed in the literature (Barkai, 2020; Farhi and Gourio, 2018; Karabarbounis and Neiman, 2019; Eggertsson et al., 2021). Although our model underscores the deep issues with applying financial returns to the aggregate economy, we follow the existing literature to provide a clear statement of the current discourse. We then detail our method for adjusting the Compustat sample to harmonize financial and national accounting, addressing concerns about what gets measured and at what cost (book or replacement value). Across a variety of robustness checks, we find the public-firm return on capital has fallen, just as with our earlier descriptive evidence on profit rates, and this fall suffices to explain the prevailing economic profit puzzle.

3.1 The Integrated Macroeconomic Accounts

To quantify the prevailing economic profit rate, we use data from the Integrated Macroeconomic Accounts (IMAs). The IMAs are the product of a joint effort by the Bureau of Economic Analysis and the Federal Reserve to harmonize current, capital, and financial accounts for stock-flow consistency (Cagetti et al., 2014; Jorgenson, 2018). This consistency is especially important considering recent literature reviews on the macroeconomics of market power, which report significant discrepancies between aggregate markup and economic profit estimates even when data and methods are ostensibly similar (Syverson, 2019; Basu, 2019). The IMAs ensure all profits are either paid out or reinvested, offering less error in our measurement than if we had pulled data from diverse sources with differences in methods and representativeness.

The key variables we get from the IMAs are as follows. Matching our model, we denote value added net of production taxes as P_tY_t and employee compensation including wages, salaries, and benefits as w_tL_t. Capital is the sum of inventories, land, structures, equipment, and intellectual property products. Intellectual property products are capitalized from flows of research and development, software, and art (at a depreciation rate of about 30%, see Li and Hall (2020)). We use $q_{t-1}K_t$ to denote capital measured at replacement value, and $q^B_{t-1}B_t$ to denote capital measured at book value.

3.2 The Economic Profit Puzzle

The economic profit rate is a function of three important factor rates (equation 10): (1) the output to capital ratio $P_tY_t/q_{t-1}K_t$, (2) the labor to capital ratio $w_tL_t/q_{t-1}K_t$, and (3) the aggregate cost of capital $\bar{R}^c_t$. The return on capital R_t is the output to capital ratio minus the labor to capital ratio (equation 6), while the economic profit rate, by manipulating equation (10), additionally subtracts off the aggregate cost of capital:

$$R^\pi_t = \frac{P_tY_t - w_tL_t - q_{t-1}\bar{R}^c_{t-1}K_t}{q_{t-1}K_t} = R_t - \bar{R}^c_{t-1}. \tag{12}$$

The aggregate cost of capital has four components: The cost of finance, expected inflation, depreciation, and net taxes (equation 7). Our model shows its theoretical ideal is the expected return on a representative unit of capital (see also Mulligan, 2002). We construct the latter three components ($\bar{\nu}_t$, $\bar{\delta}_t$, and τ_t) by dividing flows by the capital stock.[10] Expected inflation is the 5-year moving average of capital revaluations. We use this expected inflation measure because it is simple and goes back to the 1950s, noting Barkai (2020) and Karabarbounis and Neiman (2019) find little difference when using inflation surveys or other time series filters. Depreciation uses the consumption of fixed capital, and net taxes use the net tax on income, wealth, and capital.

For the cost of finance $\bar{\rho}_t$, we use the weighted average cost of finance by

[10]Consistent with our model, this is done at the firm level and only later aggregated.

combining the aggregate shares of debt and equity with the cost of debt and equity in financial markets. This measure uses the standard formula:

$$\bar{\rho}_t = d_t \bar{R}_t^d + (1 - d_t)\bar{R}_t^e, \tag{13}$$

where d_t is the debt share, $\bar{R}_t^d$ is the expected return on debt, and $\bar{R}_t^e$ is the expected return on equity. Our measure of the cost of debt is the Moody's Baa bond yield. Expected returns are of course higher than yields, but adding an expected default premium to this yield changes the results very little. To measure the cost of equity we follow Barkai (2020) by simply adding 5% to the 10-year Treasury yield.

Figure 5 compares the return on capital to the cost of capital. While the cost of capital experienced a significant decline from 20% in the late 1980s to 14% in the 2010s, the overall trend across the entire sample period remains ambiguous. The long-run trend in the cost of capital is largely driven by the long-run trend in the cost of finance, which fell from over 15% in 1980 to roughly half that value today.[11]

The aggregate return on capital diverges from the post-1980 fall of the financial market measure of the cost of capital, despite the substantial decrease in bond yields and stock valuations since 1980. All else equal, lower financial market rates should spur capital investment until the return on capital falls to match them. However, the aggregate return on capital has actually increased from about 14% in the 1980s to about 16% in the 2010s; a linear trend fitted to the series starting in 1980 reveals an average annual increase of 0.07 p.p., statistically significant at the 1% level.

The picture is not so clear before 1980. A similar trend starting in 1953 reveals an average annual increase of only 0.02 p.p.; from 1980 to 2000, the aggregate return on capital is actually lower than the financial market measure of the cost of capital. It is only after 2000 that the return on capital is higher and the

[11] Figure A.5 in the Appendix illustrates the financial market measure of the cost of capital and its four components: The cost of finance, the expected inflation rate, the depreciation rate, and the net tax rate.

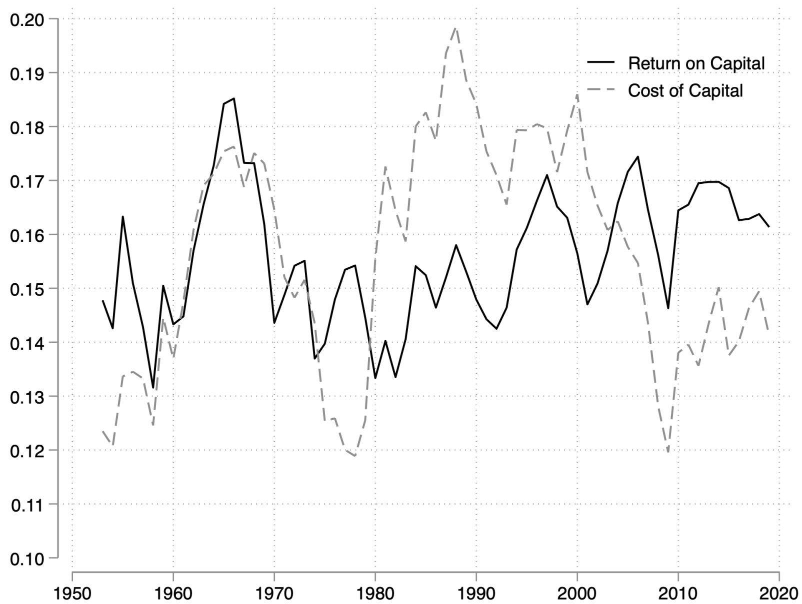

Figure 5: The Return on Capital and the Cost of Capital

This figure plots the return on capital against the cost of capital. Source: Authors' calculations using the Integrated Macroeconomic Accounts from 1953 to 2019.

consequent economic profit rate is positive. Thus, an explanation for a rising economic profit rate needs a concomitant explanation for a negative economic profit rate before 2005. While the mismatch between public and private firms explains this trend, it is difficult to use the standard literature argument of rising market power to explain multiple decades of negative economic profits.

Finally, Figure 6 plots the economic profit rate, R_t^π, along with the implied profit share of value added, $\frac{q_{t-1}K_tR_t^\pi}{P_tY_t}$. When financial market measures of the cost of capital measures are imputed to the aggregate economy, the economic profit rate appears to rise over the previous four decades. A linear trend fitted to the series starting in 1980 reveals an average annual increase of 0.01 p.p., statistically significant at the 1% level.

Looking at the full series, patterns in economic profits are much more ambiguous. A linear regression starting from 1953 yields a slope that is statistically

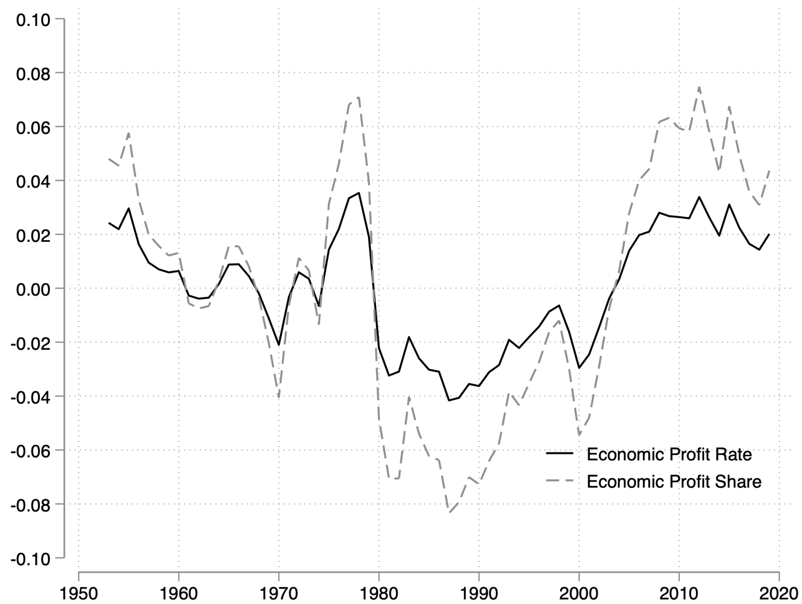

Figure 6: The Economic Profit Puzzle

This figure plots the economic profit rate and the economic profit share of value added. Source: Authors' calculations using the Integrated Macroeconomic Accounts from 1953 to 2019.

indistinguishable from zero at the 10% level. In addition, the economic profit rate hovers below zero for much of the sample. As a result, matching financial markets and national accounts implies firms are making negative economic returns for extended periods of time. This yields an uncompelling case for economic profits, but a compelling case for mismeasurement.

