The Value and Profits of Firms*

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Abstract

The real growth of the stock market value of firms has increased from close to 0% on average per year between 1958 and 1980, to 5.2% between 1980 and today. This change coincides with the rise of market power and profits, starting in 1980. This paper proposes to decompose the value of firms based on profits (earnings) rather than dividends. Because firms on average pay out only 45% of profits in dividends, dividends poorly measure firm performance. I decompose the sources of the rise of the value of all publicly traded firms into: 1. The subjective discount factor; 2. The risk-free rate; 3. Profits; and 4. Shareholder Equity (retained earnings). I find that 20% of the rise is due to the discount factor, and 80% is due to profits (half of which is retained earnings). I build a general equilibrium model of the economy where firms have market power; I perform counterfactuals and evaluate the welfare implications. The objective is to study the impact of competition policy. If market power today dropped to the level of 1980, average stock market values would be 40% lower. If market power had never increased in 1980, the average stock values would be 80% lower.

Keywords. Stock Market Valuations. Profits. Retained Earnings. Market Power. Subjective Discount Factor.

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1 Introduction

Stock market valuations have risen substantially since the early 1980s. The average real annual return of all publicly traded firms in the US has gone from around 0% between 1958 and 1980, to 6% between 1980 and today. The investment of $1 in 1980 pays over $10 today. But also the variance of firm valuations has increased a lot. At the end of 2023, the top 7 firms account for 23.6% of the stock market valuation of all publicly trade firms, and those firms account for half (49.7%) of the stock market growth year on year in 2023 (see Table C.2 in the Appendix). Intuitively, the value of a firm is related to the firm's performance. Now if firms perform well and are profitable because they exert market power, then the value of the firm is subject to policy risk. I therefore ask the question: how much would the stock market value drop as a result of stricter antitrust enforcement bringing down profits to 1980 levels?

In this paper I propose to use profits (earnings, in accounting terminology) rather than dividends as the main determinant of market value. In theory, dividends are the ideal measure. The value of a firm cannot be determined by anything other than what is paid out to the shareholders over the life time of the firm, suitably discounted. The brilliance of dividends is that the only thing that matters are future payments, so there is no need to look at what happened in the past.

But that is in theory. In practice, dividends are a poor measure of market value. Firms on average pay out only 45% of their profits for two reasons. First, firms distribute their earnings in other ways than dividends (such as share buy-backs, and stock options to employees, for example). Second, firms retain earnings (to finance capital investment for example) which delays the flow of dividends. And it is this delay that makes the theoretically perfect measure of dividends not a useful measure in practice. Many firms pay out no dividends for many years, and then pay out large dividends in other years. Dividends do not only gauge profitability, they are also a choice that reflects the firm's financing decision to use equity versus issue debt to finance investment. In practice, we never have suitable data to link this volatile measure (dividends) of firm performance and that is often heavily backloaded to market value. With a narrow window of data in the life time of a firm, we are in the dark about the flow of all future dividends. In fact, in his seminal paper, Cochrane (2011) finds that dividends have no relation to stock market values. As a result, he concludes that all variation in firm values must be due to subjective discount factors.

Here, I use profits as a measure to link flows to stocks. Profits are more stable than dividends, they give a precise picture of the current performance of the firm, and therefore they also provide a more accurate projection of the firm's future performance. There is one caveat, however. Where all *future* dividends exclusively determine the value of a firm, the firm value depends on both future as well as part of *past* profits. If firms retain earnings and don't distribute profits, then the value of the firm mechanically increases. In a similar way, the net worth of my rental property is higher if I keep the rent in the property's account or use it to pay off the mortgage principal. This is not a concern with dividends, because any retained earnings will be paid out at some point in the future, possibly at liquidation. To deal with this issue, we construct a variable Shareholder Equity that reflects the value of such retained earnings, i.e. past profits. From a measurement viewpoint, the dependence on past profits (retained earnings) is an advantage because it is accurately measurable, more so than future expected profits.

I then decompose the sources of the rise of the value of all publicly traded firms into: 1. The discount factor (both the subjective and risk-free discount factor); 2. Profits (current and future); and 3. Shareholder Equity (past profits). I find that less than 20% of the rise in the value of firms is due to discounting, and over 80% is due to the rise in past and future profits. Firms keep on average 20% of their profits as retained earnings in the firm. Those accumulated past profits account for 35% of the firm value. As profits grow over time, so do retained earnings together with firm value.

Given the contribution of profits to the value of firms, I ask the counterfactual question what would happen to firm values if profits dropped to the level of profits in 1980. The objective is to find out what the impact is of policy risk – for example, stricter antitrust enforcement – on the stock market. This counterfactual can be interpreted in two ways: first, a fall in profits today to 1980 levels with past profits unchanged; second, profits stay at 1980 levels between 1980 and today, which affects the accumulation of earnings. In the first counterfactual, firm values drop on average by around 40%. In the second counterfactual, firm values drop by 80%. The reason for the difference between the two counterfactuals is the stock of accumulated retained earnings (equity capital). Had firms retained none of their earnings, both counterfactuals would have been identical. In other words, if there was a sudden policy change that reduces profits, investors and households would lose substantially less value because part of their value is stored in firms in the form of accumulated past profits.

I then build a general equilibrium model of the economy where firms have market power. The objective of the theory is to find out which determinants – technology, market structure, preferences – contribute to the rise of profits and hence to the rise of the value of firms. The model builds on Atkeson and Burstein (2008) and De Loecker, Eeckhout, and Mongey (2021), where firms compete in a market with a small number of competitors, and where consumer preferences are modeled in a nested Constant Elasticity of Substitution (CES) structure. We introduce common ownership as in Ederer and Pellegrino (2021) and Azar and Vives (2021). A variation in the extent of common ownership changes the market structure. Market power also depends on technology, through the dispersion of technology (Total Factor Productivity, TFP) as well as the overhead cost. Comparative statics exercises illustrate how the model outcomes such as profits, market value, wages, output and welfare depend on the underlying parameters of the model.

I then estimate the parameters in the model using simulated method of moments to match data on profits and markups, as well as using calibrated parameters for preferences, wages and employment.

I perform counterfactuals under different scenarios of these determinants of market power, and evaluate the implications for profits, stock market valuations and welfare. In the estimated model, the biggest contributors to market power and hence profits are market structure and technology.

Related Literature. There is an extensive literature in finance on which the current paper builds, aiming to link the value of firms (stocks) to dividends (flows). The seminal paper in this literature is Cochrane (2011) who finds no link between the variation in dividends and stock prices. There is also a long literature in asset pricing in finance that often interprets asset price movements through the lens of an asset pricing model, with well-defined expectations about profits and dividends. For example, the highly influential work by Campbell and Shiller (1988) linearizes outcomes along the steady state trend. Doing so, this approach does not always capture long term trend movements well.

In this paper I do not attempt to explain demand-side factors for the stock market valuation of a firm, such as the Equity Premium Puzzle, the fact that the return on stocks relative to the risk-free rate is much higher than can be rationalized with reasonable preferences for risk (Mehra and Prescott (1985)). There are numerous explanations for this puzzle, including limited stock market participation and heterogeneity in the elasticity of intertemporal substitution in consumption (Guvenen (2009)). This mechanism concentrates non-stockholders' labor income risk in the hands of a small group of stockholders who demand a high premium for bearing this aggregate equity risk. This mechanism simultaneously explains high wealth inequality where a large fraction of the economy's wealth is in the hands of a small number of stockholders. Similarly, Chien, Cole, and Lustig (2011, 2012) show that volatility (and hence the equity premium) is determined by the fraction of total wealth held by active traders, and not the fraction held by all participants, since only active traders respond to prices and thus absorb all the residual risk. Yet other explanations for the equity premium point towards behavioral biases by households and demographic changes. Declining aggregate risk and the increased access to diversified portfolios should show a decline in the equity premium.

Here, I focus on the supply of assets and their value, not demand. Of course, the demand affects the price as much as supply does, but I will take the demand as given and any variation is absorbed in the stochastic discount factor.

There is a growing literature linking profits to the value of firms, to which my approach is complementary. Atkeson, Heathcote, and Perri (2022, 2024) look at the role of profits economy-wide for the value of all firms in the corporate sector. They use aggregate information from the National Financial Accounts rather than firm-level data. Vuolteenaho (2002) uses a Vector Autoregression (VAR) method to address the same question. He decomposes firm-level valuations into cash-flow expectations and changes in discount rates and finds that firm-level stock returns are mainly driven by cash-flow news. And Belo, Gala, Salomao, and Vitorino (2022) decompose firm value into the contribution of capital (physical and intangible capital) and labor. They estimate a structural model using firm-level data.

Corhay, Kung, and Schmid (2020a,b) use firm-level data as I do here. Corhay, Kung, and Schmid (2020a) find that markets where firms have higher markups are prone to bigger risk of entry and are therefore more volatile. This translates in a higher risk premium.

Kuvshinov and Zimmermann (2022) find that there is structural break in the returns in 1980. This also coincides with the start of the rise in markups, profits rates and as we find currently, in stock market valuations (see De Loecker et al. (2020)). Kuvshinov and Zimmermann (2022) also has a more accounting approach as in Campbell and Shiller (1988) using dividends. Greenwald, Lettau, and Ludvigson (2019) decomposes firm values, linking it to the capital share. They use an asset pricing model without the accounting identities that I use here to construct stocks and flows.

2 Data and Preliminary Evidence

Data. We use data from Compustat to construct the empirical measures of variables used in the model. Compustat contains data of financial statement and balance sheet for listed companies in the United States from 1965 to 2022. We deflate all variables, using the Gross Domestic Product (GDP) deflator, and expresses all units in 2022 values.[1] All units for market values and profits are in millions of dollars. For more details on the data, see Appendix B.1.

Conceptual Framework. We think about the value of the stock of a firm in relation to the discounted flow of profits. Most commonly in the literature, the value of a firm is linked to the discounted flow of dividends, the payout to shareholders. Interpreted as a Lucas (1978) tree, the value V_{it} of a firm i at time t is the discounted flow of the dividend payments Div_{it} (the fruits from the tree). Then we write

[1] The Consumer Price Index (CPI) closely tracks the GDP Deflator. We have also verified robustness to the Fixed Investment deflator and the Intellectual Property Product deflator. All deflators are from the National Income and Product Accounts (NIPA): Bureau of Economic Analysis, National Income and Production Account (Implicit Price deflators table 1.1.9.).

the standard asset pricing equation in recursive form and explicitly as:

$$V_{it} = \frac{Div_{it+1} + V_{it+1}}{1 + r_{it}} = \sum_{\tau=1}^{\infty} \beta_{it}^{\tau} Div_{it+\tau}. \tag{1}$$

where future values are discounted at rate r_{it} with $\beta_{it} = \frac{1}{1+r_{it}}$.

In this paper we are interested in expressing the value of the firm in terms of future profits, rather than dividends. Of course, eventually all profits have to paid out at some point in terms of dividends. Over the full horizon of a firm's lifetime from birth to death, the flow of profits must equal the flow of dividends.[2] However, because the timing of the payout of dividends differs from the realization of the profits, with discounting the value of the firm will differ whether we use profits rather than dividends to construct the firm value.[3]

If firms retain no earnings and pay out all profits in dividends, then equation (1) is equivalent if we substitute Div_{it} with π_{it}. Instead, when firms retain some of their earnings, i.e. $\pi_{it} > Div_{it}$, the value not only depends on the future flow of dividends but also the stock of accumulated past earnings. While eventually, the total sum of dividends must correspond to the earnings, the way investors discount now makes a difference.

I will express the stock in terms of the flow of expected profits $\mathbb{E}_t \pi_{it+1}$ as well as the value of the current stock of retained earnings E_{it}. Then we can write the value of the firm at time t as:

$$V_{it} = \sum_{\tau=1}^{\infty} \beta_{it}^{\tau} \mathbb{E}_t \pi_{it+\tau} + E_{it} \tag{2}$$

where $\mathbb{E}_t \pi_{i\tau}$ is the expectation in period t of profits in period τ, β_{it} is the discount factor, E_{it} is the value of shareholder equity. Since we use end-of-year observations, profits in period t are already included in the value of equity E_{it}, so we start counting expected profits from π_{it+1} onwards.

Note that equation (2) can be written in recursive form as

$$V_{it} - E_{it} = \beta_{it} \mathbb{E}_t \pi_{it+1} + \beta_{it} \left(V_{it+1} - E_{it+1} \right). \tag{3}$$

provided $\beta_{it} = \beta_{it+1}$ and $\mathbb{E}_t \pi_{it+\tau} = \mathbb{E}_{t+1} \pi_{it+\tau}$.

A firm's Shareholder Equity E_{it} is the accumulated stock of earnings that are retained in the firm.

[2]Modulo the inflow of new capital via the issuance of share and share buybacks, to which we return below.

[3]Moreover, in our sample of publicly traded firms as in all data sets, we do not have data from birth until death for most firms, so we cannot construct the complete flow of profits and dividends.

Denote by γ_{it} the fraction of earnings that a firm retains, then we can write Shareholder Equity as

$$E_t = E_{t-1} + \gamma_{it}\pi_{it} \quad \text{and} \quad \Delta E_t \equiv E_t - E_{t-1} = \gamma_{it}\pi_{it} \tag{4}$$

or equivalently, the change in Shareholder Equity is equal to retained earnings.[4]

Below, I will decompose the discount factor β_{it} into the risk-free discount factor and the subjective discount factor. The risk-free discount factor has risen since the 1980s (the risk-free interest rate has fallen). In this framework, the subjective discount factor is the residual in equation (2) accounting for the market value, the expected stream of profits, the risk-free discount factor and the value of shareholder equity. And while there is an extensive literature investigating the origins of the subjective discount factor, by treating it as the residual I remain agnostic about the determinants of the demand for stocks. Like with TFP in a production function, which is the residual after accounting for inputs, such as capital and labor, here the subjective discount factor is the residual after accounting for our measure of expected profits, the risk-free discount factor and the stock of shareholder equity. To paraphrase Abramovitz (1956)'s quip about productivity, the origins of the subjective discount factor are a measure of our ignorance.

Next, I detail the measurement of each of the components of the market value: profits, discounting, and shareholder equity.

2.1 Market Value

We denote the firm's market value by V_{it} and use its measure from Compustat. Figure 1 plots the average and distribution of market valuations.

The average market value has increased by factor 9.38 from 1980 onwards, which is an average increase by 5.19% per year. Instead, a dollar invested in 1958 generated an annual average real return in 1980 close to 0%. There is a lot of heterogeneity underlying this evolution. The middle panel of Figure 1 shows that there is a first-order stochastic dominance shift in the log-value distribution, and that the variance has increased. We can see that from the percentiles of the distribution that there is a sharp rise in the level of the top percentiles, and much less so of the bottom percentiles.[5] The rise in the top percentiles of the distribution has also been pointed out by Bessembinder (2018).

[4]Below, we elaborate on this further and show that the stock of retained earnings is closely related to the value of total assets net of debt and net of Goodwill. Shareholder Equity is not exclusively a function of past profits, it also depends on value of stocks that are issued, for example, Shareholder Equity increases if new stocks are issued. Note further that this is an accounting equation and does not necessarily have a stable steady state. To transform it into an economically relevant measure, we need to adjust for the fact that the return on the equity E is counted as part of profits π.

[5]In Figure C.6 in Appendix Appendix C.4 we see that the growth rate of the percentiles is very similar for the upper percentiles, and with slower growth for the lower percentiles.