3.3 Capitalization and Decapitalization Principles

An important principle in both accounting and economics is to maintain consistency in flows and stocks when capitalizing an asset. This section reviews some of those principles as they are relevant for harmonizing Compustat with National Accounts data and for constructing alternative measures of the return on capital used in robustness exercises.

As discussed below, in order to adjust the Compustat data so that it is consistent with the Integrated Macroeconomic Accounts (IMA) data, we must capitalize R&D expenses as done in the IMA data. For example, the Compustat measure of the return on book capital is analogous to the following:

$$R_t^{\text{expense}} = \frac{P_t Y_t - w_t L_t - F_t}{q_{t-1} K_t},$$

where F_t is the dollar flow expense of R&D and $P_t Y_t - w_t L_t$ represents the income after wages and other input costs but before this R&D flow expense. In this example, R&D is treated as an expense rather than a capital investment. To reverse this and treat it as a capital investment, we calculate the following:

$$R_t^{\text{capital}} = \frac{(P_t Y_t - w_t L_t - F_t) + F_t}{q_{t-1} K_t + S_t},$$

where S_t represents the accumulated capital stock in dollars from R&D. Note that both the numerator and denominator must be modified, just as both assets and liabilities must be modified in standard double-entry bookkeeping. A naive approach may be to measure the following return on capital:

$$R_t^{\text{incorrect}} = \frac{P_t Y_t - w_t L_t - F_t}{q_{t-1} K_t + S_t}. \tag{14}$$

This is incorrect because it takes the ratio of income after R&D expenses to capital values that include R&D capital. Both the numerator and denominator must be adjusted for consistency and comparability.

We follow this standard principle, but in reverse, to adjust capital stock values that we want to consider expensed rather capital investments. This conversion process is referred to as decapitalization. We stress that decapitalization must generate an additional expense in the numerator and subtract capital stock off from the denominator, similar to capitalization above. For example, we consider decapitalizing goodwill and a category of assets called other assets below, and both must involve numerator and denominator effects to unwind these values in the data.

This decapitalization procedure is the standard in the accounting literature, and used to undo the original capitalization of an asset category and expense the relevant flow. For example, Koh et al. (2020) use this method to understand how the capitalization of intellectual property products in the BEA affects the labor share. They similarly stress that removing the relevant capital stock without also adjusting the income violates stock-flow consistency and double-entry bookkeeping, thus generating incomparable income and capital stock values.

3.4 Harmonizing Financial and National Accounting

We now turn to using the Compustat sample to measure the return on and cost of capital for public firms, in a way that is as consistent as possible with the IMA data. We measure gross value added net of labor costs $P_tY_t - w_tL_t$ as EBITDA. From a theoretical perspective, EBITDA is appropriate because it records sales less intermediate-input and labor costs, directly corresponding to the national accounts measure. EBITDA is the standard definition for profits in the literature (e.g. Autor et al., 2020; Covarrubias et al., 2020), making our results comparable to other work. Mitton (2022) documents EBITDA is also the most commonly used measure of profits in empirical corporate finance articles published in the top finance journals over the last 20 years.

Financial accounting standards dictate that firms report the book value of assets as a depreciated measure of historical costs. Fortunately, this book value $q^B_{t-1}B_t$ is available in both Compustat and the IMAs. In Compustat, we begin with the book value of nonfinancial assets (the sum of inventories, physical capital, intangible capital, and other fixed assets).

Compustat has important differences when compared to the IMAs, and we adjust our Compustat measure to harmonize the two datasets. Compustat uses financial accounting rules which depreciate capital on a straight-line basis, expense R&D, and include goodwill. In contrast, the IMAs use national accounting rules which depreciate capital on a geometric basis, capitalize R&D, and do not include goodwill.

To make capital comparable at book value, we adjust for differences in depreciation methods (Li and Hall, 2020), capitalize R&D flows, and decapitalize goodwill stocks. Critically, these adjustments are stock-flow consistent following clean surplus accounting so that investment flows from profits and into the capital stock. As discussed above, R&D and goodwill both affect recorded earnings, so it is critical we treat them consistently in both profit and capital measurement. For example, capitalizing R&D will increase the capital denominator, but also the profit numerator as we need to add back the implicit depreciation expense. It will also increase the depreciation rate in our cost of capital calculation.

First, we adjust for depreciation methods. The IMAs use geometric depreciation, but US Generally Accepted Accounting Principles mandate public firms use straight-line depreciation. The BEA switched from straight-line to geometric depreciation in 1997, which increased the capital stock by 22.4% (Katz and Herman, 1997). This percentage increase was remarkably stable over several decades. To approximately recover the geometric-depreciation version of capital, we multiply our Compustat capital stock by 1.224. To preserve stock-flow consistency, we divide the Compustat depreciation flow by 1.224 when we calculate $\bar{R}_t^c$ for public firms. Because this rescaling is constant over time, it will only affect our results in levels, not in trends.

Second, we adjust for R&D. To make Compustat comparable to the IMAs, we capitalize R&D and reverse the booked expense. To do this, we calculate the stock and flow of R&D as:

$$S_{t+1}^{\text{R\&D}} = (1 - 0.295) \times S_t^{\text{R\&D}} + F_{t+1}^{\text{R\&D}}, \tag{15}$$

where $F_t^{\text{R\&D}}$ is the flow of R&D available in the data. We use a depreciation rate of 29.5% following results in Li and Hall (2020). This rate is higher than the rate in earlier studies such as Peters and Taylor (2017), but is more in line with values in the national accounts. This depreciation rate is consistent with Ewens et al. (2019), who argue that the 15% depreciation rate sometimes used in the literature is about half of the correct value estimating from the data.

Third, we adjust for goodwill. Goodwill is not counted in the IMAs, but ignoring it entirely would violate stock-flow consistency and artificially increase public-firm profit rates by decreasing the denominator without also decreasing the numerator. In other words, goodwill should be decapitalized for comparability.

Finally, we adjust the Compustat measure of EBITDA to be consistent with our treatment of intangible capital. For the profit numerator, we add back R&D expenses and subtract goodwill flows. For the capital denominator, we add R%D capital and subtract goodwill stocks. Decapitalizing goodwill is different from the R&D capitalization above, because we need to determine the consistent flow. We estimate this flow as:

$$F_{t+1}^{\text{Goodwill}} = S_{t+1}^{\text{Goodwill}} - S_{t}^{\text{Goodwill}} + 0.11 \times S_{t+1}^{\text{Goodwill}}, \tag{16}$$

where $S_{t+1}^{\text{Goodwill}}$ is the stock of goodwill in the data. This corresponds to an 11% depreciation rate, averaged across the previous and current stock of goodwill values. While goodwill amortization and impairment guidelines have changed through time, we use a constant 11% to match the 15-year service life suggested by contemporary financial accounting standard and US tax code Section 197, at a 1.65 declining-balance rate to match the BEA default (Katz and Herman, 1997). A service life of 15 years and default declining balance rate is 1.65 corresponds to this 11% rate (1.65 / 15 = 0.11).

With these stocks and flows in hand, we can adjust EBITDA and the book capital stock to create return on book rates that are comparable across the Compustat sample and the IMA data, consistent with the discussion above on capitalization and decapitalization of stocks and flows.

3.5 The Fall of the Public-Firm Return on Capital

Figure 7 shows that the public-firm return on book capital has declined. Which factors contribute to this decline? The figure shows our corrections for depreciation, R&D, and goodwill make little difference. The same is true when we conduct corrections for R&D and goodwill individually. Indeed, the decline in the return to book capital is robust to a wide variety of different treatments of R&D and goodwill.

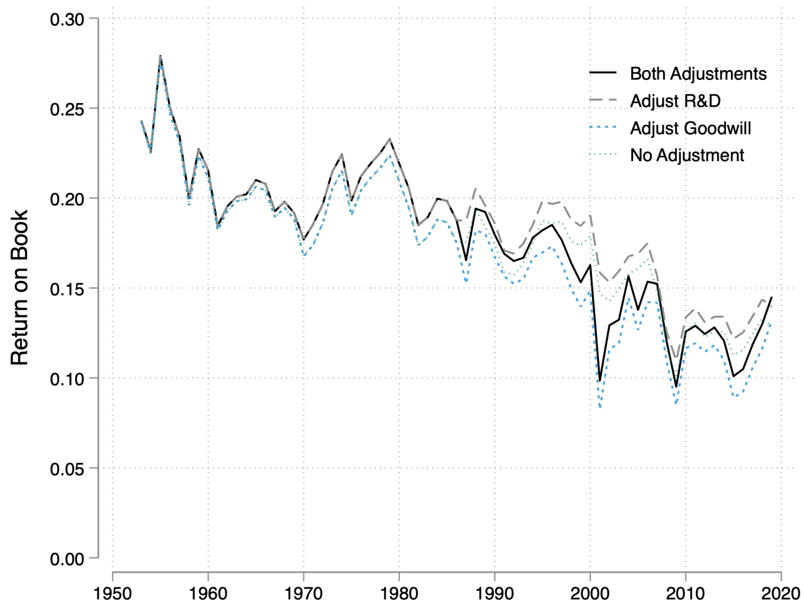

Figure 7: A Robust Fall in the Public-Firm Return on Book

This figure plots the public-firm profit rate measured by the return on book, with variations in the capitalization of R&D and goodwill. Source: Authors' calculations using the CRSP/Compustat Merged Database from 1953 to 2019.

Figure 8 shows how the book profit rates compare for Compustat and the IMAs. The two series follow each other fairly closely until around 1980, when the Compustat return on book rate drops markedly below the IMA return on book rate. Since then, public-firm profit rates have fallen.

We perform various robustness checks described below. Figure A.1 in the Appendix shows the quantiles of these profit rates across various quantiles of public firms, and this decline appears robustly across quantiles. As an important additional robustness check, we decapitalize the "Other Assets" and "Other Intangible Assets (Excluding Goodwill)" categories of assets in the Compustat data, similar to the decapitalization exercise above. The fall in public firm return on capital rates is similar, as shown in Figure A.2 in the Appendix.