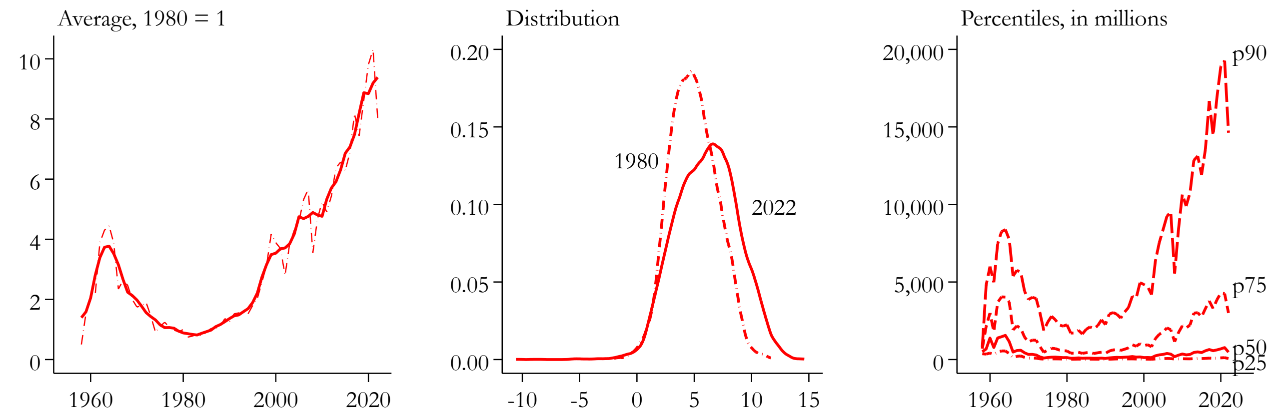

Figure 1: Market Value V_{it} over time: average (1980=1) and distribution

Notes. We use the variable *MKVALT*, which is the sum of all issue-level market values, including trading and non-trading issues. If the variable *MKVALT* is missing, then we use the product of total common share outstanding (*CSHO*) and closing price (PRCC_F) to replace it. For the left panel, we plot the average market value of all publicly traded firms (in Appendix C.3 we plot the same series of the total market value for all firms); the solid line is the 5-year moving average and the thin line is the annual data. In Appendix Appendix C.4 we plot the percentiles, each normalized to 1 in 1980.

2.2 Profits

Accounting Profits. We use for profits (earnings) of the firm, the accounting profits π_{it} as follows, also known as 'net income':

$$\pi_{it} = R_{it} - COGS_{it} - SGA_{it} - INT_{it} - DEPAM_{it} + NOPI_{it} + SPI_{it} - TAX_{it} \tag{5}$$

where R denotes total revenue, $COGS$ the total cost of goods sold, and SGA denotes selling, general and administrative expense, INT is interest, i.e., the cost of debt, $DEPAM$ is the sum of depreciation of tangible fixed assets and amortization of intangibles,[6] $NOPI$ is non-operating income/expenses, SPI is special items,[7] and TAX is the tax liability paid by the firm.

We use net accounting income because that is what is what pertains to the shareholders, either as dividends or as retained earnings. We also perform the analysis for other income measures such as EBITDA (earnings before interest, taxes, depreciation, and amortization: $R - COGS - SGA$), EBIT (earnings before interest, taxes, depreciation, and amortization $R - COGS - SGA - DEPAM$), or pre-tax income ($R - COGS - SGA - DEPAM + NOPI + SPI - INT$). Those are reported in Appendix

[6] Depreciation is only for tangible capital and amortization is only for intangible capital.

[7] Non-operating income results from secondary business-related activities, excluding those considered part of the normal operations of the business, like dividend income, rental income, foreign exchange adjustment,... Special items are unusual or nonrecurring items presented before taxes by the company. For example, flood, fire, and other natural disaster losses; impairment of goodwill, unamortized intangibles,... For most years, $\frac{\sum(NOPI+SPI)}{\sum SALE}$ is between -1% and 1% (only in 8 years from 1958 to 2022 is this value larger, and the largest is less than 5%).

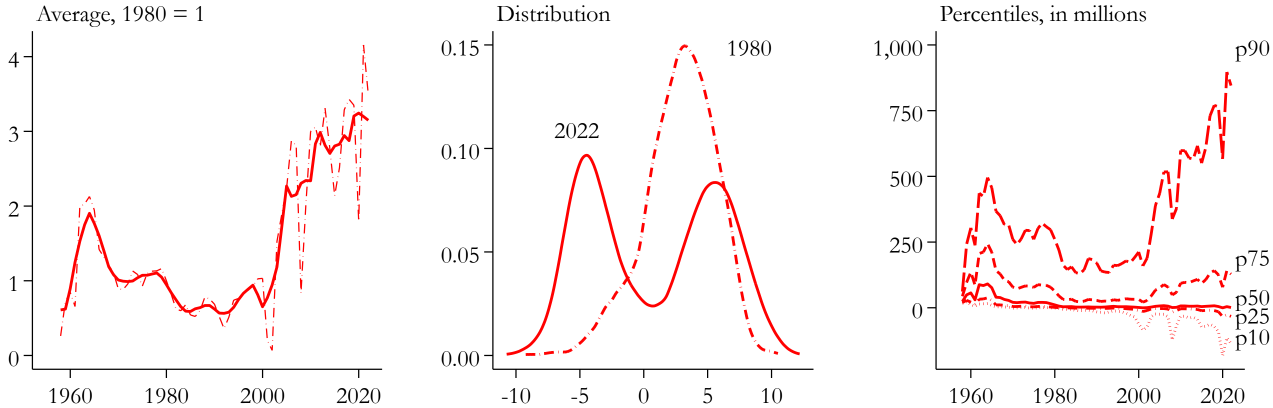

Figure 2: Accounting Profits π over time: average per firm and distribution

Notes. For the left panel, the solid line is the 5-year moving average of the average profit and the thin line is the annual average profit. For the middle panel, profits are on a log scale, and we use the Inverse Hyperbolic Sine (IHS) transformation to deal with the log of negatives profits.

Appendix C.11.

Note that in accounting profits, we include non-operating income as well as special items because they are not included in the equity valued at cost E, and hence they enter the stock valuation in (2) via profits in (5).

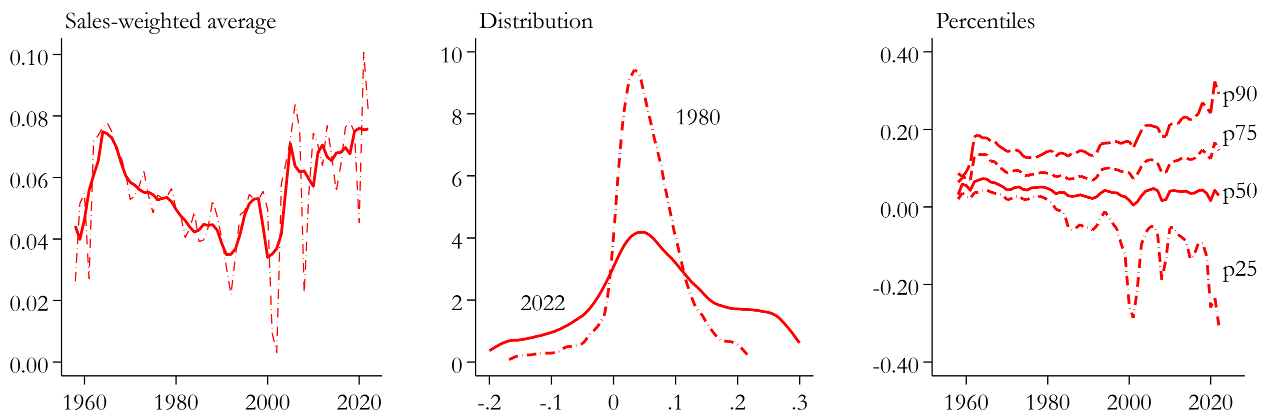

Figure 3: Accounting Profit rate $\frac{\pi_{it}}{R_{it}}$ over time: sales-weighted average and distribution

Notes. For the left panel, the solid line is the 5-year moving average of the profit rate and the thin line is the annual profit rate. For the middle panel, we limit the range of profit rate within [-0.2, 0.3].

Figure 2 plots the evolution of accounting profits. Average profits have increased by a factor 3.5 between 1980 and 2022. The distribution has also become more dispersed: the distribution of log profits[8]

[8]Because a substantial fraction of firm profits are negative, we use the Inverse Hyperbolic Sine (IHS) transformation: $\log(x + (x^2 + 1)^{1/2})$ which except for very small values of x, the inverse sine is approximately equal to $\log(2) + \log x$.

shifts to the right and shows a marked increase in the variance of log profits from 7.74 in 1980 to 26.93 in 2022. The increase in inequality of profits comes mainly from the upper percentiles.

The profit rate – profits as a share of revenue, in Figure 3 – has doubled from 4% to 8% between the early 1980s and 2022. Dispersion in the profit rate has gone up, especially in the lower tail: the variance has increased from 0.17 to 13.6.[9]

Economic Profits. Because some shareholders maintain some of the assets in the firm, the accounting profits do not adequately measure the opportunity cost of those funds the shareholders expect to obtain, and which should be deduced from the profits. The assets kept in the firm last period are E_{it-1}.[10] Then economic profits are equal to:

$$\pi^E_{it} = \pi_{it} - r^d_{it} E_{it-1}, \tag{6}$$

where r^d_{it} is the firm-specific interest rate that firms pay on average on their entire debt (see below).[11]

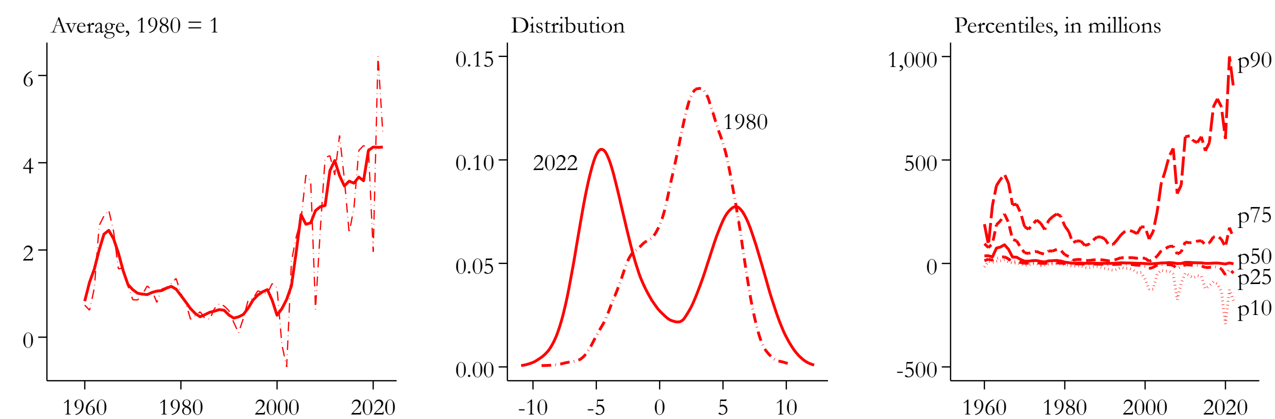

Figure 4: Economic profits π^E over time: average and distribution

Notes. For the left panel, the solid line is the 5-year moving average of the average profit and the thin line is the annual average profit. For the middle panel, profits are on a log scale, and we use the Inverse Hyperbolic Sine (IHS) transformation to deal with the log of negatives profits.

Figure 4 shows that economic profits show a similar pattern as accounting profits, with an even higher average increase by factor 4.35 as well as an increase in the variance of economic profits.

The economic profit rate in Figure 5 shows a similar pattern as the accounting profit rate with an

[9]For the variance calculation, we drop the top1% and bottom 1% to account for the effects of outliers.

[10]We could also use Bookvalue, the difference between total assets and total liabilities. Below, we show there is a close relation between Equity Capital and Bookvalue.

[11]One could value the opportunity cost of the firm's retained earnings at alternative rates. For example, if the investor were to put the money in 10-year government bonds, it would get a return $r^F_t < r^d_{it}$ (see below). Alternatively, the firm could also make a more risky investment with a higher return. Because banks and bond holders are willing to lend the firm at the rate r^d_{it}, this is the most appropriate interest rate. It is also consistent with the Modigliani and Miller (1958) capital structure irrelevance principle.

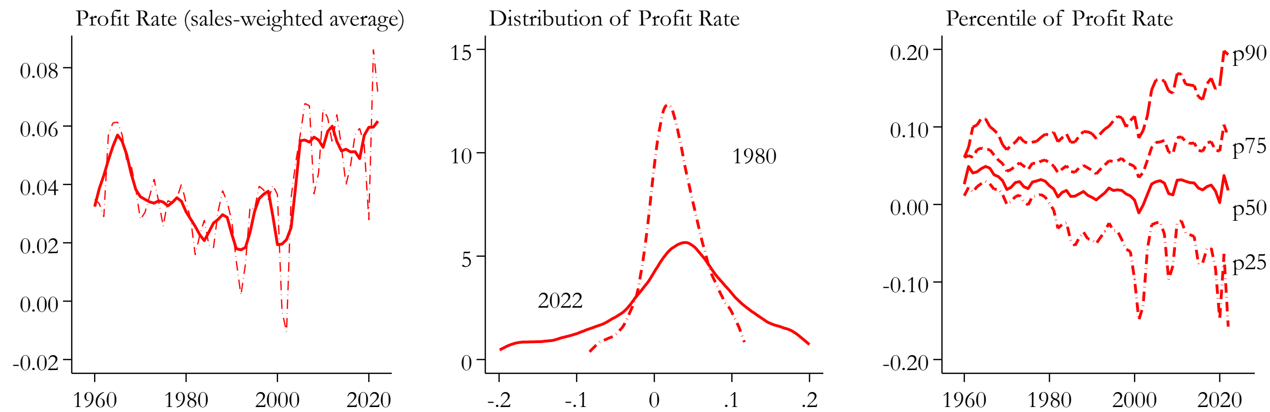

Figure 5: Economic profit rate $\frac{\pi^E}{R}$ over time: average and distribution

Notes. For the left panel, the solid line is the 5-year moving average of the profit rate and the thin line is the annual profit rate. For the middle panel, we limit the range of profit rate within [-0.2, 0.2].

increasing trend since 1980 from 3.12% to 6.18% and increasing variance.[12]

Free Cash Flow. To evaluate how representative the publicly traded firms are in the Compustat data compared to the economy as a whole, we use economy-wide data from the National Income and Product Accounts (NIPA) to calculate first the evolution in real terms of the free cash flow for the corporate sector (Figure 6). The Free Cash Flow is a measure of accounting profits. It is used to measure the role of aggregate economy-wide profits for the aggregate valuation of firms in Atkeson et al. (2022, 2024).

Economy-wide, the free cash flow has grown by a factor of 12, even more than the growth of average profits in the publicly traded firms. And as a share of value added of the corporate sector (corporate sector GDP), the free cash flow increases from 4% in 1980 to 14% today (Figure 7).

The fact that profits economy-wide, i.e., as measured by free cash flow in the national accounts, have increased even more (twice as much) than the profits of the publicly traded firms may indicate that the value of private equity has increased even more than the stock market value of publicly traded firms. Because the value of private equity is so hard to measure (for an attempt to do so, see Campbell and Robbins (2023)), I restrict attention to publicly traded firms.

2.3 Shareholder Equity

Not all profits (earnings) are distributed to the shareholders. Any profits that are kept in the firm contribute to the value of the firm. The value of a stock is thus not just the expected flow of profits,

[12] In Appendix C.5 we also calculate another measure of profits $\pi = SALE - COGS - SGA - rK$, where rK is defined as in De Loecker et al. (2020).