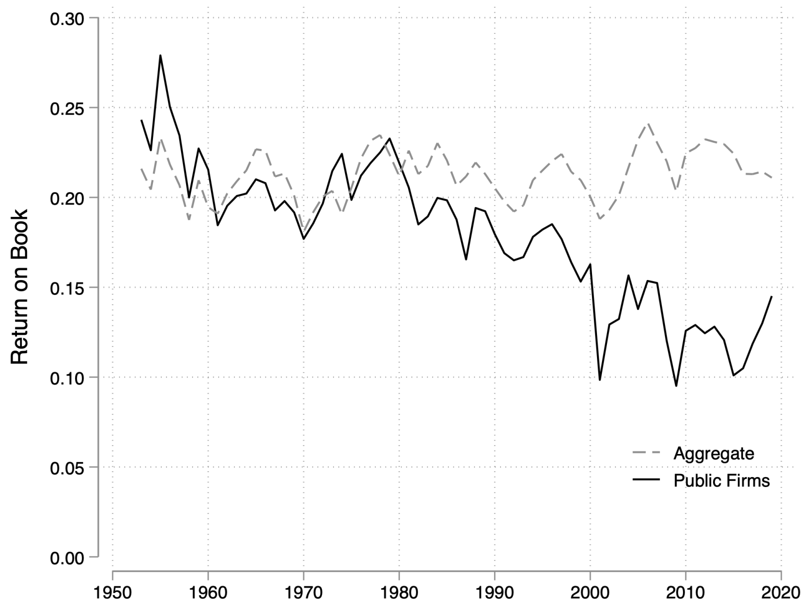

Figure 8: Public-Firm and Aggregate Profit Rates

This figure plots the public-firm and aggregate profit rates measured by the return on book from 1953 to 2019. Source: Authors' calculations using the CRSP/Compustat Merged Database from 1953 to 2019.

The findings in both figures have important implications for the argument that aggregate markups have increased over recent decades. To see why, recall the measurement of the economic profit rate depends on both the return on capital and the cost of capital. Because the cost of capital for the representative firm is typically not observed, this quantity is approximated by the cost of capital for public firms, $\bar{R}_t^{c,pub}$. Our results show the return on capital for public firms is lower than the aggregate return on capital, $R_t^{pub} < R_t$. But since $\bar{R}_t^{c,pub} = R_t^{pub} - R_t^{\pi,pub}$, the cost of capital for public firms is also likely biased downward relative to the aggregate cost of capital. Under this assumption, if one extrapolates $\bar{R}_t^{c,pub}$ to the aggregate economy, the measured economic profit rate corresponds to the residual $R_t - \bar{R}_t^{c,pub}$, which is biased upward.

Without data on all private firms in the US, we cannot offer direct evidence that the cost of capital for public firms is indeed lower than the cost of capital for private firms. However, our results show this conclusion holds unless the economic profit rate for private firms is sufficiently larger than the economic profit rate for public firms to make up for the (increasing) difference in the observed returns to capital. Regardless of which assumption holds true in the data, those findings cast doubt on the measurements of aggregate markups and the profit share that extrapolate public firm data to infer the cost of capital.

We take advantage of the IMAs data to create a return on capital series, rather than just a return on book capital. The theoretical return on capital from Section 2 uses the replacement cost of capital, rather than book costs. This method takes advantage of the IMAs capital types and their corresponding replacement to book value ratios to account for different types in the Compustat sample. Figure 9 shows the ratio of the replacement value of capital to the book value for inventories; property, plant, and equipment (PPE); and intellectual property products (IPP). Since the replacement value is typically above the book value, most of these series are above one most of the time. We can use these three series to transform our book capital profit rates back into our profit rates from above with replacement capital values, assuming Compustat firms have the same replacement-to-book ratios as in the IMAs data. We scale each capital type by its corresponding ratio, exploiting the observable capital mix in Compustat.

Next, we construct a public-firm cost of capital series. Recall from equation (7) that depreciation and tax rates are important components of the cost of capital. Public and private firm depreciation and tax rates may differ. Using Compustat, we can observe both depreciation and tax rates, adjusting them to match the IMAs data, as discussed above. We include R&D and exclude goodwill depreciation, following the same laws of motion above. Tax rates of public and private firms are similar, especially from 1990 toward the end of the sample. Depreciation rates of public firms are lower in levels, and the

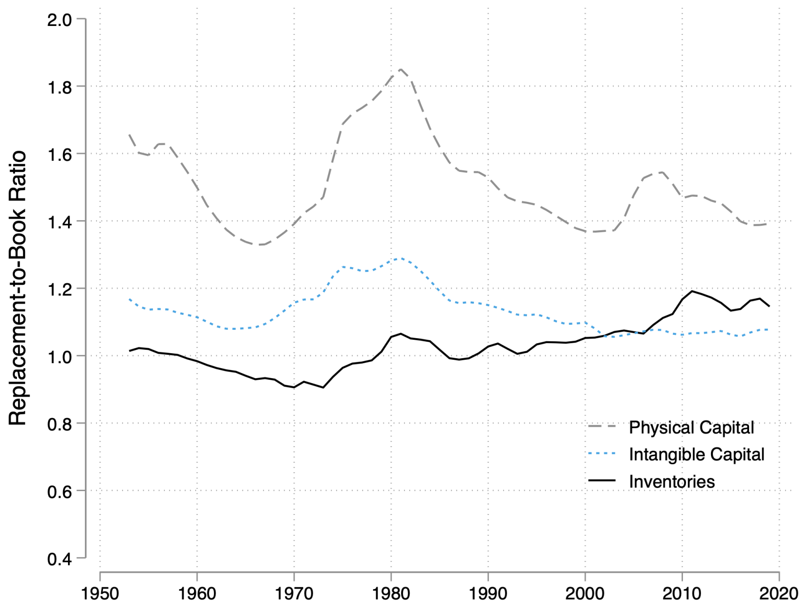

Figure 9: Replacement to Book Adjustment Factors

This figure plots the replacement-to-book ratios in the national accounts that we use to adjust public-firm capital stocks. Source: Authors' calculations using the CRSP/Compustat Merged Database and the Integrated Macroeconomic Accounts from 1953 to 2019.

difference grows larger over time.[12] Inflation and the discount rate, $\bar{\rho}_t$, are measured as discussed before.[13]

Figure 10 shows the return on capital and the cost of capital together. The difference between these two series is the public-firm economic profit rate. The difference is close, implying an economic profit rate that is much smaller than reports in the literature. This emphasizes the mismatch: When we consider only public firms, there is no puzzle.

[12]Figure A.11 in the Appendix shows the difference between Compustat and IMAs data depreciation rates and tax rates.

[13]Acknowledging the drawbacks of this simple measure, we also point out that it is likely a better measure of the discount rate for public firms than it is for private firms; the reason is that public firms trade equity and debt on financial markets, while private firms often rely on banks or private investment. As such, the evolution of discount rates faced by public firms should be closer to the evolution of other financial rates, such as Treasury yields.

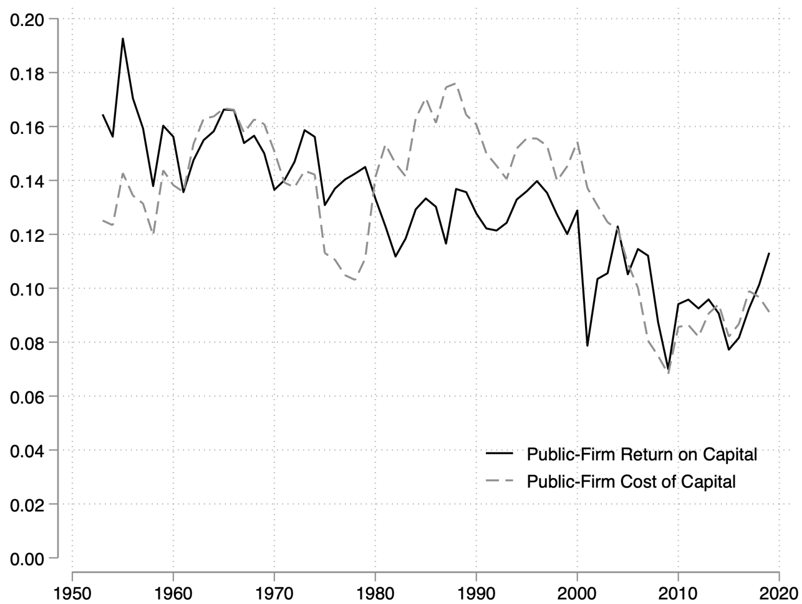

Figure 10: Public-Firm Returns and Costs

This figure plots the return on capital and the cost of capital for public firms. Source: Authors' calculations using the CRSP/Compustat Merged Database and the Integrated Macroeconomic Accounts from 1953 to 2019.

The absence of public-firm profits has larger implications for the economic profit rates of private firms. Suppose public firms represent the aggregate economy. In that case, the aggregate economic profit rate is low and fairly stable. This conclusion is at odds with findings in the recent literature, even if those findings assume public firms are representative when they extrapolate their cost of capital to all firms. A second possibility is that the aggregate economic profit rate has indeed been increasing over the last decades, but was driven by dynamics in private firms. Under this hypothesis, one would expect private firms would have little incentive to go public as they hold all the economic profit in the economy. We would then expect the share of capital in public firms would shrink. In the next section, we test some potential explanations for this divide and test how representative of the aggregate economy, public firms have been.

4 Implications for Public Versus Private Firms

So what drives the divergence between the aggregate return on capital and financial market measures of the cost of capital? In this section, we explore this secular change between public and aggregate profitability and its implications for the public and private firm mismatch. We start by deriving the profit rate of private firms as the weighted difference between the aggregate profit rate and the public-firm profit rate. This approach contributes to the literature by offering the first long-run series of the private-firm profit rate, which is otherwise generally unavailable in public-use datasets. Next, we explore how public and private firms are fundamentally different on observable characteristics, and test whether these differences are at the root of the mismatch in profit rates. We find size and sector differences cannot account for the divergence in profit rates between public and private firms, but intangible capital intensity might.