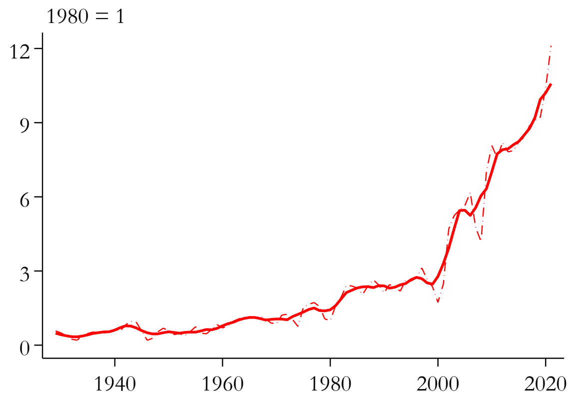

Figure 6: Free Cash Flow over time

Data Source: National Income and Product Accounts (NIPA) table 1.14

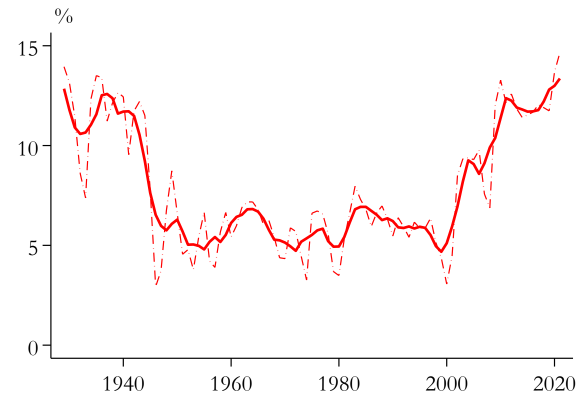

Figure 7: Free cash flow relative to value added (US corporate sector)

Note. Data Source: National Income and Product Accounts (NIPA) Table 1.14.

it also includes the net value of the stock assets the shareholders own in the firm, which I denote by Shareholder Equity. First, I ask what firms do with their profits and how they distributed them.

Distributing Profits: Dividends, Other Distributed Earnings, and Retained Earnings. What do firms do with their profits? The objective of the firm is to generate income for its stakeholder. The firm either pays profits out to all the stakeholders in the company or keeps them in the firm as retained earnings. The most prominent stakeholder is the shareholder of the firm, who has invested in equity and receives a dividend Div in return. But there are other Distributed Earnings in which profits are distributed to stakeholders, which we denote by $OthDistEarn$. Those include share buy-backs, where the firm pays cash to shareholders in exchange for their shares. The shareholders whose shares are not bought back receive no cash but now they own a bigger share of the company. $OthDistEarn$ also includes payments to stakeholders such as employees (management in particular) who receive part of their labor compensation in shares and stock options, which are paid out of the profits of the firm, as well as liability for underfunded pension plans, etc.[13] See more details of all items included in distributed earnings in Appendix Appendix C.16.

All funds that the firm does not pay out to stakeholders are kept in the firm as Retained Earnings. Retained Earnings are the accounting operation that transforms Earnings (Profits) from the Income Statement to an item on the Balance Sheet such as cash or other assets. Denote by RE_{it} the retained earnings of firm i and by $\Delta RE_{it} = RE_{it} - RE_{it-1}$ the change in retained earnings. A firm's profits are

[13] Stock options that are paid to management can be interpreted as compensation for human capital (salary), rather than compensation for financial capital. See Smith, Yagan, Zidar, and Zwick (2019) for an analysis of private pass-through business profit, which can include entrepreneurial labor income for tax reasons.

thus distributed as follows:[14]

$$\pi_{it} = Div_{it} + OthDistEarn_{it} + \Delta RE_{it}. \tag{7}$$

Denote by γ_{it}, the share of profits that a firm retains and by γ_t the aggregate of γ_{it}:

$$\gamma_{it} = \frac{\Delta RE_{it}}{\pi_{it}} \quad \text{and} \quad \gamma_t = \frac{\sum_i \Delta RE_{it}}{\sum_i \pi_{it}}. \tag{8}$$

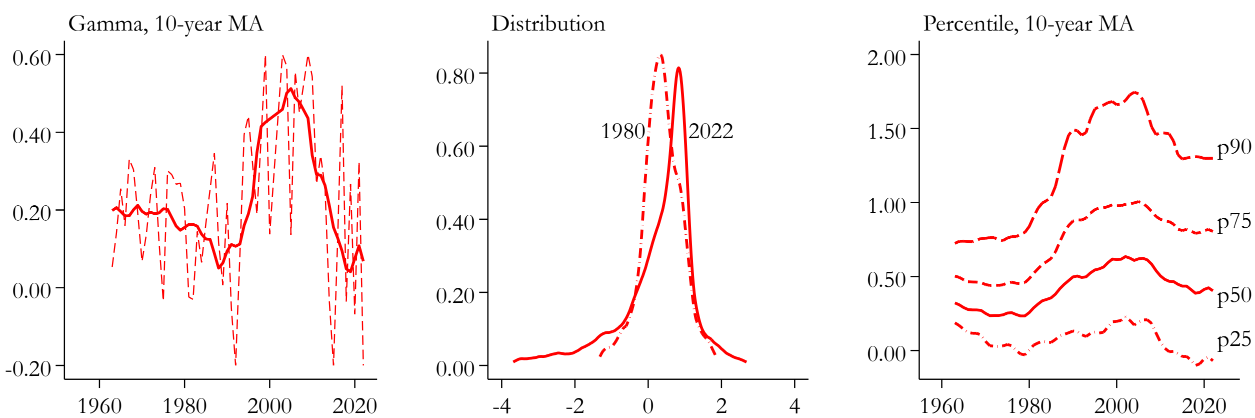

Figure 8: Economywide $\gamma_t = \frac{\sum_i \Delta RE_{it}}{\sum_i \pi_{it}}$, distribution of $\gamma_{it} = \frac{\Delta RE_{it}}{\pi_{it}}$ and percentiles of γ_{it}

Note. The time average over 1962-2022 for $\gamma = 0.235$ (the unweighted time-average is 0.209). For the left panel, we drop the observations for 2001, 2002 and 2008 due to negative ratios and limit the range of the Y-axis in the Figure between [-0.2, 0.6]. For the middle panel, We drop the observations of top 5% and bottom 5% of each year. Note that the change in retained earnings can be negative, for example when profits are negative.

Figure 8 plots the aggregate γ_t between 1960 and 2022 as well as the distribution. The aggregate share of profits (moving average) that firms retain fluctuates from 20% in 1980, down to 40% in 2000 up to 10% in 2022. The distribution of γ_i shifts in parallel with the aggregate γ, and there is relatively little change in the variance or percentile.

Firms don't pay out all of their accounting profits to stakeholders, on average only 76.5%. And of the profits that leave the firm, only part are paid in dividends. Figures 9 and 10 show the evolution over time of the components in profits from equation (7). The average fraction in profits that consists of dividends fluctuates between 40% and 60%, with a time average around 45%. This already indicates that dividends are not the adequate flow measure to link the flow of firm performance to the stock market value.

As we have seen in Figure 8, there is a lot of heterogeneity in the share that firms distribute to

[14]Note that each of these variables, including profits π_{it} and the change in retained earnings ΔRE_{it} can be negative, so we have to heed caution in interpreting those, especially once we calculate percentages and ratios.

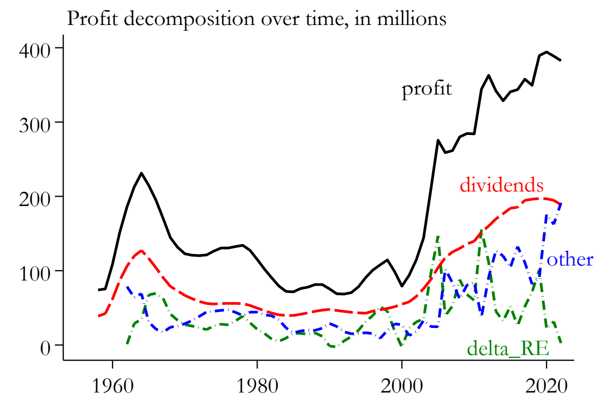

Figure 9: Average π, Div, ΔRE, $OthDistEarn$ over time, 5-year moving average

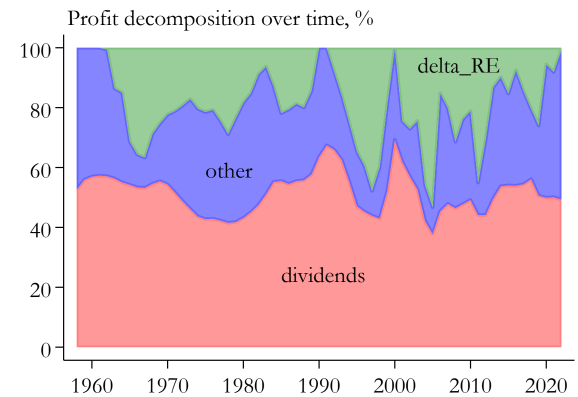

Figure 10: Percentile of components of profit over time, 5-year moving average

Note: We replace average ΔRE_t with 0 when it is negative

stakeholders. One such dimension is the life-cycle of the firm. In Figure 11 we plot by firm age the profit rate as a share of revenue (in red) as well as the change in retained as a share of revenue.[15]

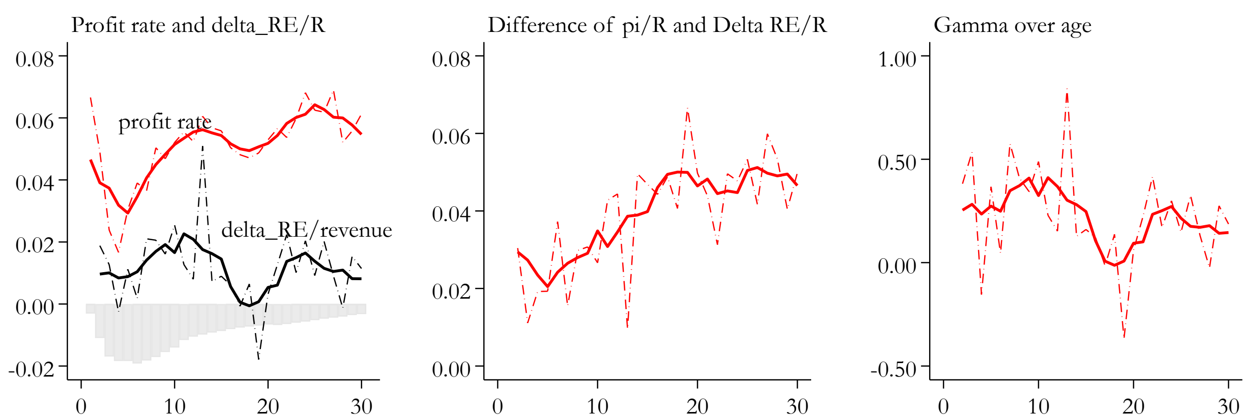

Figure 11: $\frac{\sum_i \pi_i}{\sum_i R_i}$, $\frac{\sum_i \Delta RE_i}{\sum_i R_i}$, $\frac{\sum_i (\pi_i - \Delta RE_i)}{\sum_i R_i}$ and γ by age, 5-age MA. The grey area is the histogram of the number of firms by firm age (the Figure with age range 0-60 is in Appendix C.12

Over the entire life cycle, profits appear fairly stable around 5-6% of revenue. The majority of the mass of the firm age distribution is between 2 and 15 years. There the profits are increasing from 3% to 6%, so there is backloading. Though to a lesser extent, retained earnings also increase over the same age. Figure 11 analyzes the evolution of the average γ over the life cycle of firms. Younger firms retain

[15]The age variable in our data is of poor quality. Consequently, we have to be cautious with the interpretation of firm age. The age in our data, is the moment of Initial Public Offering (IPO) not of incorporation, and is reset whenever there is a merger between two formerly publicly traded firms. There are also few firms older than 20 years old, so the results for older firms should be interpreted with caution.

fewer earnings, going from 40% at 5 years of age to closer to 0% at 20 years of age, though increasing again after age 20.

Shareholder Equity. Our notion of Shareholder Equity E_{it} is essentially the sum of past retained earnings. From an accounting viewpoint, Shareholder Equity also includes the issuance of stock, which is the cash injection independently of profits, for example at startup or with new stock issuance.

Our notion of Shareholder Equity has a close relation to the Bookvalue ($BKVAL_{it}$) of a firm. The Bookvalue is the total value of all assets net of the debt.[16] And in accounting terms, Bookvalue is equal to retained earnings plus the value of $Stock$: $BKVAL_{it} = RE_{it} + Stock_{it}$. However, we do not use Bookvalue as the measure for E because Bookvalue includes Goodwill ($GDWL$), which enters the balance sheet for example when a firm buys an asset (such as another firm or a patent) at a price above the Bookvalue of that asset. The difference between the market price and the Bookvalue of that asset is booked as Goodwill. If the same asset was developed within the firm (say through organic growth instead of M&A), then those expected profits generated would not be booked as goodwill. In both cases, the future profits still appear in the income statement each year. We subtract Goodwill to calculate Shareholder Equity in order to avoid double counting. The market price of the asset is higher than the Bookvalue because the asset is expected to generate future income (profits) and those will be booked as profits in the income statement. Therefore, we define Shareholder Equity E_{it} as:[17]

$$\begin{aligned} E_{it} &= BKVAL_{it} - GDWL_{it} && (9) \\ &= RE_{it} + Stock_{it} - GDWL_{it}. && (10) \end{aligned}$$

If this relation holds in levels, it holds in differences, $\Delta E_{it} = \Delta RE_{it} + \Delta Stock_{it} - \Delta GDWL_{it}$. Therefore :

$$E_{it} = E_{it-1} + \Delta RE_{it} + \Delta Stock_{it} - \Delta GDWL_{it}. \tag{11}$$

In what follows, we use this relation to calculate E_{it}. Intuitively, we can think of Shareholder Equity as

[16]The Bookvalue as reported in the balance sheet includes: 1. current asset (which includes cash, short-term investment, receivables, inventories, accounts payable, and deferred tax); 2. Property, Plant and Equipment (PPENT); 3. intangible capital (INTAN); 4. investment and advances (equity and non-equity); 5. other assets (deferred charges and other sundry); 6. minus the debt. We have repeated our exercise using alternative measures of capital, using the permanent inventory method (PIM) based on investment to calculate an alternative measure of equity. We plot the average and distribution of Bookvalue in Figure C.10 in Appendix Appendix C.6.

[17]For goodwill, only post-1988 data is available. For data between 1980 and 1987, we used the ratio of total goodwill to total assets in 1988 to calculate goodwill for those years. Goodwill is only defined for intangible assets. Therefore, we also consider the goodwill in physical assets, Investment & Advances - Equity (IVAEQ), which represents long-term investments and advances to unconsolidated subsidiaries and affiliates in which the parent company has significant control. Because this data is not available, we use the ratio of total goodwill to total assets each year to calculate. Data prior to 1987 were calculated using the 1988 ratio.

being approximately equal the cumulative value of retained earnings

$$E_{it} \approx E_{it-1} + \Delta RE_{it}. \tag{12}$$

In Appendix Appendix C.7 we analyze the relation between E_{it}, RE_{it} and $BKVAL_{it}$ and show that the approximation in equation (12) indeed holds approximately in the data.[18]

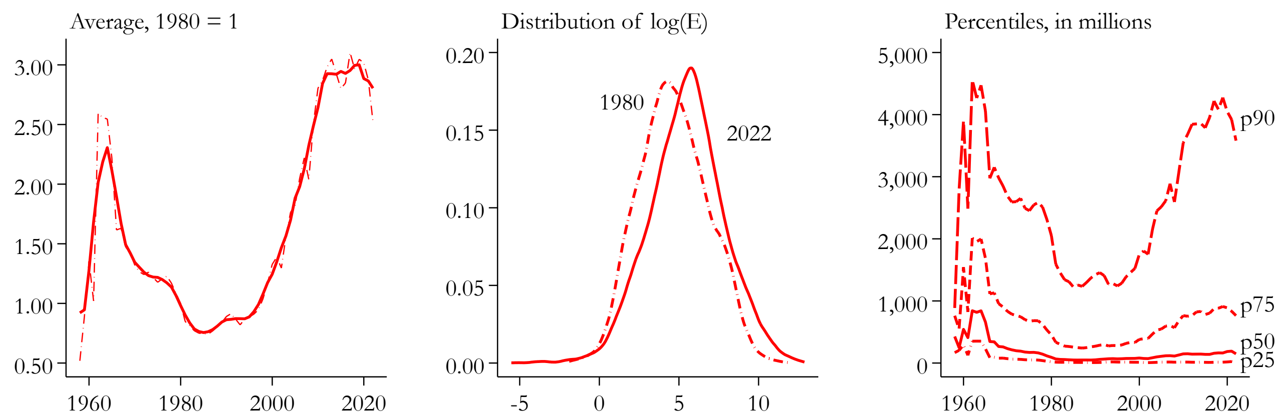

Figure 12: Shareholder Equity (E) over time: average and distribution

Figure 12 plots the average and distribution of Shareholder Equity over time. Shareholder Equity E has risen, by a factor of 3, starting in the mid-1990s, which we also observe in the right shift of the density. The variance of the distribution remains fairly constant, though with a fatter upper tail.

Average Shareholder Equity has grown in absolute terms, and also as a share of revenue, from 37% in 1980 to 49% now (Figure 13), but it becomes smaller relative to debt.[19]

[18]We value the Shareholder Equity here at its cash value. The Shareholder Equity typically enters the firm originally in cash when it originates in profits or through new stock issuance. Once the firm invests in capital, this liquidation value may no longer be equal to the initial cash value. For recent work on the liquidation value of firms (for example at bankruptcy), see Kermani and Ma (2023).

[19]In Appendix Appendix C.8 we also plot the ratio of Shareholder Equity and of Goodwill to total assets.

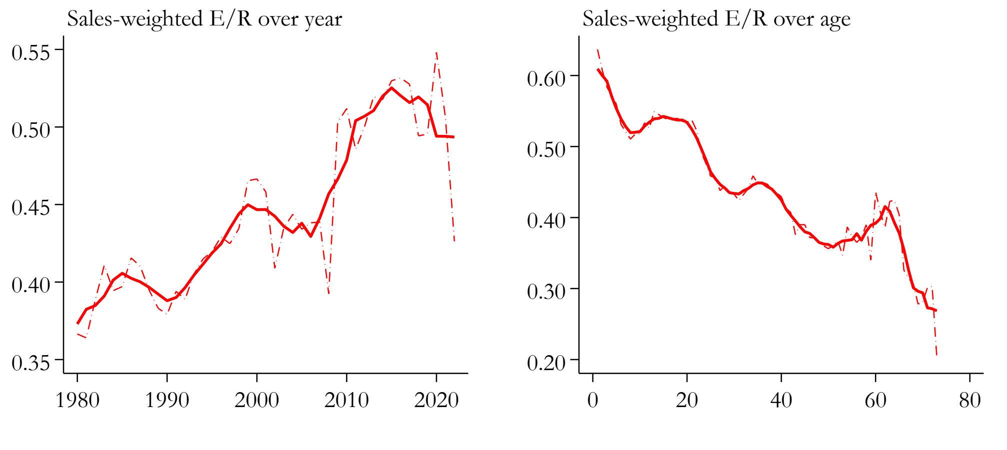

Figure 13: Sales weighted E_{it}/R_{it} over time and over age, 5YMA

2.4 Discounting

Cost of Debt. To obtain a firm-level cost of debt, we calculate an average using the total interest payments (INT, measured as short and long term interests on debt) and the total debt of the firm D. A firm's cost of debt r^d_{it} is then:

$$r^d_{it} = \frac{INT_{it}}{D_{it}}. \tag{13}$$

Figure 14 has the plot of the average and distribution of r^d_{it} and shows that since the 1980s, the average cost of debt has fallen from 4.8% to 1.5%. The distribution has shifted left and the variance has declined, with a decline at all percentiles.

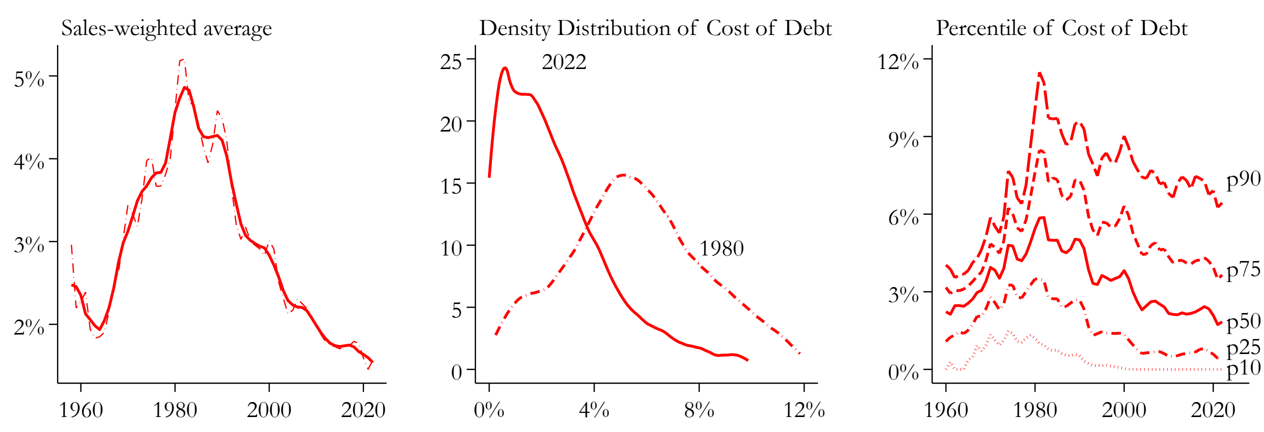

Figure 14: Firm-level cost of debt r^d_{it} over time: average and distribution

Notes. For the left panel, the solid line is the 5-year moving average (sales-weighted) and the thin line is the annual data.

This indicates that firms have obtained access to cheaper credit, and that the dispersion in the cost of credit has fallen. To evaluate whether this informs us about the credit spread, we first take a look at the risk-free rate.

Risk-free Rate. We measure the risk-free interest rate by the real market yield on U.S. treasury securities at 10-year constant maturity and denote it by r_t^F. Figure 15 plots the rate r_t^F as well as the factor $\beta_t^F = \frac{1}{1+r_t^F}$. There is a clear downward trend in r_t^F from over 7% in 1984 to below 0% in 2022. The risk-free rate increases between 1980 and 1984, mainly due to high inflation in that period. For that reason, below we will focus on the change starting in 1984 rather than 1980.

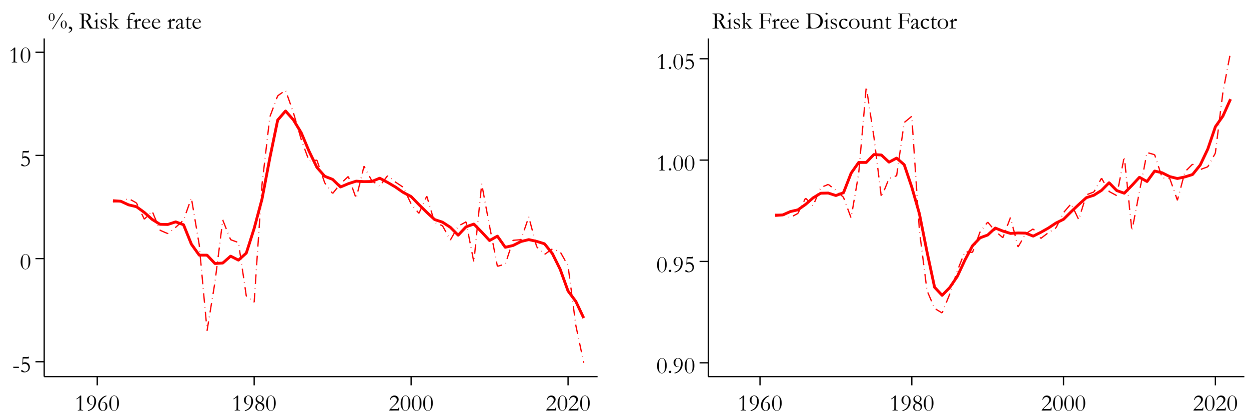

Figure 15: Risk free rate r_t^F and the risk free discount factor β_t^F over time

Notes. Data source: Board of Governors of the Federal Reserve System (US). For the left panel, the solid line is the 5-year moving average and the thin line is the annual data.

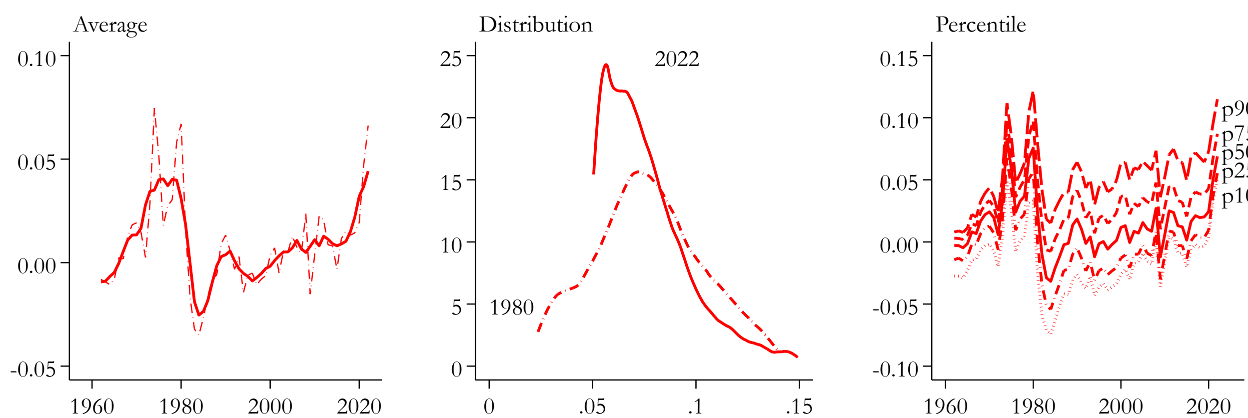

Figure 16: Spread $r_{it}^d - r_t^F$ over time: average and distribution

Notes. For the left panel, the solid line is the 5-year moving average and the thin line is the annual data.

The average cost of credit of credit has gone down, and so has the risk-free rate (see Figure 16).

The average spread between the two has gone up, especially in the early 1980s and the recent years of inflation, but has increased only moderately in the intermediate period from zero to one percent. There is little change in the distribution. This may be an indication that firm debt has become slight more risky, either because activities have become more uncertain, or because firms are incurring more debt.[20]

The Subjective Discount Factor. The last ingredient is the subjective discount factor. I assume that households in period t discount the future flow of funds of firm i by a discount factor β_{it}. Because some of the discounting reflects the risk-free market rate (a measure of the opportunity cost of holding the asset), and we thus write the firm-specific discount factor β_{it} as

$$\beta_{it} = \beta_t^F \beta_{it}^S \tag{14}$$

and consists of the common risk-free discount factor β_t^F and the firm-specific subjective stochastic discount factor β_{it}^S.[21] I interpret the subjective stochastic discount factor as the residual given observations on market value, profits, the risk-free rate and under assumptions over the expectations of investors.

2.5 Expectations

The more general version of the value of a stock in equation (2) as:

$$V_{it} = E_{it} + \mathbb{E}_t \left(\sum_{\tau=1}^{\infty} \beta_{i\tau}^{\tau} \pi_{it+\tau} \right), \tag{15}$$

where $\mathbb{E}_t$ is the expectation operator at time t about a realization at time τ, for example $\mathbb{E}_t \pi_{i\tau}$ is the expectation households have at time t about profits at time $\tau > t$. Key is what we assume regarding those expectations about profits, about Shareholder Equity, and about the discount factor.

Expectations about future profits in particular determine the stock market value. Investors observe contemporaneous profits. If they expect future profits to rise for ever, then the stock market value will be higher than if investors expect profits to be stationary. While there is a large literature on the role and measurement of expectations, in this paper I don't use any specific information on expectations. We can nonetheless *assume* different expectations regimes. To account for different expectations, I consider two distinct beliefs regarding the expectations of investors about profits:

A. Constant growth expectations: $\mathbb{E}_t \pi_{i\tau} = \pi_{it} \psi^{\tau}, \ \forall \tau > t$

[20] See Lian and Ma (2021) for evidence on the growth of cash-flow financed credit.

[21] Instead of equation (14) we could also assume that the interest rate r_{it} corresponding to the discount factor β_{it} is given by $r_{it} = r_t^F + r_{it}^S$. Then the discount factor would be $\beta_{it} = \beta_t^F \beta_{it}^S = \frac{1}{1+r_t^F} \frac{1}{1+r_{it}^S} = \frac{1}{1+r_t^F + r_{it}^S + r_t^F r_{it}^S} \neq \frac{1}{1+r_t^F + r_{it}^S}$. The difference from the term $r_t^F r_{it}^S$ is negligible for values of r_t^F and r_{it}^S close to zero.

B(T). Rational Expectations for T periods ($T \geq 2$): $\mathbb{E}_t \pi_{it+\tau} = \pi_{it+\tau}, \ \ \forall \tau \in \{1, ..., T-1\}$, and $V_{i\tau} = V_{it}, \ \forall \tau \geq T$

Constant growth expectations is what is often assumed in the finance literature, where investors face a stationary (martingale) stochastic process, but account for the fact that there is economy-wide GDP growth rate g, where $\psi = 1 + g$. Below, we assume that $g = 2\%$. Instead, under expectations **B**(T), investors correctly predict the path of profits for T periods. The T periods is both for realism and practical reasons. Realism calls for a limit to how much the investors can foresee the future profits the firm will generate. And practically, we never have observations for an infinite horizon $T \to \infty$. Moreover, we cannot simply assume T is the full duration of the sample, because then it is impossible to make any comparable calculations across periods. In the empirical exercise I set $T = 5$.

For the discount factor, I assume households have constant expectations: $\mathbb{E}_t \beta_{i\tau} = \beta_{it}$ for all $\tau > t$. The expectations about β apply to both components of the discount factor $\mathbb{E}_t \beta^S_{i\tau} = \beta^S_t$ and $\mathbb{E}_t \beta^F_{i\tau} = \beta^F_t$. Under this assumption, investors expect no change in the risk-free interest rate and did not predict the decline in the risk-free interest rate.[22,23] Likewise, we assume that households have stationary expectations about the Shareholder Equity E, that is, agents assume that E_t evolves according to equation (4). Under these assumptions, the expression (15) reduces to equation (2).[24]

Under the two expectations regimes, we can write the market value from equation (2) as:

$$V^{\mathbf{A}}_{it} = \sum_{\tau=1}^{\infty} (\beta_{it}\psi)^{\tau} \pi_{it} + E_{it} = \psi \beta_{it} \frac{\pi_{it}}{1 - \psi \beta_{it}} + E_{it} \tag{16}$$

$$V^{\mathbf{B}}_{it} = \sum_{\tau=1}^{T-1} \beta^{\tau}_{it} \pi_{it+\tau} + E_{it} + \beta^{T}_{it} (V^{\mathbf{B}}_{it} - E_{it}) = E_{it} + \frac{\sum_{\tau=t+1}^{T-1} \beta^{\tau}_{it} \pi_{it+\tau}}{1 - \beta^{T}_{it}}, \quad \text{for } T \geq 2. \tag{17}$$

for $T \geq 2$.

3 Results

With the firm-level series for $V_{it}, \pi_{it}, \beta^F_t$ it is now possible to back out the subjective discount factor β^S_{it} as the residual under model **A** or **B**(T). Once we have backed out the subjective discount factor, all the information is available to decompose the value V_{it} of a firm into π_{it}, β^F_t and β^S_{it}.

[22] This also implies that investors are not aware of a link between profits and the risk-free rate that may exist empirically (see Deb and Eeckhout (2024)).

[23] Imposing non-stationary expectations on the discount factor is feasible but complex. At least two issues of concern arise. First, we need to solve a fixed point problem to back out beliefs of the own household's future expectations as well as the higher order beliefs of other households. Second, there may be an identification problem backing out beliefs regarding β simultaneously with beliefs about π.

[24] Note also that here we make a very strong and simplifying assumption that β^S_{it} and π_{it} are uncorrelated. An investor's subjective discount factor is likely to depend on the amount of risk the flow of profits generates.