In what follows, we adjust the Compustat sample by dropping financial and foreign firms and weighting nonfinancial firms by their domestic income share to match as closely as possible to the underlying firms in the IMAs. In the IMAs, profits and capital are calculated from nonfinancial domestic activity only. Consistent with Figure 3 in Section 1, our earlier results are similar when analyzed on either subset.

4.1 The Public-Firm Share of Capital

How representative are public firms in terms of the aggregate capital stock? We derive the public-firm share of capital by comparing the total book capital in our Compustat sample with the total book capital in the IMAs. Quantifying the public-firm share depends on how we select our Compustat sample. For instance, if we adopt a broader definition of what it means to be a public firm—such as including firms with securities in over-the-counter markets—we will keep more observations and the share will mechanically increase. While these methodological choices influence the level of the public-firm share, a broad set of different filter variations affect the trends very little. With these limitations in mind, our measure provides a first step to the broader research agenda on the representativeness of public firms.

Figure 11 illustrates the public-firm capital share through time. Our analysis reveals an increase in public-firm representativeness of the US capital stock before 1980, followed by a period of stability. It is well-known Compustat is quite sparse until the 1970s, and indeed the capital share is low during this period. It begins at about 20% in the 1950s and gradually increases to about 60% in the 1970s. From 1980 onward, it's much more stable, hovering between 50% and 60% as a share of aggregate capital. This stability is remarkable in light of the dramatic changes in the number, size, and sector composition of public firms (Fama and French, 2004; Kahle and Stulz, 2017; Traina, 2018; Schlingemann and Stulz, 2022).

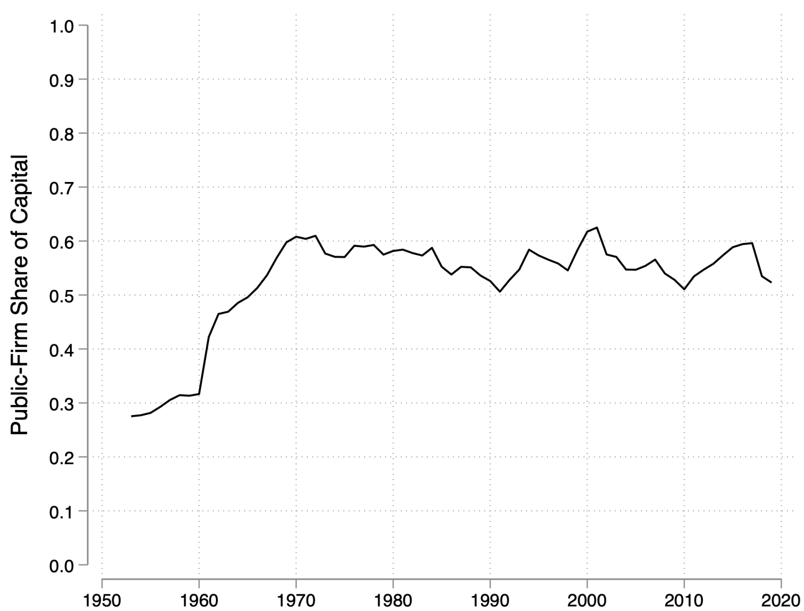

Figure 11: Stable Representation of Public Firms

This figure plots the share of aggregate capital in public firms. Source: Authors' calculations using the CRSP/Compustat Merged Database and the Integrated Macroeconomic Accounts from 1980 to 2019.

The stability of the public-firm share of capital implies the economic profit rate for private firms is also low. To illustrate this point, let's consider a scenario where the economic profit rate is high for private firms (in absolute terms, because we've already established it's low for public firms). Firms would have an incentive to stay private for longer, leading to a rise in the private-firm share of capital and a fall in the public-firm share of capital. However, these movements are not what we see in the data, which show stable relative shares of aggregate capital. Interestingly, public firms have decreased in number and in the share of employment (Doidge et al., 2017), but the public firm capital share has been stable during this period.

Our research offers a novel contribution to understanding the representativeness of public firms by focusing on the capital stock. Our result on stability aligns with Davis et al. (2007), who document a relatively stable trend in the public-firm share of employment from 1980 to 2000. Our focus complements the work of Schlingemann and Stulz (2022), who examined the representativeness of public firms up until current times in terms of value added and employment and find falling representativeness for these variables. We can draw macroeconomic implications by comparing results. For instance, our findings imply public firms are increasingly more capital-intensive relative to private firms. This implication aligns with the overrepresentation of the manufacturing sector among public firms, a sector that has been steadily increasing in capital intensity over recent decades.

4.2 The Rise of the Private-Firm Return on Capital

Have private-firm profit rates risen or fallen over time? We've reasoned the economic profit rate of private firms is likely low given the low public-firm economic profit rate and the stable public-firm share of capital. However, that reasoning only implies the return on capital and the cost of capital move together—it's unclear whether these rates are low or high, or have fallen or risen. To answer this question, we infer the private-firm profit rate from the residual of economic activity. More precisely, we calculate private-firm values by subtracting public-firm values from the aggregate. The ratio of the derived private-firm profits to private-firm capital gives us the return on capital for private firms.

Figure 12 plots the evolution of private-firm profit rates, revealing a stark contrast between the private-firm and public-firm return on capital. The figure reveals private and public firm profit rates were similar before the late 1970s, when they started to diverge. The private-firm profit rate started increasing and is over 50% higher today than in the late 1970s. This trend is happening on average, but we don't know whether it's because private firms are now in more profitable sectors, or because private firms within these sectors are more profitable. Given that changes in public-firm composition vary a lot by decade (Fama and French, 2004; Kahle and Stulz, 2017), it's plausible that both factors are at play but at different times. The contrast is not unexpected: Mechanically, the residual private-firm profit rate must have increased substantially to account for the secular break between public-firm and aggregate return on capital rates. However, the degree of this shift is significant: The private-firm profit rate is over 10 percentage points higher than the public-firm profit rate in the post-2000 period.

Our result provides a new perspective on the apparent disconnect between factor shares and financial market measures of the cost of capital. Specifically, this disconnect can be attributed largely to the differing trends of private and public firms. If there are prevailing economic profits, they're coming from private firms, which have not followed the falling cost of capital in financial markets. Of course, this argument would have to reconcile the stable private-firm share of capital.

4.3 The Composition of Public Firms

How are public and private firms different? Using the Business Dynamics Statistics (BDS) dataset from the US Census Bureau during the post-1980 period, we evaluate the representativeness of our public-firm sample. The BDS contains annual totals of employment within firm size and sector bins for

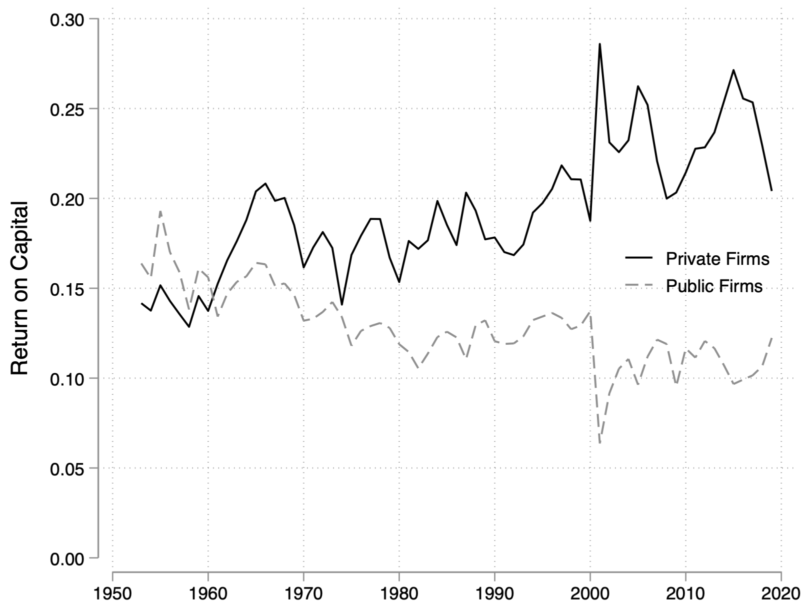

Figure 12: Increasing Return on Capital Rates of Private Firms

This figure plots the return on capital for private and public firms. Source: Authors' calculations using the CRSP/Compustat Merged Database and the Integrated Macroeconomic Accounts from 1980 to 2019.

the aggregate economy from 1978 onwards. In contrast to our IMA data, the BDS includes noncorporate businesses but does not include profit or capital measures. We define mega firms as those with over 10,000 employees (Hall, 2018), the largest size bin in the BDS dataset, and classify firms based on their 2-digit SIC codes into the goods (01-39) or services (40-59 and 70-89) sectors.

Figure 13 illustrates the employment share differences between Compustat and the BDS by firm type. The difference in the share of mega firms is roughly 52%, and the difference in the share of goods producers is roughly 13%. For a sense of levels behind these series, the employment share of mega firms rose from 28% to 30% in the aggregate and 77% to 85% in public firms, while the employment share of goods producers fell from 37% to 19% in the aggregate and 57% to 27% in public firms.