Backing out the Subjective Discount Factor. Given the assumptions on the model, and with data on the series $\{V_{it}, \pi_{it}, E_{it}, \beta_t^F\}$ for all i, t, we back out the series $\{\beta_{it}^S\}$ as the residual. Therefore, from equation (16) for model **A** we calculate the subjective discount factor explicitly as:

$$\beta_{it}^{S,\mathbf{A}} = \frac{1}{\psi \beta_t^F} \left(\frac{V_{it} - E_{it}}{V_{it} - E_{it} + \pi_{it}} \right). \tag{18}$$

Instead, under rational expectations $\mathbf{B}(T)$, we cannot explicitly calculate the the market value in equation (17), but we can solve it numerically as the fixed point of:

$$\left\{ \beta_{it}^{S,\mathbf{B}} : V_{it} = E_{it} + \frac{\sum_{\tau=t+1}^{T-1} \left(\beta_{it}^F \beta_{it}^S\right)^\tau \pi_{it+\tau}}{1 - \left(\beta_{it}^F \beta_{it}^S\right)^T} \right\}. \tag{19}$$

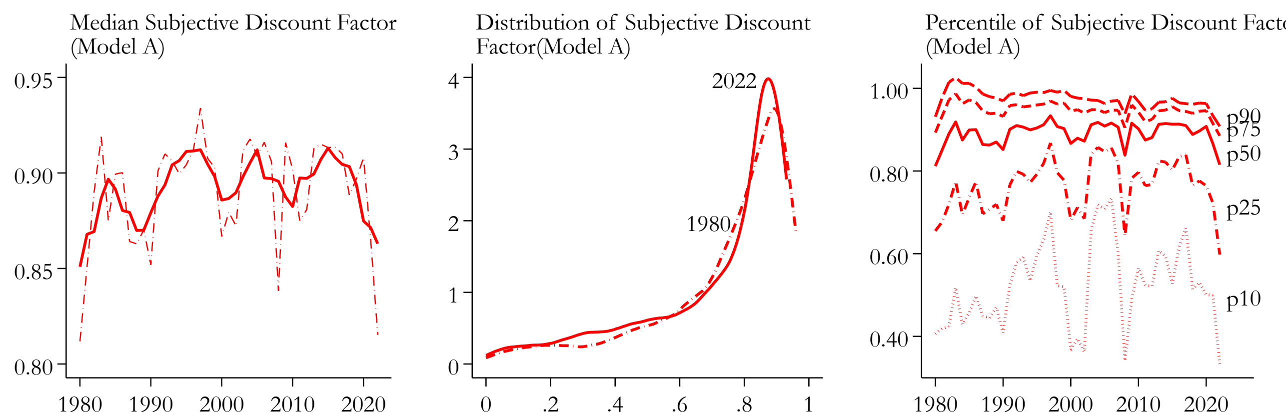

Figure 17: Subjective Discount Factor β^S under constant expectations **A** over time: average and distribution (first panel 5-year moving average)

Notes. We keep only those observations where $0 < \beta(1+g) < 1$ (i.e. 36 % of observations, and 11 % of the value), i.e. we drop either $\{\pi < 0$ and $V - E > 0\}$ or $\{\pi > 0$ and $V - E < 0\}$ since in that case the series in equation (2) does not converge. For the left panel, values outside [0.85, 1] the figure is cropped.

Figures 17 and 18 plot the properties of the distribution of the discount factors. They are lower under **A**, than under **B**. In both cases they are fluctuating but more or less flat over the entire time period.

Market Value and its components. Figure 19 shows the trend of market-wide market value, economic profits and Shareholder Equity that we documented before.[25] Figure 20 shows the evolution of $\frac{\beta^F \beta_t^S}{1-\beta_t^F \beta_t^S}$ for the three measures of the discount factor.

Since 1980, market value has risen by factor 9.38. Of the three components, profits has risen by

[25] See also Appendix Appendix C.13 for the trend of total rather than average V, π, E.

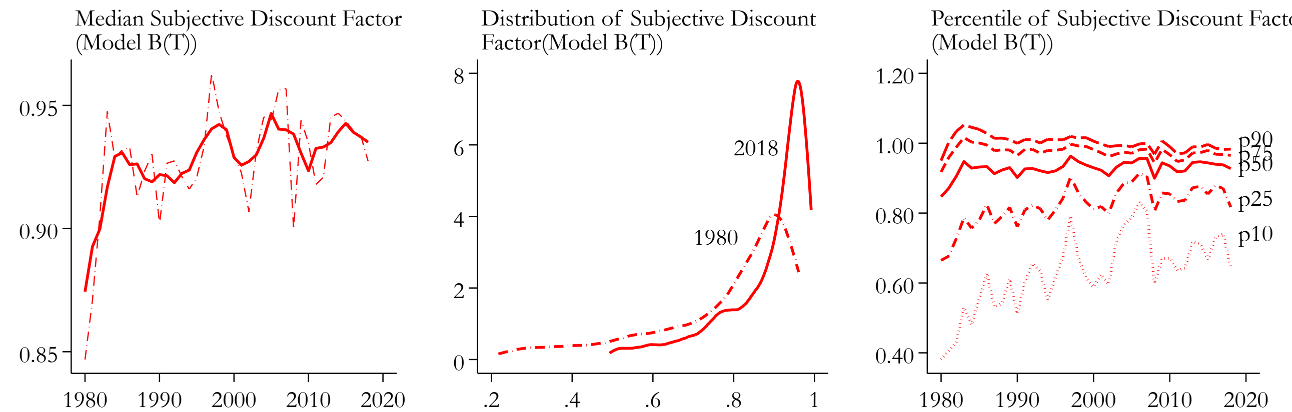

Figure 18: Subjective Discount Factor β^S under constant expectations $\mathbf{B}(T)$ ($T = 5$) over time: average and distribution (first panel 5-year moving average)

Notes. We keep only those observations where $0 < \beta < 1$ (i.e. we drop 51.7% of the observations, and 13 % of the value). For the left panel, values outside [0.88, 1] the figure is cropped.

factor 3.15; Shareholder Equity 2.8; and the discount factor has risen by factor component ($\frac{\beta^S \beta^F}{1-\beta^S \beta^F}$) has risen by factor 1.64.

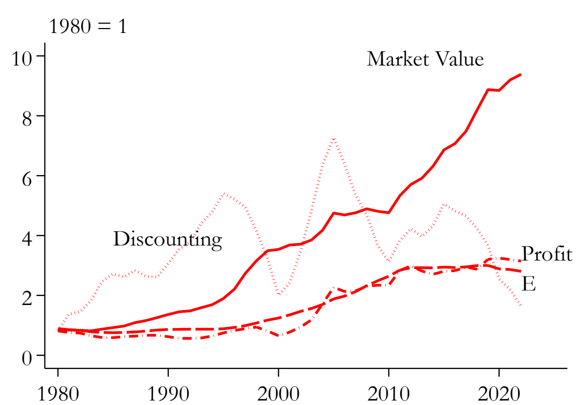

Figure 19: Trend of average V, π, E and median $\frac{\beta_t^F \beta_t^S}{1-\beta_t^F \beta_t^S}$, 5-year moving average

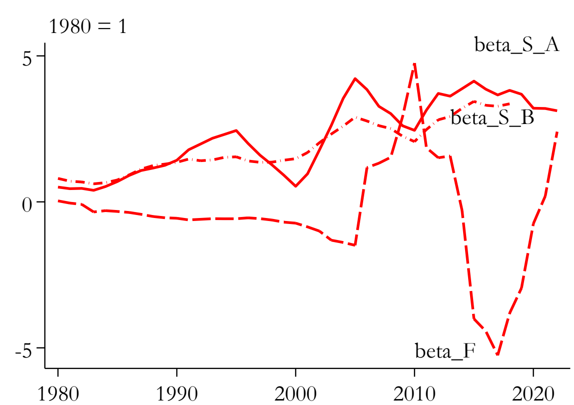

Figure 20: Trend of median $\frac{\beta^S}{1-\beta_t^S}$ for the 3 measures: β^F, $\beta^{S,\mathbf{A}}$, $\beta^{S,\mathbf{B}}$ (5-year moving average)

Counterfactual Decomposition of Market Value (Model A). The evolution of each of the components does not necessarily translate into the same evolution of the market value which is a non-linear function of these components. In order to decompose the growth of market value, we now construct counterfactual market values that capture the contribution of one component only: profits, discounting or Shareholder Equity.

We start with model **A**. We construct those measures fixing all components at their 1980 level, while varying one of them. In particular, we construct the following four counterfactual market values:

$$V_t^E = \beta_0^F \beta_0^S \frac{\pi_0}{1-\beta_0^F \beta_0^S} + E_t \qquad V_t^{\pi} = \beta_0^F \beta_0^S \frac{\pi_t}{1-\beta_0^F \beta_0^S} + E_0 \tag{20}$$

$$V_t^{\beta^F} = \beta_t^F \beta_0^S \frac{\pi_0}{1-\beta_t^F \beta_0^S} + E_0 \qquad V_t^{\beta^S} = \beta_0^F \beta_t^S \frac{\pi_0}{1-\beta_0^F \beta_t^S} + E_0 \tag{21}$$

The left panel of Figure 21 shows each of these values, normalized to 1 in 1984.[26] We see the contribution of the 4 different components as well as the market value. We see that the counterfactual of profits rises by factor 2.81, of equity capital by 2.38, of the fixed discount factor by 3.27 and of the subjective discount factor by 0.96, i.e. virtually no change. The left panel show the corresponding pattern for model $\mathbf{B}(T)$ (see equations (23)-(26) below) with similar results.

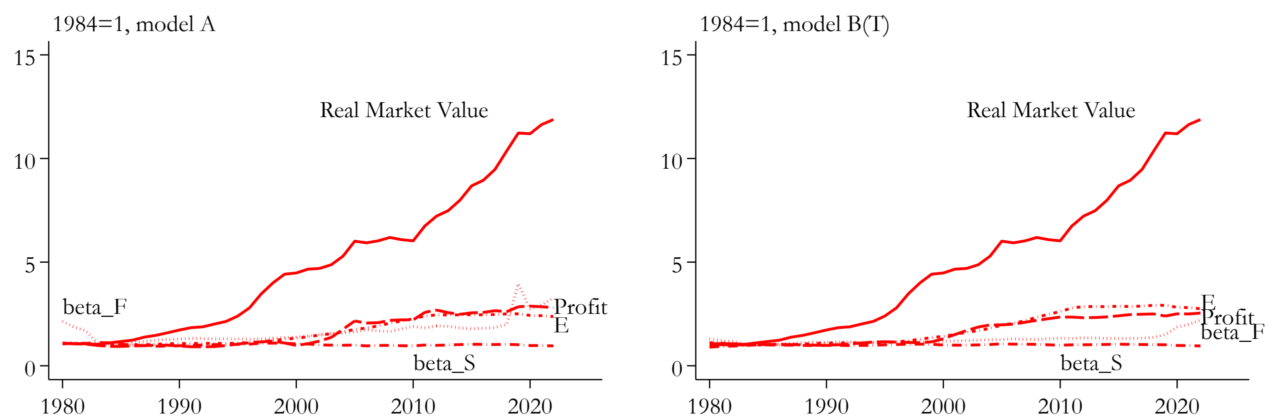

Figure 21: Real average market value and four counterfactual market value over time (Model **A** and Model $\mathbf{B}(T)$, aggregate level), normalized to 1 in 1984; 5-year Moving Average (we also have counterfactual market values computed through total profit and equity in Appendix C.14)

Next, we show the contribution of each of the four components as a percentage of the total rise of market value. For example, we measure the fraction of π^E in the decomposition as (and likewise for the other components):

$$\Delta V_t^{\pi} = \frac{V_t^{\pi} - V_0}{V_t^{\pi} + V_t^E + V_t^{\beta^F} + V_t^{\beta^S} - 4V_0} \tag{22}$$

In Figure 22 we plot the percentage contribution of the three components of the counterfactual value: profits, equity capital and total discounting (all 3 components adding up to 100%), where the

[26] Because the risk-free rate rises sharply between 1980 and 1984, we normalize in this decomposition to 1984.

contribution of the counterfactual V_t^π is calculated as:

$$\Delta V_t^\pi = \frac{V_t^\pi - V_0}{V_t^\pi + V_t^E + V_t^\beta - 3V_0},$$

and likewise for ΔV_t^E and ΔV_t^β.

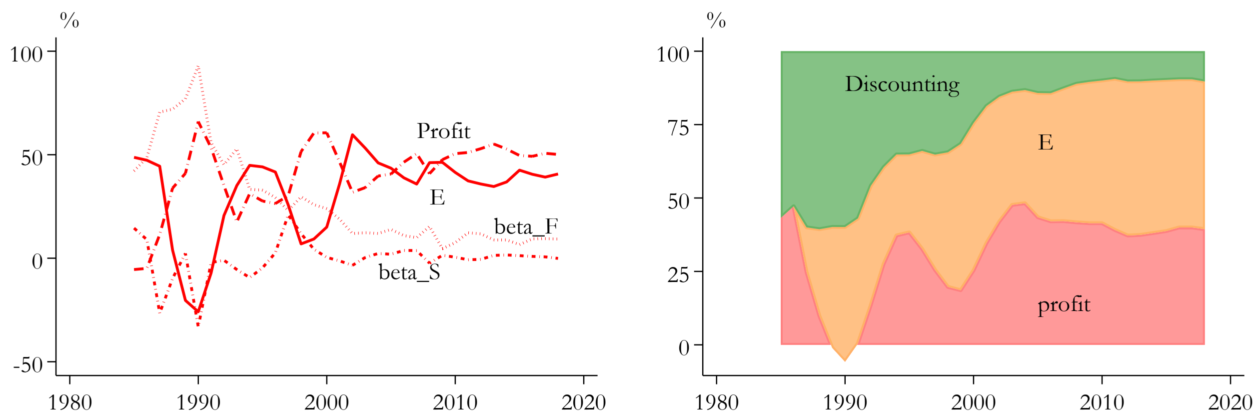

Figure 22: Counterfactual contribution of the components (in %) (Model **A**, aggregate level, 5-year moving average).

Notes. We set V_0 for $t = 1984$. For the right panel, we crop values outside $[-25\%, 100\%]$.

Figure 22 shows the contribution of each of these counterfactual changes in value. Discounting initially accounts for half, but by the end of the period, it is less than 20%. Equity capital and profits each account for about the same amount, around 40% of the total increase.

In Appendix C.15 we use an alternative way to calculate the counterfactuals where we change all components, except one, instead of keeping all components constant and only change one.

Counterfactual value under Expectations B(T). We now repeat the same exercise for model **B**. For beliefs **B**, now we need to calculate $V_{it}^{\pi^E}(\mathbf{B}), V_{it}^{r^{ES}}(\mathbf{B}), V_{it}^{\beta^F}(\mathbf{B}), V_{it}^{\beta^S}(\mathbf{B})$ using the infinite sum. Then we have:

$$V_t^{\pi}(\mathbf{B}(T)) = E_0 + \sum_{\tau=1}^{T-1} (\beta_0^F \beta_0^S)^{\tau} \pi_{t+\tau} + (\beta_0^F \beta_0^S)^T (V_t^{\pi}(\mathbf{B}(T)) - E_0) \tag{23}$$

$$V_t^{E}(\mathbf{B}(T)) = E_t + \sum_{\tau=1}^{T-1} (\beta_0^F \beta_0^S)^{\tau} \pi_{0+\tau} + (\beta_0^F \beta_0^S)^T (V_t^{\pi}(\mathbf{B}(T)) - E_t) \tag{24}$$

$$V_t^{\beta^F}(\mathbf{B}(T)) = E_0 + \sum_{\tau=1}^{T-1} (\beta_t^F \beta_0^S)^{\tau} \pi_{0+\tau} + (\beta_0^F \beta_t^S)^T (V_t^{\pi}(\mathbf{B}(T)) - E_0) \tag{25}$$

$$V_t^{\beta^S}(\mathbf{B}(T)) = E_0 + \sum_{\tau=1}^{T-1} (\beta_0^F \beta_t^S)^{\tau} \pi_{0+\tau} + (\beta_0^F \beta_t^S)^T (V_t^{\pi}(\mathbf{B}(T)) - E_0) \tag{26}$$

And likewise for $\mathbf{B}(T)$. Each time the equivalent of the two figures, equivalent of figures 22. The results are very similar to those under model **A**: of the counterfactual values, 20% is due to discounting, 40% due to equity capital and 40% due to profits.

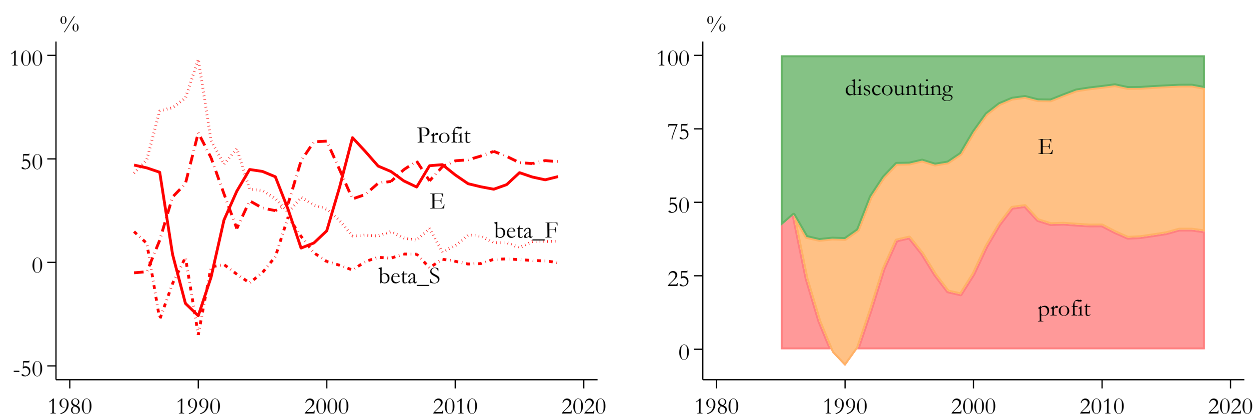

Figure 23: Counterfactual contribution of the components (in %) (Model **B**(T), aggregate level, 5-year moving average).

Notes. We set V_0 for $t = 1984$. For the right panel, values outside $[-25\%, 100\%]$ the figure is cropped.

4 Model

We build a general equilibrium model, featuring oligopolistic competition in the output markets and endogenous markups as in Atkeson and Burstein (2008). We incorporate common ownerships of firms to model variation in the market structure.

4.1 Model Setup

Environment. Time is discrete with an infinite horizon. There are a continuum of markets indexed by $j \in [0, J])$ and a finite number of I firms in each market.

Preferences. There are a continuum of representative households who supply labor homogenous L and consume the bundle of all goods C. The household's utility is given by:

$$U(C, L) = C - \bar{\varphi}^{-\frac{1}{\varphi}} \frac{L_t^{1+\frac{1}{\varphi}}}{1+\frac{1}{\varphi}}, \tag{27}$$

where C is the double-nested Constant Elasticity of Substitution (CES) aggregator of firm-level consumption C_{ij} and market level consumption C_j:

$$C = \left[\int_0^J J^{-\frac{1}{\theta}} c_j^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}, \quad c_j = \left[\sum_{i=1}^{I} I_j^{-\frac{1}{\eta}} c_{ij}^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}. \tag{28}$$

The elasticities of substitution θ and η measure how substitutable goods are, with $\theta < \eta$; goods within the market are closer substitutes than between markets.[27] Households choose c_{ij} and L to maximize utility subject to the budget constraint

$$\max_{c_{ij}, L} \; U(C, L) \tag{29}$$

$$\text{s.t} \int_j \sum_i p_{ij} c_{ij} \leq WL + \Pi \tag{30}$$

where p_{ij} is the output price for good i, j (with sectoral price index p_j and aggregate price index P), total income is equal to labor earnings WL, where W is the wage rate, and a representative portfolio of economy-wide profits Π.

Technology. Firm's produce using a linear technology with a single input labor l_{ij}, given by $y_{ijt} = A_{ijt} l_{ijt}$. $A_{ijt} = A_j Z_{ijt}$ denotes the firm's Total Factor Productivity (TFP), where A_j is the market-level productivity. We assume it follows a log-normal distribution with mean μ_A and variance σ_A and captures the variation of productivities across markets. Z_{ijt} is the firm-specific productivity, the log of which follows an AR(1) process with time changing, where $z_{ijt} = \log Z_{ijt}$ with TFP shock σ_z.

$$z_{ijt} = \rho z_{ijt-1} + \varepsilon_{ijt}, \qquad \varepsilon_{ijt} \sim \mathcal{N}(\mu_z, \sigma_z^2) \tag{31}$$

[27] The terms $J^{-\frac{1}{\theta}}$ and $I_j^{-\frac{1}{\eta}}$ in the utility functions are introduced to kill the love of variety effect.

In order to ensure that the mean of the process Z_{ijt} is equal to one and the stochastic process does not depend on the persistence, we assume $\mu_z = -\frac{1}{2}\frac{\sigma_z^2}{1+\rho}$.

In reality, firms choose the form of financing (through debt or equity), in our model we take the share of Shareholder Equity γ_t as exogenous. This implies that we can write the Shareholder Equity of a firm as

$$E_{ijt} = E_{ijt-1} + \gamma_t \pi_{ijt} \tag{32}$$

for any given E_{ij0}.

Market Structure. Because the number of firms within a market is finite, there is strategic interaction between firms in the market.[28] Firms compete à la Cournot. A key assumption is that firms are assigned to a new market in each period t. Given the continuum of markets, this assumption implies that there is no inter-temporal strategic interaction between firms. The likelihood of competing against the same firm in the future is zero. As a result, the equilibrium can be solved as a static Nash equilibrium. Firms' profits are given

$$\pi_{ijt} = p_{ijt} y_{ijt} - W_t l_{ijt} - W_t \phi_t, \tag{33}$$

where $W_t \phi_t$ is the sunk cost (overhead), expressed in overhead labor units ϕ_t.

Common Ownership. To allow for variation in the extent of competition between firms, rather than changing the number of firms, we assume that the ownership of firms changes. We follow the literature on common ownership by assuming that firms take into account not only their own profits when choosing production decisions, but also part of the profits of their competitors (see amongst others Rotemberg (1984); Azar (2012); Appel, Gormley, and Keim (2016); Ederer and Pellegrino (2021)). In particular, in our setting, a firm i in a market j owns an equal fraction $\alpha \in [0,1]$ of the profits of all firms $k \neq i$ in the same market.[29]

We thus write the objective of the firm to maximize $\pi_{ijt} + \alpha_t \sum_{k \neq i} \pi_{kjt}$, where $\alpha = 0$ corresponds to the standard Cournot solution and $\alpha = 1$ corresponds to the solution where all firms in the market perfectly collude and behave as a monopolist.[30] This implies firm i, j chooses y_{ij} taking as given the optimizing behavior of its competitors, the inverse demand p_{ij} of the households, as well as the aggregate

[28] Since there is a continuum of markets, there is no strategic interaction between firms in different markets.

[29] In principle, the common ownership share α_i^k of firm i in firm k is specific the pair; moreover, it need not be equal to α_k^i. Our setup is highly stylized in the sense that $\alpha_i^k = \alpha$ for all firms in all markets.

[30] See Appendix Appendix D.1 for more details.

prices W and P:

$$\max_{y_{ijt}} \quad p_{ijt}y_{ijt} - \frac{W_t y_{ijt}}{A_{ijt}} - W_t\phi_{ijt} + \alpha_t \sum_{h\neq i}\left[p_{hjt}y_{hjt} - \frac{W y_{hjt}}{A_{hjt}} - W_t\phi_{hjt}\right]. \tag{34}$$

Because firms are reassigned to new competitors in every period, current output decisions do not affect future decisions and an equilibrium is the static Nash equilibrium solution to this Cournot quantity competition game. In what follows for the model solution, we drop the time subscript.

Market Value. Once we obtain the series of profits for each year, we calculate the market value V_{ijt} for each firm ij in year t exactly as in the empirical section. Depending on the assumption about investors' beliefs $\mathbf{A}$ or $\mathbf{B}(T)$, we obtain $V^{\mathbf{A}}_{ijt}$ using equation (16) and $V^{\mathbf{B}}_{ijt}$ using equation (17).

4.2 Solution

Household solution. From the first-order condition of the utility with respect to labor, labor supply function is:

$$L^s(W) = \bar{\varphi}\,(W/P)^{\varphi}. \tag{35}$$

Following Atkeson and Burstein (2008), household optimization leads to an inverse demand function for each good y_{ij} (where consumption equals production $c_{ij} = y_{ij}$):

$$p_{ij} = I^{-\frac{1}{\eta}} J^{-\frac{1}{\theta}} \left(\frac{y_{ij}}{y_j}\right)^{-\frac{1}{\eta}} \left(\frac{y_j}{Y}\right)^{-\frac{1}{\theta}} P \tag{36}$$

Firm solution. The firm's first-order condition from maximizing profits (34) with respect to y_{ij} is:

$$\frac{\partial \pi_{ij}}{\partial y_{ij}} + \alpha \sum_{h\neq i} \frac{\partial \pi_{hj}}{\partial y_{ij}} = 0 \tag{37}$$

$$\frac{\partial p_{ij}}{\partial y_{ij}} y_{ij} + \alpha \sum_{h\neq i} \frac{\partial p_{hj}}{\partial y_{ij}} y_{hj} = \frac{W}{A_{ij}}, \tag{38}$$

where

$$\frac{\partial p_{hj}}{\partial y_{ij}} y_{hj} = \left(\frac{1}{\eta} - \frac{1}{\theta}\right) s_{ij} \frac{s_{hj}}{s_{ij}} p_{ij} \tag{39}$$

with s_{ij} is firm i's sales share in market j. Then the FOC is equivalent to

$$p_{ij}\left[1 - \frac{1}{\eta} + \left(\frac{1}{\eta} - \frac{1}{\theta}\right)\left(s_{ij} + \alpha \sum_{h\neq i} s_{hj}\right)\right] = \frac{W}{A_{ij}} \quad \Leftrightarrow \quad p_{ij}\underbrace{\left(1 + \varepsilon^{p}_{ij}\right)}_{\mu^{-1}_{ij}} = MC_{ij} \tag{40}$$

where MC_{ij} is the marginal cost, ε_{ij}^{p} is the residual demand elasticity, and the markup is given by:

$$\mu_{ij} = \frac{p_{ij}}{MC_{ij}} = \left[1 - \frac{1}{\eta} + \left(\frac{1}{\eta} - \frac{1}{\theta}\right)\left(s_{ij} + \alpha \sum_{h \neq i} s_{hj}\right)\right]^{-1} \tag{41}$$

The sales shares s_{ij} could be computed by the following equation,

$$s_{ij} = \frac{p_{ij} y_{ij}}{\sum_i p_{ij} y_{ij}} = \frac{\left[\frac{1}{\left[1-\frac{1}{\eta}+\left(\frac{1}{\eta}-\frac{1}{\theta}\right)\left(s_{ij}+\alpha \sum_{h\neq i} s_{hj}\right)\right] A_{ij}}\right]^{1-\eta}}{\sum_q \left[\frac{1}{\left[1-\frac{1}{\eta}+\left(\frac{1}{\eta}-\frac{1}{\theta}\right)\left(s_{qj}+\alpha \sum_{h\neq q} s_{hj}\right)\right] A_{qj}}\right]^{1-\eta}}. \tag{42}$$

Where q is the firms in market j. This equation shows us that, after introducing common ownership weights, sales shares are determined not only by productivity, preferences, but also by the weights α. Since these parameters are given ex ante, then we could numerically solve for sales shares using this equation, after which we could compute the markups μ_{ij} by equation $\mu_{ij} = \left[1 - \frac{1}{\eta} + \left(\frac{1}{\eta} - \frac{1}{\theta}\right)\left(s_{ij} + \alpha \sum_{h\neq i} s_{hj}\right)\right]^{-1}$. Equation zero could also be expressed by μ_{ij},

$$s_{ij} = \frac{\left(\frac{\mu_{ij}}{A_{ij}}\right)^{1-\eta}}{\sum_q \left(\frac{\mu_{qj}}{A_{qj}}\right)^{1-\eta}}. \tag{43}$$

Market equilibrium. We normalize aggregate price index $P = 1$, as the numeraire, by which we could immediately solve for wage after getting sales shares and markup. We can solve numerically for market shares through fixed point iteration, which gives the markups μ_{ij}.The goods market clearing gives us the equilibrium wage, it is pinned down through first order condition and price aggregates, and can be expressed as,

$$\frac{W}{P} = \left[\int_j \frac{1}{J}\left(\sum_i \frac{1}{I}\left(\frac{\mu_{ij}}{A_{ij}}\right)^{1-\eta}\right)^{\frac{1-\theta}{1-\eta}}\right]^{-\frac{1}{1-\theta}}, \tag{44}$$

Then we looked the labor market clearing, since the labor supply specification is:

$$L_s = \bar{\varphi}\left(\frac{W}{P}\right)^{\varphi} \tag{45}$$

And the labor market clearing condition,

$$L_{prod} + L_{overhead} = L_s \tag{46}$$

where labor demand, $L_{prod} = \int_j \sum_i l_{ij}$, $L_{overhead} = \int_j \sum_i \phi_{ij}$, [31] would elicit the general equilibrium results. In the first step, combining with production function $y_{ij} = A_{ij} l_{ij}$ and the demand function derived from household solution, we could firstly solve for the output Y, then secondly, individual variables would be solved.

Market Value. Given the equilibrium profits π_{ijt} and with the value of Shareholder Equity E_{ijt} from equation (4), we can calculate the value of the firm, under model **A** using equation (16) or model **B** from (17).

4.3 Comparative Statics

To understand the mechanism underlying the model, we analyze the comparative statics impact of the key parameters in the model $\alpha, \sigma_z, \phi, \mu_A, \sigma_A$ [32] and their effect on average profits, the percentiles of the profit distribution, the aggregate variables wages, output and welfare, the market value under model A and B as well as the percentiles of both market value distributions.

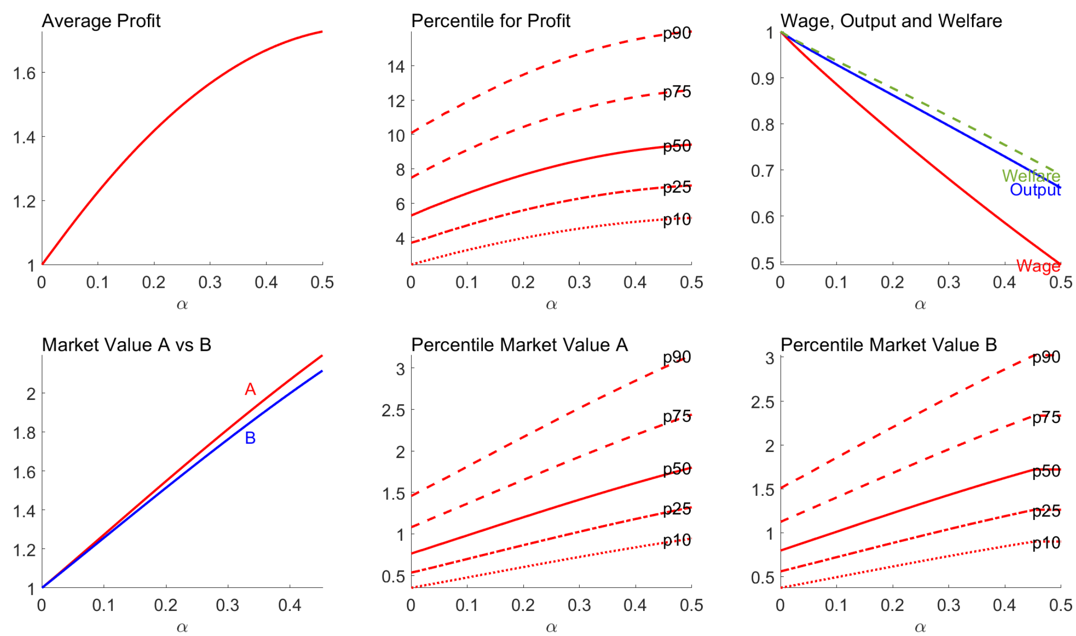

Figure 24: Comparative Statics in Common Ownership share $\alpha \in [0, 0.5]$

Notes. Average profits, market values, wages, output and welfare are normalized to 1 when $\alpha = 0$

We use the following specifications: $\alpha = 0.1, \sigma_z = 0.01, \mu_A = 4, \sigma_A = 0.1, \phi = 100, \beta = 0.9$. Share-

[31] Noticing that L_{prod} should always be positive, so ϕ_{ij} must always satisfy the following constriction, $L_s - \int_j \sum_i l_{ij} > 0$. This restriction would appear in the algorithm of solving for the model and quantitative exercise we performed.