Echoing discussion in Traina (2018), Figure 13 shows public firms are dis-

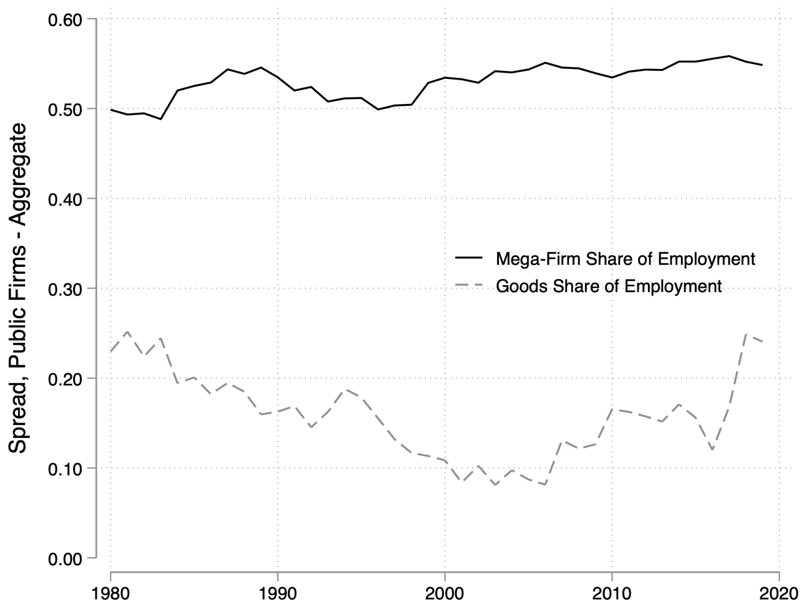

Figure 13: Mega-Firm and Good Sector Employment Shares

This figure plots the public-aggregate spread of the employment shares of mega firms and goods producers. We classify firms as mega if they have more than 10,000 employees, and into goods if their 2-digit SIC code is between 01 and 39. Source: Authors' calculations using the Business Dynamics Statistics and the CRSP/Compustat Merged Database from 1980 to 2019.

proportionately large and in goods-producing sectors. Although mega firms are becoming more prevalent in modern economies, their overrepresentation in Compustat has increased only modestly from 50% in 1980 to 55% in 2019. Turning to sectoral trends, Ali et al. (2008) demonstrate that industries that appear highly concentrated in Compustat are those that have recently experienced poor growth, often resulting in only a few large public firms remaining. In our analysis, while goods-producing sectors have declined in aggregate, this decline has been more pronounced for public firms, whose overrepresentation fell from 20% to 8%. This fact indicates the rise of services is differentially in public firms, and this rise more than offsets the effect that sectoral decline hits small firms hardest.

4.4 Size, Sector, and Intangible Capital

Do compositional differences between public and private firms explain the mismatch in profit rate trends? There are two potentially concurring ways for a characteristic to explain the mismatch in profitability trends between public and private firms. For a given characteristic, the first way is a within phenomenon: A level difference in representation, and the relative profit rates are changing over time. For example, if public firms tend to be larger, and if the profit rates of larger firms fell more than those of smaller firms, then the overall public-firm profit rate would also have fallen. The second way is a between phenomenon: A level difference in profit rates, and the relative representation of public firms is changing over time. For example, if larger firms are more profitable than smaller firms, and the tendency of larger firms to go public is falling, then the overall public-firm profit rate would also have fallen. We therefore propose three hypotheses to understand the profit rate disparity between public and private firms.

The first two hypotheses are about firm size and sector composition. The size hypothesis posits the representation of large firms in Compustat could drive the observed secular shift. Large firms, benefiting from scale economies or higher market power, might exhibit different dynamics than smaller firms. Conversely, smaller, younger firms, given their survival, could grow faster and increase their profits more quickly. The sector hypothesis posits the sectoral composition of public and private firms and the evolution of profit rates within these sectors could influence the overall profit rate. For instance, if Compustat overrepresents the goods sector, and this sector experienced a decrease in profit rates since 1980, this could account for the overall fall in the public-firm profit rate. Sector-specific shocks, such as external competition or the evolution of production technology, could also significantly influence profit rates.

Our last hypothesis is the disparity in profit rates between public and private firms is attributable to trends in intangible capital. This intangible capital hypothesis builds on evidence that public firms represent the majority of R&D (Feldman et al., 2021). The effect on profit rates is unclear. Firms with a high intensity of intangible capital might experience increased productivity growth as they innovate or adopt new technologies (Dabla-Norris et al., 2023), which might lead to higher profit rates or even market power. However, high R&D firms might experience lower profit rates due to the time lag in realizing profits from their investments and the high uncertainty associated with the outcomes of their R&D activities. In either case, firms with a high intensity of intangible capital are also the most likely to have mismeasured capital stocks, given the challenges in measuring intangible capital (Crouzet et al., 2022).

We test the size and sector hypotheses by investigating the divergence along these dimensions within the Compustat sample itself. We find a common decline in the return on book capital for both mega firms and smaller firms, as well as for goods producers and service providers.[14] Figure 14 reweights these returns by the employment shares in Figure 13, demonstrating that neither the size nor sector hypotheses alone can account for the overall mismatch in profit rates.

The figure presents our unadjusted return on book, a reweight to match the aggregate mega-firm employment share, and a reweight to match the aggregate goods employment share. To construct these reweighted series, we first calculate profit rates by firm type in Compustat by summing profits and book capital within each type and then dividing, producing the returns in Figure A.14. We then compute a weighted average of these profit rates using the employment shares from the BDS, producing the returns in Figure 14. While we acknowledge the ideal would be to use aggregate capital shares by firm type as shown in section 2, such data are unavailable in the BDS or other public-use sources. Despite this limitation, the reweighting exercise does not support the hypotheses that the fall in public-firm profit rates is about size or sector composition.

[14]Figure A.14 in the Appendix reveals service sectors exhibit lower returns than goods sectors. Given the overrepresentation of goods producers in Compustat, one might expect higher returns for public firms compared to the aggregate. However, this overrepresentation is decreasing over time, shifting Compustat towards service sectors which have lower profit rates. This shift offers support for the sector hypothesis.

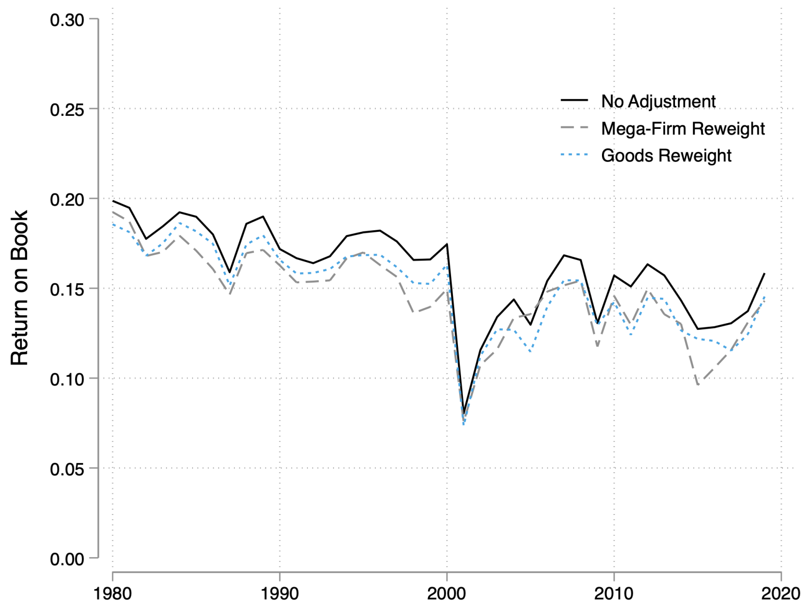

Figure 14: Reweighted Profit Rates

This figure plots the public-firm return on book, reweighted by the aggregate size and sector shares. We classify firms as mega if they have more than 10,000 employees, and into goods if their 2-digit SIC code is between 01 and 39. Source: Authors' calculations using the Business Dynamics Statistics and the CRSP/Compustat Merged Database from 1980 to 2019.

In our final analysis, we explore the role of intangible capital in the fall of the public-firm profit rate. Intangible capital is an increasingly important part of firm capital stocks and can help explain macroeconomic and financial trends, such as valuation (Eisfeldt and Papanikolaou, 2014), investment (Peters and Taylor, 2017), markups and productivity (Crouzet and Eberly, 2021), among others (Crouzet et al., 2022).

We classify firms in Compustat into two groups: Those that invest in R&D and those that do not. Figure 15 reveals a similar decline in the return on book for both types of firms, which implies the overrepresentation of public firms does not contribute to the trend. However, the profit rates of R&D firms are about 20%, while those of non-R&D firms are about 12%. This level difference hints that a fall in the public-firm share of intangible assets could drive the public-private return mismatch. Although our data do not allow for a direct test of this hypothesis, the recent surge in intangible asset investments and the challenges in quantifying their capitalization, as noted by (Eisfeldt and Papanikolaou, 2014; Crouzet and Eberly, 2021; Corrado et al., 2022), make this explanation plausible.

Figure 15: Return on Book by R&D Investment

This figure plots the return on book for firms classified by whether they invest in R&D. Source: Authors' calculations using the CRSP/Compustat Merged Database from 1980 to 2019.

In sum, we find little empirical support for the size and sector narratives, but leave the role of intangible capital as an intriguing area for future research. Also promising are narratives that propose a concurrent rise in the relative cost of capital for private firms. In our model, such a rise is captured by the risk premia term, but it could include many other capital wedges such as financial frictions. The core of these narratives are that while private firms may offer higher returns, they are offset by higher costs that investors are unwilling to bear. As a result, the net benefit of staying private or going public hasn't changed significantly, aligning with the observed stable share of aggregate capital in public firms. Finally, as an additional investigation, we show the return on capital rates for firms with below median values, as a ratio of book capital, of "Other Assets" (AO), R&D, goodwill, intangible assets, and other intangible assets excluding goodwill. This is shown in Figure A.2. Note that the return on capital is higher for firms with low values of other assets. This is at least in part mechanical, since AO includes assets from discontinued operations. This component of AO includes assets that are likely ex ante productive, since they were purchased in the first place, but ex post unproductive. Thus, it is unsurprising that conditioning on low values of these types of assets results in high return on capital values due to a simple look-ahead bias.

5 Concluding Remarks

The US has seen aggregate profit rates increase and financial market rates decrease since 1980, leading to the emergence of a "profit puzzle." We investigate a novel explanation: National accounts track the return on capital for all firms, while financial markets track the cost of capital for public firms only. The capital profiles of public and private firms differ and vary over time, which can lead to financial market rates misrepresenting the cost of capital faced by a representative firm.