[32] The graphs for the latter three are in Appendix Appendix D.4.

holder Equity E_t evolves according to equation (4) with $\gamma = 0.2$.[33] The firm productivity follows and AR(1) with $\rho = 0.73$ and in accordance with the setup of the model, in each period the set of competitors is randomly assigned. In each comparative statics exercise, we keep all parameters constant and vary the one parameter for which we do the comparative statics analysis.

An increase in the common ownership share α (Figure 24) leads to an increase in the average profit rate (normalized to 1 when $\alpha = 0$), as well as all percentiles of the distribution of profits, but with a minor increase in the variance of profits. Wages, output and welfare fall, due to the general equilibrium effect. The market value (under both models) is increasing in α: more common ownership leads to higher profits which in turn leads to higher stock market valuations, both via the direct effect of higher profits and the indirect effect of higher Shareholder Equity E as firms accumulate a constant fraction of profits.

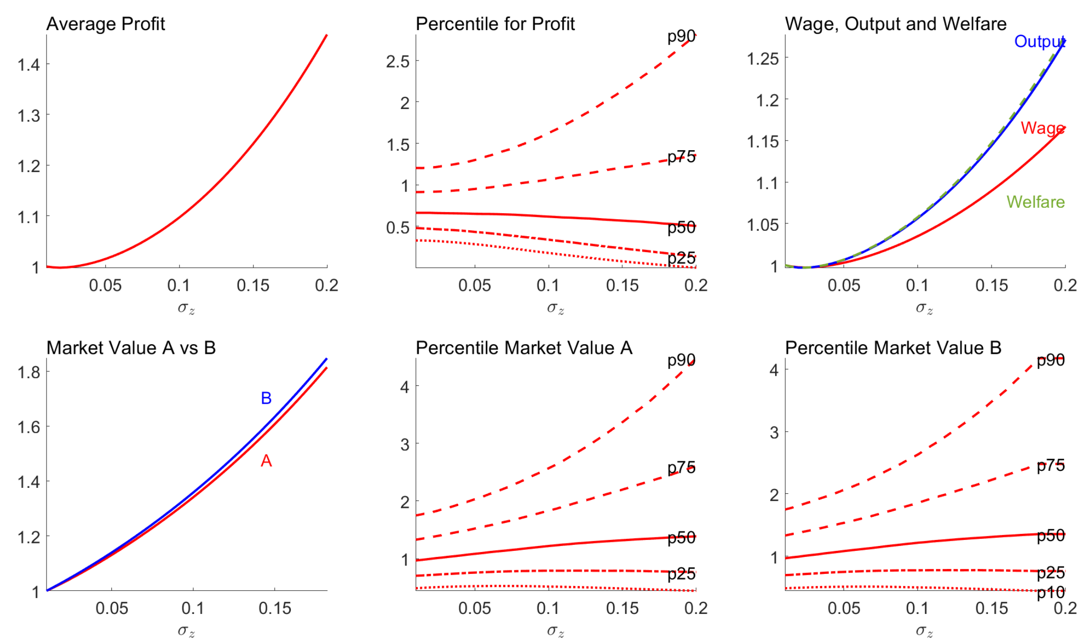

Figure 25: Standard deviation of Firm-level (log) TFP shock $\sigma_z \in [0.01, 0.2]$

Notes. Average profits, market values, wages, output and welfare are normalized to 1 when $\sigma_z = 0.01$

Figure 25 illustrates the effect of an increase in σ_z, the standard deviation of the firm-specific productivity parameter. The higher the variance in productivities between competing firms, the higher average profits as well as the higher the variance in profits, including a decline in the lower percentiles of the profit distribution. Wages, output and welfare increase: when there is more dispersion in TFP, the high productivity firms have a higher market share which is efficiency improving. The market value increases as well as the distribution of market values, especially under model A.

[33] The initial value at $t = 1$ is equal to $E_1 = 4.41\pi_1 + \min\{\pi_{ij1}\}$, based on the cross-sectional relation between E and π in

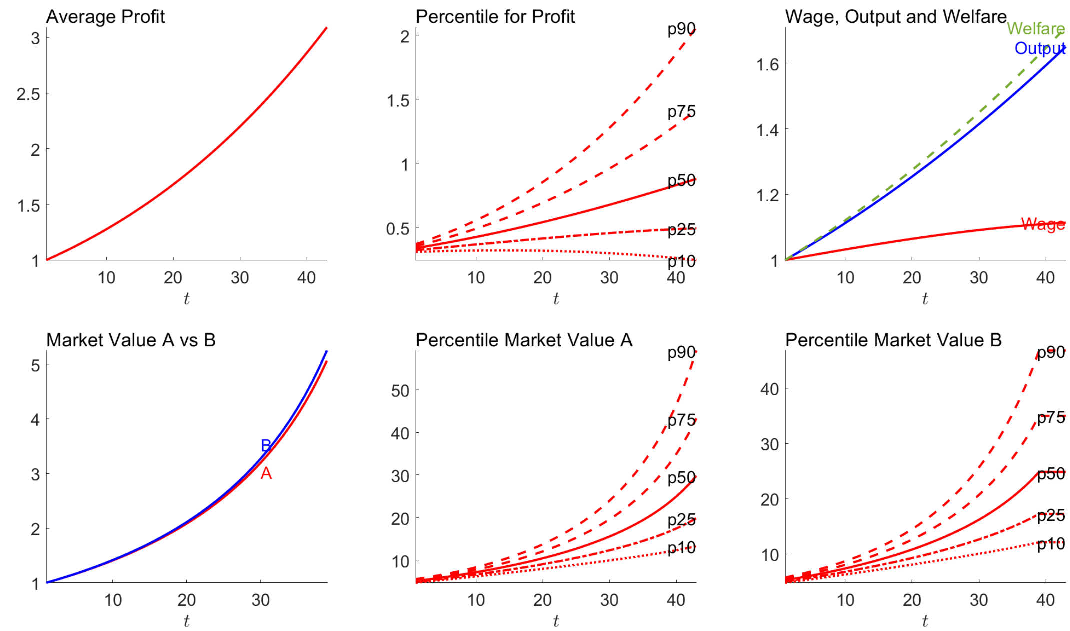

Figure 26: Time-varying, linear in t: $\alpha \in [0, 0.4]$; $\sigma_z \in [0.01, 0.15]$; $\phi \in [500, 3000]$;$\mu_A \in [9, 9.4]$; $\sigma_A \in [0.01, 0.1]$

The next comparative statics experiments aims to simulate an economy where three parameters change simultaneously, indexed by the variable $t = \{1, ..., T\}$ between 1 and 43. The idea is to consider the change in the economy between 1980 and 2022. The time-varying parameters change linearly: α from 0.1 to 0.4, σ_z from 0.01 to 0.03, and $\frac{\phi+\bar{L}}{\phi}$ from 0.15 to 0.22.[34] Figure 26 shows that profits increase by a factor 2, the variance of profits increases, while wages, output and welfare decline. This indicates that the negative welfare effect of α dominates the positive effect of an increase in σ_z.

Next, we investigate the role of retained earnings and Shareholder Equity. In the same setting as the comparative statics exercise with varying parameters α, σ_z and ϕ above, we now evaluate the market value V for different parameter value for $\gamma \in \{0, 0.2, 0.5\}$, firms either retain zero earnings, 20% as we observe on average in the data, or 50%. Figure 27 shows, not surprisingly, that over time, the value of the firm increases as γ increases. If no earnings are retained ($\gamma = 0$), the stock market value is the lowest. Most noteworthy is that γ has a sizable effect on market value.

Finally, we perform four counterfactual exercises on the model in order to disentangle the contribution of Shareholder Equity, profits and discounting to the value of a firm. After T periods where the value of firms has evolved as in Figure 26, we ask what would happen to firm value under four different scenarios, in the spirit of the counterfactuals we performed on the data using equations (20) and

the data.

[34]Those values are loosely calibrated to correspond to values we see in other work for the evolution between 1980 and 2022 (see for example De Loecker et al. (2021) and Bao et al. (2023).

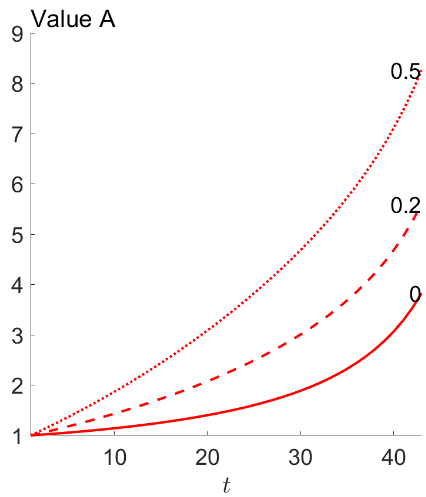

Figure 27: The value $V^{\mathbf{A}}$ for different values of $\gamma \in \{0, 0.2, 0.5\}$

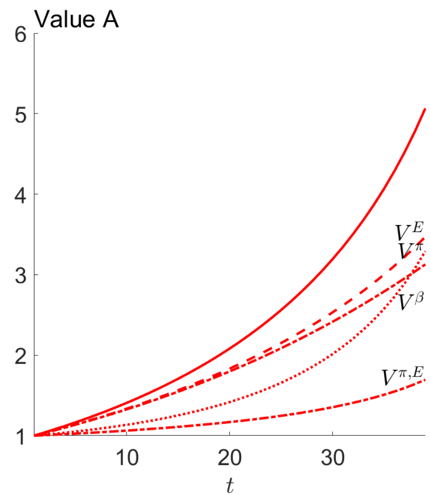

Figure 28: Four Counterfactual Firm Values (equation (47))

(21) above. But there is a difference. Above we kept all but one variable at the 1980 levels and changed the one variable. Here, we keep the one variable at its 1980 level and change all other variables.

The first scenario asks what the value of the firms would be if all profits in t were equal to the profits in $t = 1$; the second what the value would be if Shareholder Equity was at the level of the first period; the third what the value would be if the discount factor was at the level from the first period; and the fourth when both profits and Shareholder Equity were at the level of the first period and only the discount factor had changed. These four counterfactual values are given by:

$$V_t^\pi = E_t + \frac{\beta_t \pi_1}{1-\beta_t}; \qquad V_t^E = E_1 + \frac{\beta_t \pi_t}{1-\beta_t}; \qquad V_t^\beta = E_t + \frac{\beta_1 \pi_t}{1-\beta_1}; \qquad V_t^{\pi,E} = E_1 + \frac{\beta_t \pi_1}{1-\beta_t}. \tag{47}$$

Figure 28 plots these counterfactuals. Each of the counterfactuals leads to a drop in value, and the joint effect of π and E is clearly the largest.

5 Quantitative Exercise

We now estimate the model year by year using Simulated Methods of Moments (SMM). We calibrated some parameters exogenously, taken from the data or the existing literature and estimate the remaining parameters. With the series of model-generated profits we create the series of E_t for each firm using equation (4). Then together with the distribution of β's in each year backed out from data, we calculate the market values for each firm and compare the distribution of market values to that in the data. Lastly, we performed counterfactual analysis.

Parameters and moments. We exogenously calibrate the household parameters corresponding to the goods demand and labor supply, based on earlier work, as well as the user cost of capital. We take the factor share of variable inputs from the Compustat data, and we approximate the productivity persistence from measuring the persistence of profits in Compustat. We also exogenously calibrate the labor supply intercept $\bar{\varphi}$ to the level in 1980 using the labor supply function, employment and wage data. Shareholder equity evolves according to equation (32) with $\gamma_t = 0.2$. To pin down the initial value E_{ij0} for each firm in the first period (1980), we use the fit in the data between E_{ij} and π_{ij} (see Appendix C.10). We set the number of firms in each market to 16. Under common preference parameters and with Cournot competition, any number larger than 10 firms yields a virtually competitive outcome. Table 1 summarizes the exogenous parameters.

Table 1: Exogenous Parameters

Within-market demand elasticity	η	5.75	De Loecker et al. (2021)
Between-market demand elasticity	θ	1.25	De Loecker et al. (2021)
Labor supply elasticity	φ	0.25	Chetty et al. (2011)
Labor supply intercept	$\bar{\varphi}$	8×10^6	Compustat
User Costs of Capital	R	1.16	De Loecker et al. (2021)
Factor share: variable cost in total cost	ψ	0.88	Compustat
Productivity Persistence	ρ	0.73	Compustat (persistence of profits)
Retained Earnings share of Profits	γ	0.2	Compustat
Number of firms in each market	I	16	Exogenously set

We internally estimate five parameters, $\alpha, \sigma_z, \phi, \mu_A, \sigma_A$, using the five moments listed in Table 2.

Table 2: Targeted Moments and Estimated Parameters

Moment			Parameter
Average Markups (sales weighted)	μ	α	Common ownership weight
Variance of profit rate within markets	Var $\frac{\pi}{R}\vert_w$	σ_z	Productivity shock
Percentage of negative profits	$\%\pi < 0$	ϕ	Fixed costs (Overhead labor)
Average profit	π	μ_A	Market-level productivity (mean)
Variance of profit rate between markets	Var $\frac{\pi}{R}\vert_b$	σ_A	Market-level productivity (St. dev.)

All 5 moments jointly determine the 5 parameters. Informed by the comparative statics exercises above, we pick the moments to ensure that each moment identifies one parameter. The average sales-weighted markup pins down the common ownership weights α. Intuitively, since the shares other firms own in firm i substantially changes the market structure, the level of α determines average markups. The average variance in the profit rate within a market pins down the variance in the TFP shock σ_z. Higher productivity dispersion implies higher dispersion in profits and markups within a market. The average profit level is increasing with the mean of market-level productivities μ_{Aj}. Although market-level productivity doesn't affect markups, the variance of of Aj pins down profit rates between markets through the fixed cost (overhead labor and the wage). The overhead cost $W\phi Aj$ is heterogeneous across markets, implying firms in high productivity sector would face a higher fixed costs. Finally, the percentage of negative profits determines the level of the fixed cost parameter ϕ. A higher ϕ generates more negative profits in the economy.

5.1 Model fit

The model is estimated in each year. Figure 29 shows the match of the model moments to the data moments for every year between 1980 and 2022. The fit is not perfect, yet remarkably good given the stylized model of the economy.