Our analysis shows public-firm profit rates have fallen from 21% in 1980 to 12% in 2019, matching trends in financial markets. Our results are robust to assumptions about the capitalization of R&D and goodwill, as well as the measurement of capital stocks at book or replacement value. Adjusting for differences in depreciation and tax rates reveals a tight link between the return on and cost of public-firm capital. The economic profit rate for public firms is small, leading us to view our mismatch explanation as a promising solution to our motivating profit puzzle.

Comparing the IMAs with nonfinancial domestic activity in Compustat, we estimate public firms represent a stable 56% of the aggregate capital stock since 1970. Private-firm profit rates move in lockstep with public-firm profit rates until 1980, when they diverge significantly; private-firm profit rates are now over twice as high as public-firm profit rates. This secular shift is not driven by differences in the size or sector of public firms; however, further research into intangible-intensity may offer promising insights.

Our evidence challenges the claim that the public-firm economic profit rate has consistently increased over recent decades. One must then contend with two possibilities about the aggregate economic profit rate. The first possibility is there has indeed been an increase driven by private firms. Because the share of capital in public firms has been almost constant, we'd also need a sustained capital wedge that prevents reallocation and keeps firms private for longer. The second possibility is there hasn't actually been an increase. This possibility requires private firms to have a much higher cost of capital, which might be intuitive since they naturally have less access to financial markets.

Our results underscore the biases in extrapolating trends from public firms to the aggregate economy, highlighting the need for researchers to consider public-private differences. We conclude by posing a new profit puzzle: Why have public-firm and private-firm profit rates diverged so significantly?

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A Additional Figures

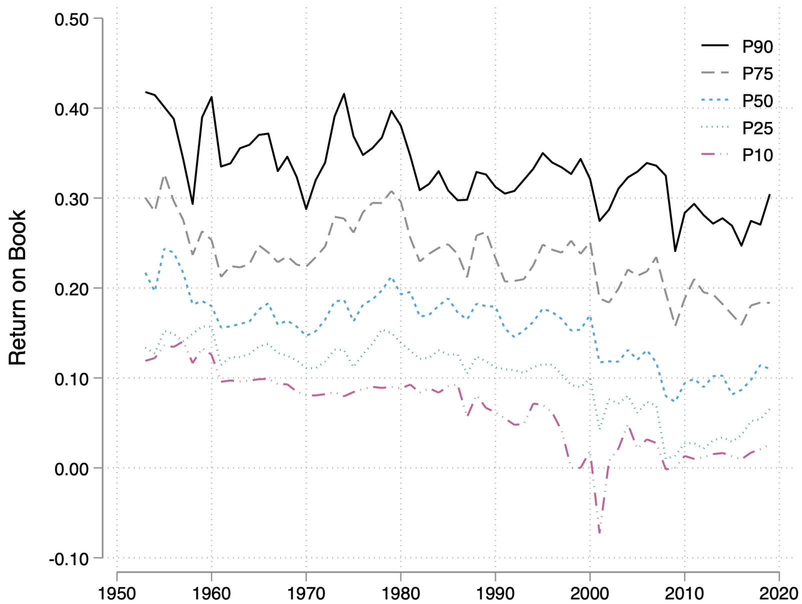

Figure A.1: Caption

This shows various quantiles (10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th}) across firms of the Compustat return on book.

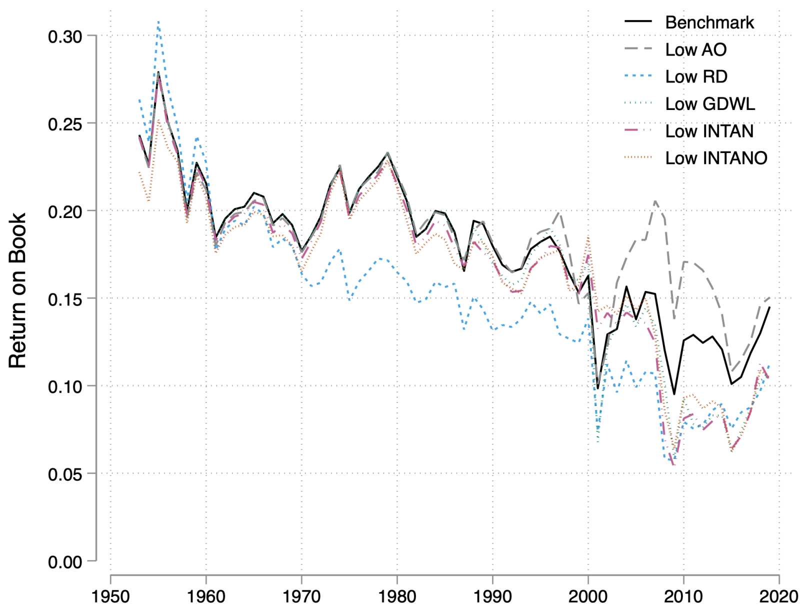

Figure A.2: Caption

This shows the return on book for all public firms (Benchmark), for public firms with a below median "Other Assets" (AO) to book assets ratio (Low AO), for public firms with a below median R&D to book assets ratio (Low RD), for public firms with a below median goodwill to book assets ratio (Low GDWL), for public firms with a below median intangible assets to book assets ratio (Low INTAN), for public firms with a below median "Other Intangible Assets (Excluding Goodwill)" to book assets ratio (Low INTANO).

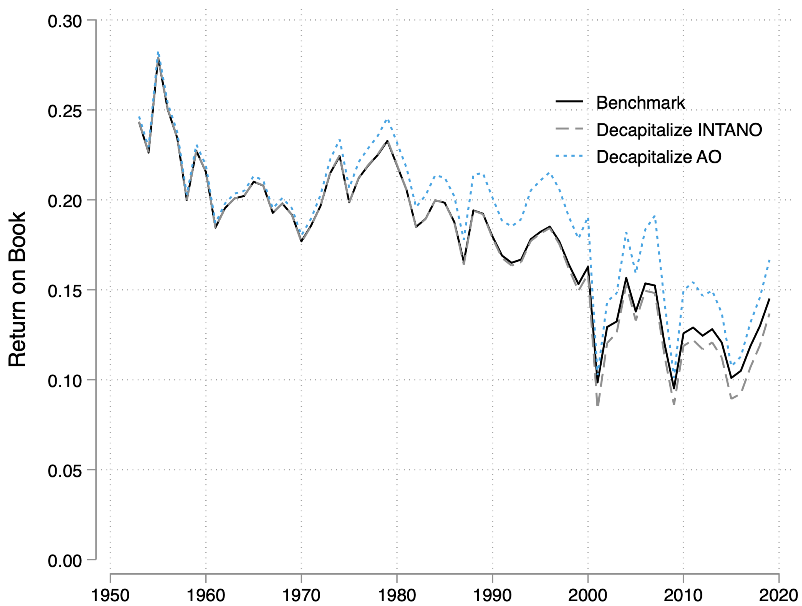

Figure A.3: Caption

This shows the return on book for all public firms (Benchmark), along with all public firms where "Other Intangible Assets (Excluding Goodwill)" are decapitalized (Decapitalize INTANO), and all public firms where "Other Assets" (AO) are decapitalized (Decapitalize AO). Removing other assets and other intangible assets from the calculation changes the return on book series relatively little.

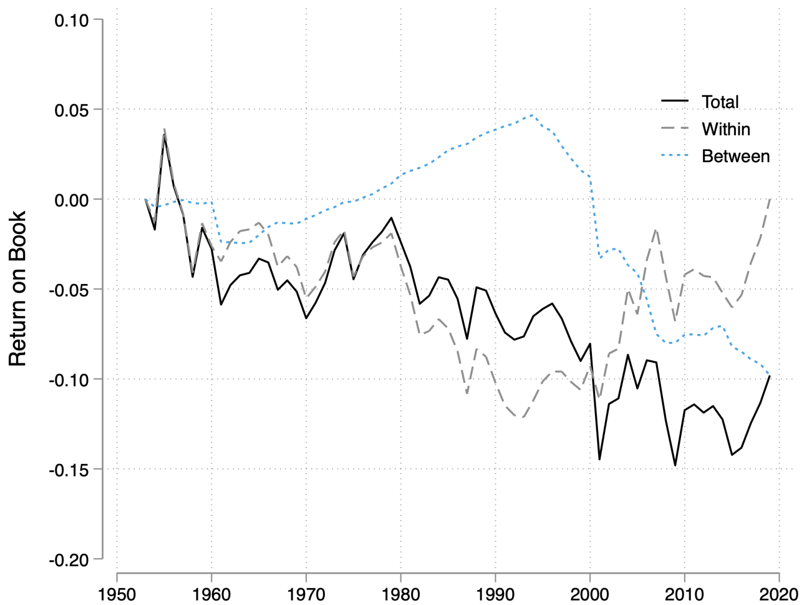

Figure A.4: Caption

We break down the return on book data for public firms into within-firm and between-firm effects. For example, we can write:

$$\Delta R_t = \underbrace{\sum_i \Delta R_{it} \times \bar{s}_{it}}_{\text{Within}} + \underbrace{\sum_i \Delta s_{it} \times \bar{R}_{it}}_{\text{Between}}, \tag{A.1}$$

where the variables with bars over them denote time series averages between the two relevant periods, and $s_{i,t}$ equals the firm's share of book value of total aggregate public firm book value in that period. This Divisia decomposition is an exact identity (not an approximation). These within and between effects are cumulated starting at zero to identify how much of the aggregate trend is within and between firms. Until the early 90s, the overall downward trend was driven by firms becoming less profitable; in fact, the reallocation towards more profitable firms was pushing the overall trend in the opposite direction. This changed in the early 1990's, which is when firms themselves grew increasingly profitable, but the book share of low profitability firms increased even faster, driving an overall downward trend.

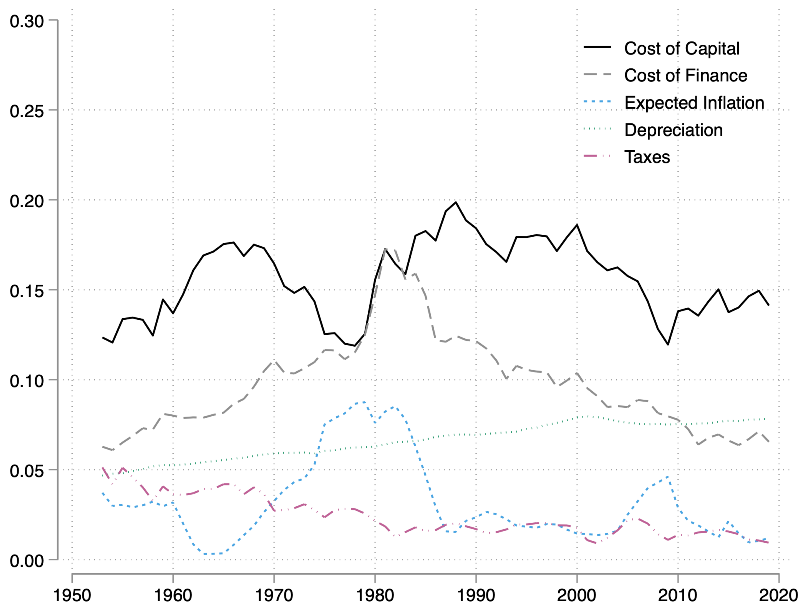

Figure A.5: The Cost of Capital and Its Components

This figure plots the cost of capital and its components—the cost of finance, expected inflation, depreciation, and taxes.

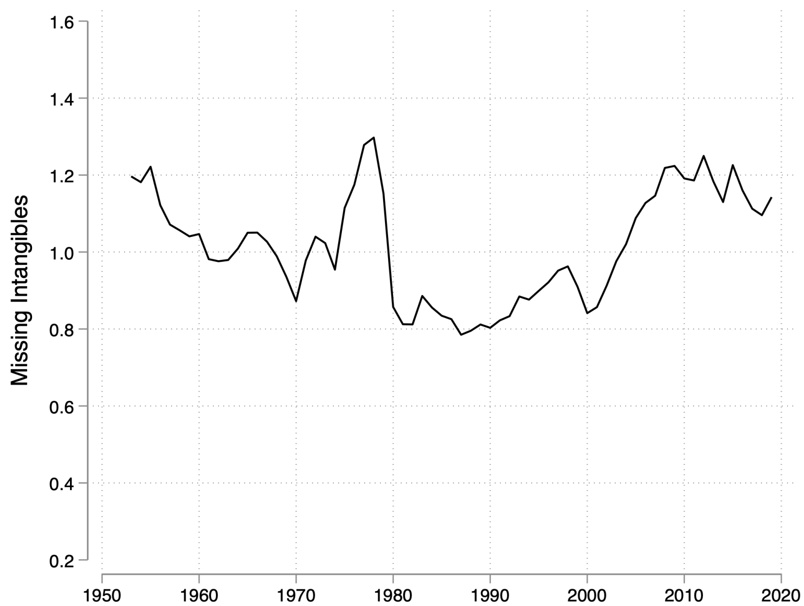

Figure A.6: Caption

We consider a simple thought experiment: What would the size of intangible assets need to be to resolve the profit puzzle (zero puzzle rate)? Mathematically, what is the value of i that satisfies the following equation:

$$P_t Y_t - w_t L_t = R_t p^k_{t-1} K_t i_t, \tag{A.2}$$

where $i_t - 1$ is a residual measure of the fraction of measured capital that is both mismeasured and required in order to have a zero economic profit rate as shown in this equation. This $i_t - 1$ could possibly denote intangible capital for example. Note that true capital would need to fluctuate from being overmeasured and undermeasured quite a bit in order to have a zero economic profit rate in aggregate.

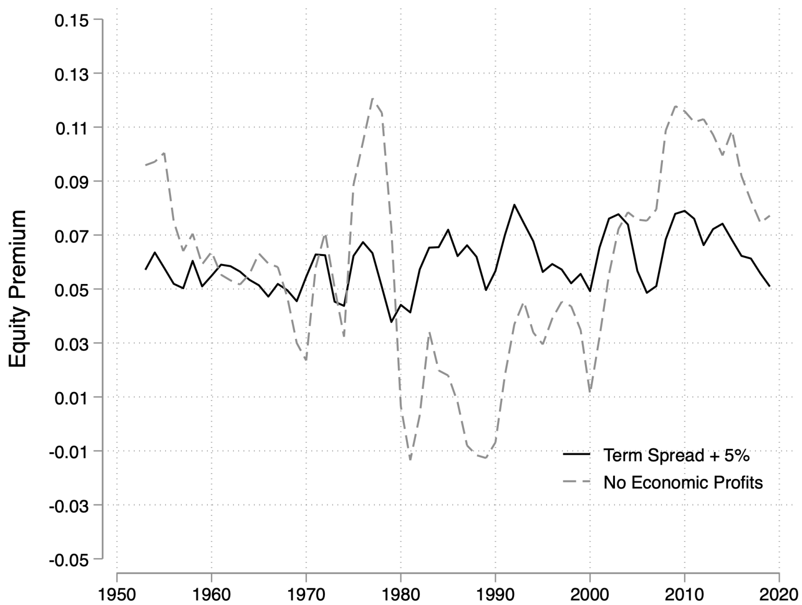

Figure A.7: Caption

This plot shows the equity premium implied from plugging in $R_t^\pi = 0$ into equation (12), and solving for the equity component of the cost of finance $\bar{R}_{t-1}^e$ from equation (13). In words, this is the equity cost of capital assuming zero economic profits (labeled No Economic Profits). This is compared to the term spread plus 5% (labeled Term Spread + 5%), which is a simple equity premium measure used in Barkai and Benzell (2018).

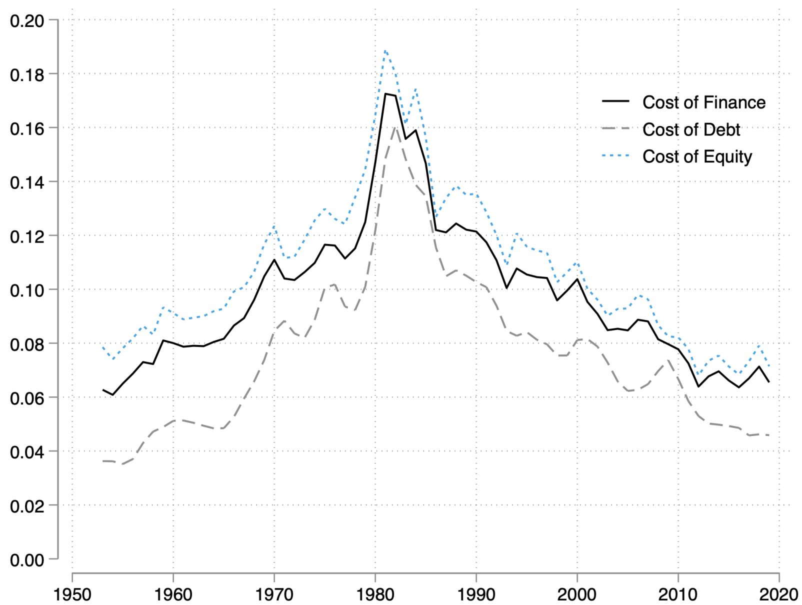

Figure A.8: Caption

This shows our simple measures of the expected return on debt, expected return on equity, and overall cost of finance from equation (13), as described in the paper.

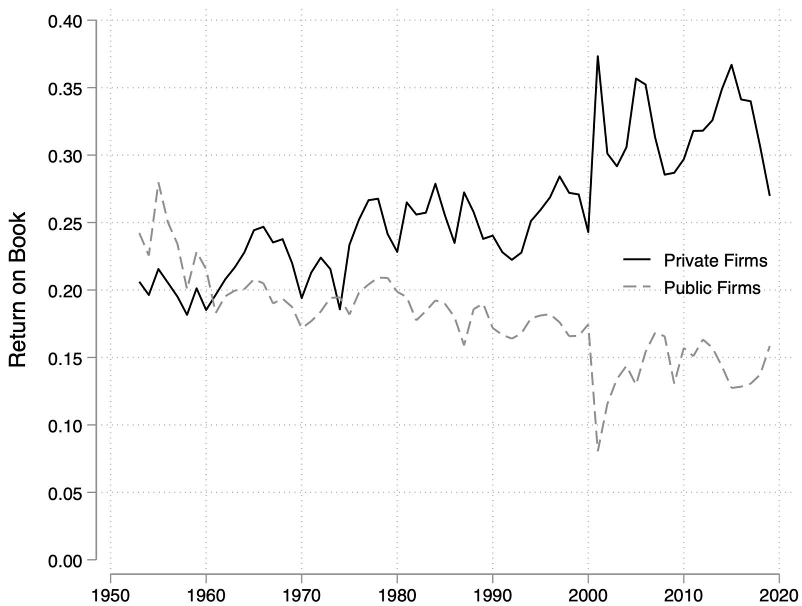

Figure A.9: Caption

This figure is similar to Figure 12, except this shows the return to book equity instead of return to capital.

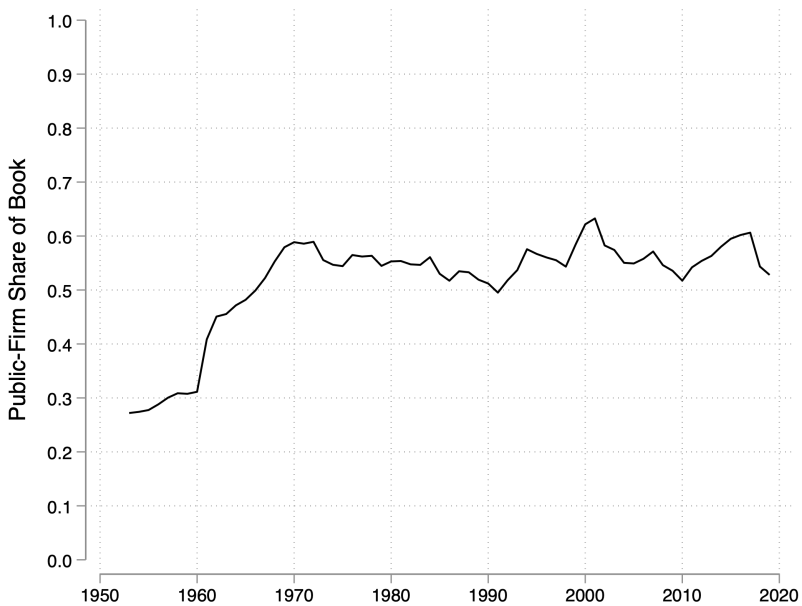

Figure A.10: Caption

This figure is similar to Figure 11, except this shows the fraction of public book capital compared to aggregate book capital. This is nearly identical to Figure 11.

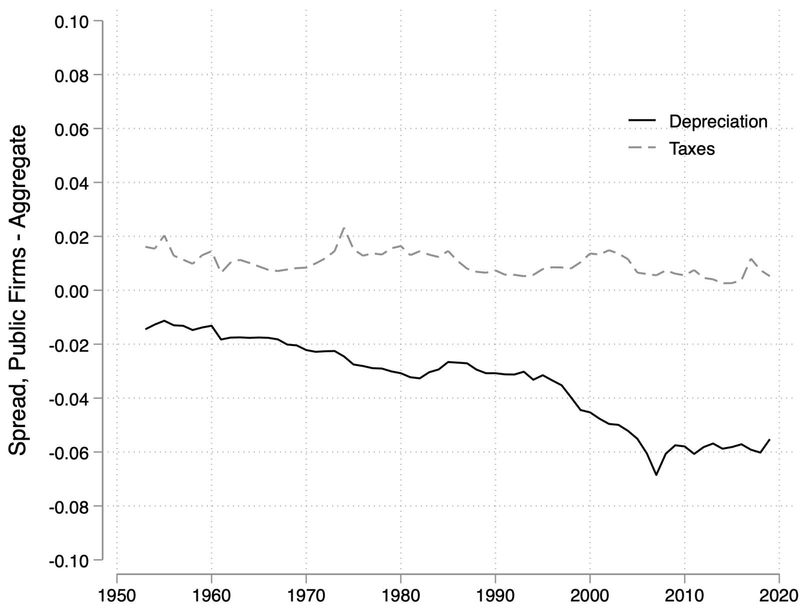

Figure A.11: Depreciation and Tax Rate Spreads

This figure plots the public-aggregate spread of depreciation and tax rates.

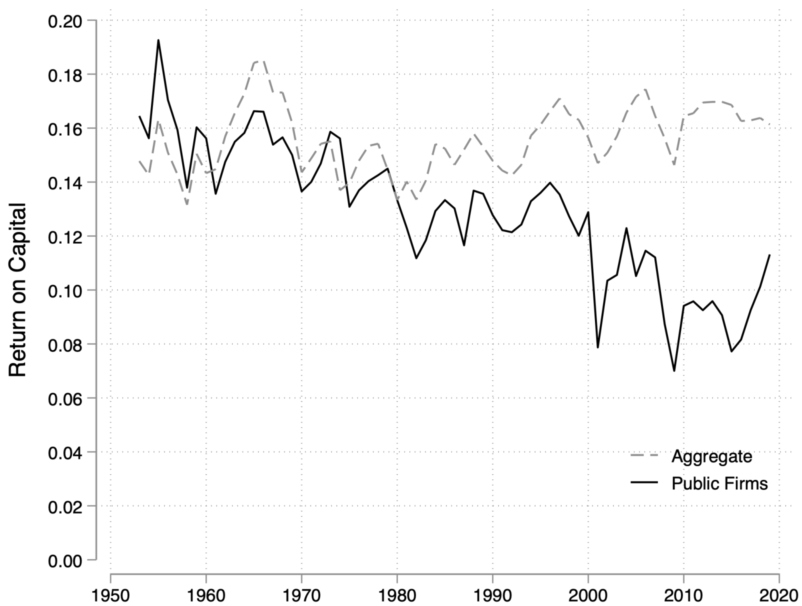

Figure A.12: Caption

This is similar to Figure 8, except this is the return on capital (not on book) for public firms compared to the aggregate return on capital.

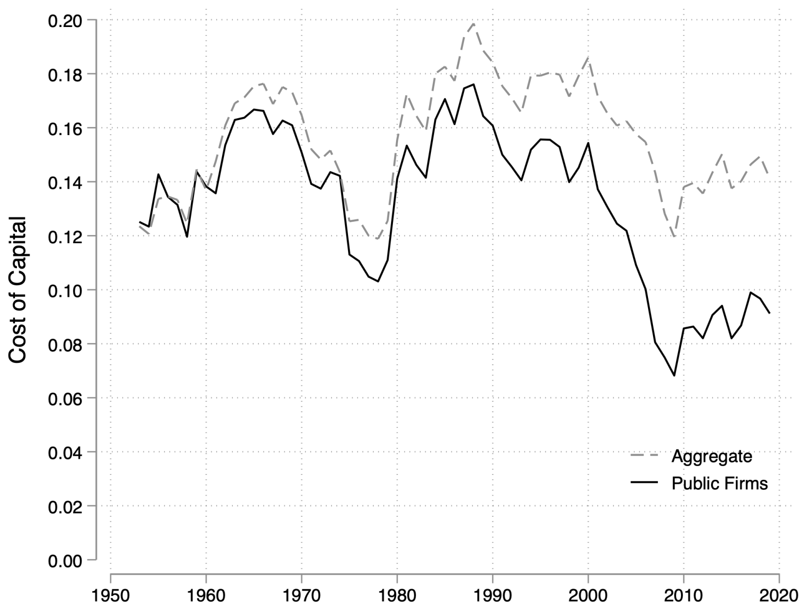

Figure A.13: Caption

This calculates the cost of capital using two methods. The first (labeled Aggregate) is the aggregate cost of capital, which is computed using the four terms in equation (7), as described in the text. The second (labeled Public Firms) calculates depreciation $\bar{\nu}_t$ and capital stock inflation ν_t from equation (7) using the Compustat data. The other two terms, $\bar{\rho}_t$ and τ_t are the same between the two plots.

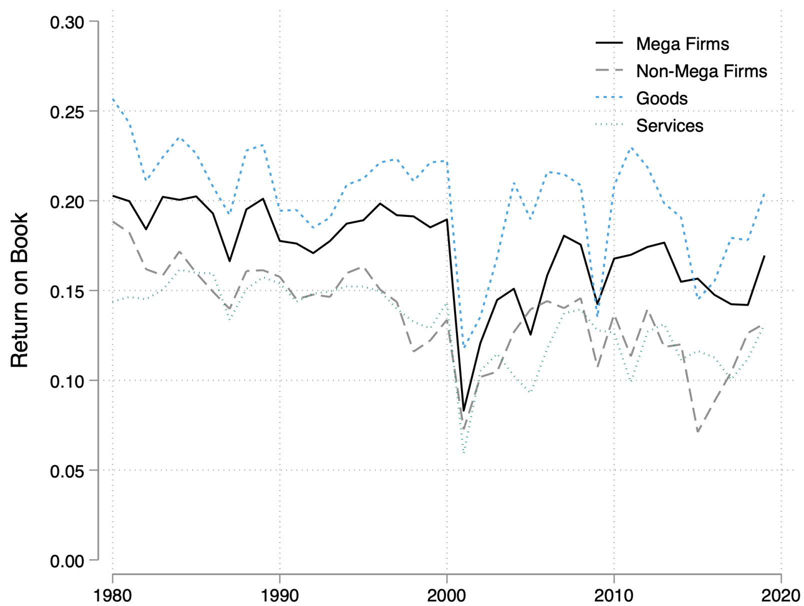

Figure A.14: Profit Rates by Size and Sector

This figure plots the public-firm return on book by size and sector. We classify firms as mega if they have more than 10,000 employees, and into goods if their 2-digit SIC code is between 01 and 39.

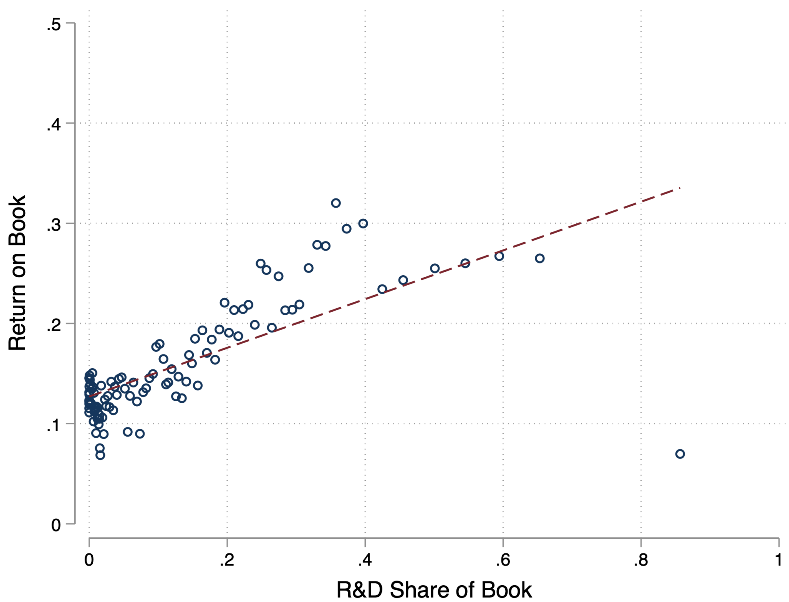

Figure A.15: Caption

This is a bin scatter plot for firm with positive R&D from 1980 onward, where the y-axis is the return on book of the firm and the x-axis is the ratio of R&D to book capital of the firm.