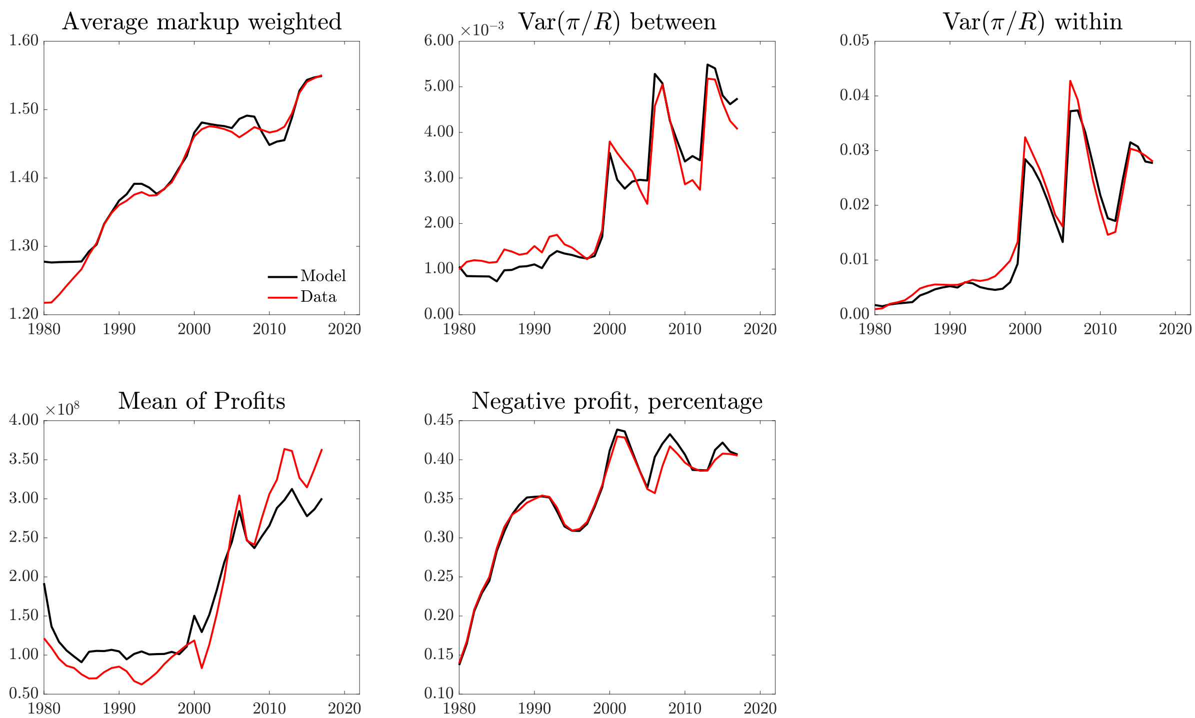

Figure 29: Match of model and data moments

Notes. We trim the variance moments at 1% and drop the data moments for the variance in the years 2000 and 2001, which is an absolute outlier due to the dotcom boom. We also stop the estimation in 2019 due to extreme observations during the COVID recession in 2020 and 2021. The sum of sales of firms with negative profits is around 10% of total sales.

The model parameters, estimated year by year, are presented in Figure 30. The parameter α represents the extent of competition in the market. The number of firms in each market is finite and goods are imperfect substitutes, so there is always some market power even if α is zero. The estimated α increases from close to zero in 1980 to 0.2 in 2022. As a rule of thumb, α roughly corresponds to competition between α^{-1} firms. In 2022, there is competition between 5 firms, compared to 16 in 1980. The increase in α is responsible for the rise in markups and profits.

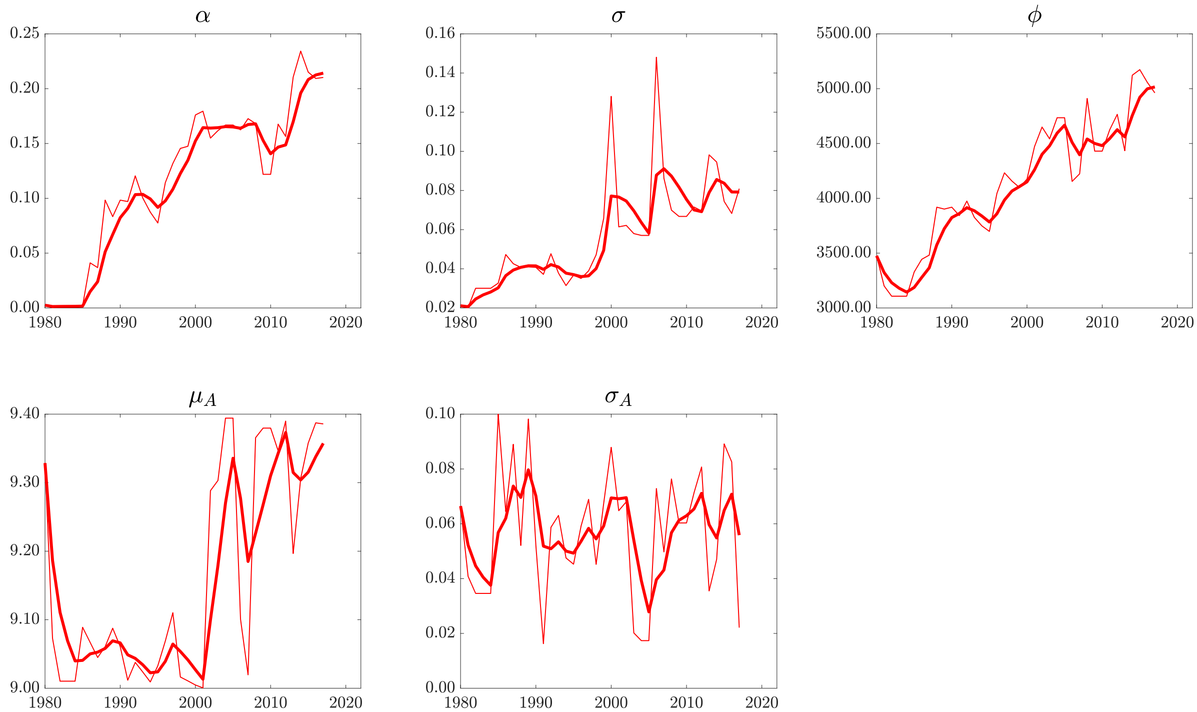

Figure 30: Estimated Parameters

Notes. The thin line represents the annual data. The solid line is the 5-year moving average.

The parameter σ_z measures the dispersion in TFP within a market. Higher dispersion leads to higher dispersion in markups and profits within a market. The estimated value of σ_z is increasing (and volatile) to capture the rising variance of profit rates within a market.

The estimated parameter ϕ that governs the fixed costs (overhead labor) is increasing between 1980 and 2000, and then moderately declines and stagnates. This parameter does not capture the total fixed cost, which is determined by $WA_j\pi$. Given an increase in W and in the average A_j, the fixed cost increases even if ϕ is constant or falls moderately.

The market level average productivity is governed by the parameter μ_A, the estimate of which initially decreases until the mid 1990s and then increases. This productivity parameter captures economy-wide growth. The parameter governing the variance σ_A fluctuates and has a mildly increasing trend, indicating that heterogeneity between markets increases over the duration of the sample.

5.2 Counterfactuals

With the parameter estimates in hand, it is not possible to perform counterfactuals. Specifically, in each year, we calculate the mean profit and the market value (using model $\mathbf{B}(T)$) where all parameters take

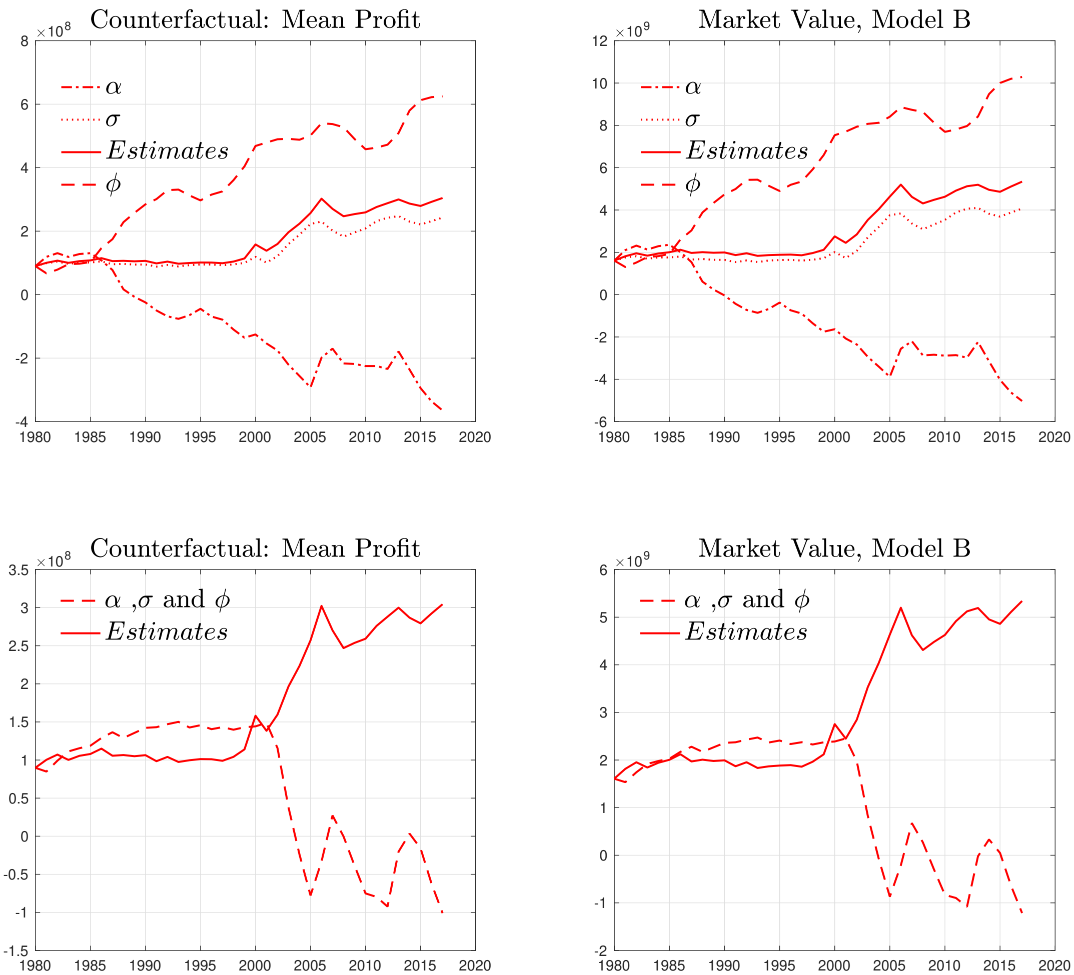

Figure 31: Counterfactual analysis. In each year we keep all the estimated parameters for that year, except one: α, σ_z and ϕ.

Notes. 5-year moving average.

the estimated value, except one. In the top two panels of Figure 31, we plot mean profits as well as the market value when either $\alpha, sigma_z$ or ϕ changes.

The largest effect on profits and market value stems from the keeping α and ϕ at the level from 1980, with a negative effect on profits from imputing α from 1980 when there is more competition. This also implies lower stock market valuations. Imputing the low fixed costs ϕ from 1980 leads to a rise in profits and stock market valuations. It is important to note here that we don't have entry, as in De Loecker et al. (2021).

The effect of imputing the lower dispersion from 1980 in the productivity distribution σ_z has a minor (negative) effect on profits and stock market valuations. Lower dispersion leads to lower market power and hence lower profits.

In the bottom two panels of Figure 31 we evaluate the three effects jointly. The effect of α dominates over the effect of ϕ, resulting in a lower counterfactual average profit and market value.

6 Discussion

I finish with a discussion of two issues. First, the evolution of the value and profits of firms in the global economy, comparing different continents. Second, I compare the backed out subjective discount factors to those obtained in other work.

6.1 Global: Value and Profits around the Globe

Using the Worldscope data that collects information on publicly traded firms around the world for 118,104 firms in 160 countries between 1980 and 2022, I compare the evolution of market value and profit of global firms (see Appendix C.2). The main insights are the following.

First, the same patterns arise for the sample of global firms as those traded on the US exchanges (Figure C.1). The main difference is that the rise in market value is less pronounced globally, an increase by factor 5-6 rather than factor 9-10 for the US. There is also a more moderate increase in the variance of the value, especially of the top firms. Likewise, there is an increase in profits, but more moderately, by factor 2 rather than factor 3 in the US (Figure C.2).

Focusing on the continents, Europe, North America, Asia and Oceania, we see that the patterns for market values (Figure C.3) in Europa and North America are quite similar, slightly lower than the US, and that the rise of market values in Asia and Oceania is substantially less pronounced. This is also the case for the trend in profits (Figure C.4). Europe and North America show an increase in profits by a factor of 3, in line with the US, whereas Asia and Oceania se an increase by a factor 2.

Some caution is due interpreting the geography of publicly traded firms. In the Compustat data for US firms, 40% of the activity is not domestic. Many of the dominant firms are global firms that are active on all continents. Their historical origin or postal address does not necessarily tell us much about the where their economic activity takes place, where there customers are and where their employees reside and where production takes place. Moreover, many firms trade on multiple exchanges on multiple continents. Recent work by Atkeson, Heathcote, and Perri (2022) documents that there is global coordination towards trading stocks on US exchanges, with huge implications for the US Balance of Payments. From a welfare point of view, it is probably best to consider those firms global firms rather than geographically differentiated firms.

6.2 Increasing Subjective Discount Factors

The subjective discount factors that we back out from the model are fairly constant over the last four decades. There are fluctuations, with possibly a moderate increase over that period. Instead, the work by Farhi and Gourio (2018) and Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019) finds declining subjective discount factors. Unlike the risk-free discount factor which we observe in the data – and which is increasing, i.e., the risk-free interest rate is decreasing –, the subjective Because it is a latent variable. Because we do not directly measure it, the subjective discount factor is model-specific.

Farhi and Gourio (2018) construct a neoclassical growth model with Epstein-Zin preferences, inelastic labor supply, CES final goods aggregates, a Cobb-Douglas production function and stochastic productivity. Within this model they derive the spread between the marginal product of capital and the risk-free interests rate as as

$$MPK - r^F = \delta + g_Q + \frac{\mu - 1}{\alpha}\left(r^* + \delta + g_Q\right) + r^* - r^F,$$

where δ is the depreciation rate, g_Q is the rate of growth of investment-specific technical progress, μ is the markup, α is the Cobb-Douglas coefficient on capital, and r^* is a composite parameter including the expectation of stochastic discounting. They estimate the parameters of the model and then find that for the estimated model, the implied subjective discount factor is increasing. Even though MPK increases, r^F decreases more, leading to a decreasing equity premium $MPK - r^F$.

Jordà et al. (2019) compute the total nominal return R for asset j in country i at time t as

$$R^j_{i,t} = \frac{P^j_{i,t} - P^j_{i,t-1}}{P^j_{i,t-1}} + Y^j_{i,t}$$

where P is the price of asset and Y is the yield rate. Then the real return is

$$r^j_{i,t} = \frac{1 + R^j_{i,t}}{1 + \Pi^j_{i,t}} - 1.$$

where Π is the inflation rate. This equation can be derived immediately from equation (1). There are two reasons why the subjective discount factor that we back out differs. First, we back it out at the level of the firm and then take the average. Second, we use profits (equation (2)), not dividends to back out the subjective discount factor.

7 Conclusion

How much of the rise in firm values is due to the rise in profits? This paper aims to answer this question by decomposing firm level stock market values into the contribution from profits (past and future) and discounting. Discounting contributes 20%. Of the remainder, equal shares are due to past profits (retained earnings) and expected future profits. As a result, if the profit level today suddenly dropped to levels from the 1980s, the average stock market value would be 40% lower. And if profits had never risen and had stayed at the 1980s level for the past 4 decades, the counterfactual stock market level would be 80% lower as far less earnings would have been retained.

Profits and retained earnings provide a measure of the flow of earnings that is easy to measure, contemporaneous and precise. It does not suffer from the measurement problems that arise with dividends. Dividends are backloaded, volatile, and they only partially reflect firm performance since on average only 45% of profits are paid out in dividends.

I build a model of the economy with imperfect competition and estimate it to match key moments on the profitability of US publicly traded firms. The main drivers of the increase in profits and firm value since the 1980s are fixed cost and the market structure. I analyze the welfare implications and perform counterfactual analysis to gauge the impact of changes in the market structure or the technology. Policies that can change these determinants would have substantial implications on the stock market and on welfare. The key insight here is the large redistribution from shareholders to consumers and workers. The net effect on welfare is positive because competition policy reduces the deadweight loss from market power.

This analysis shows that effective competition policy poses a substantial policy risk on shareholders. The immediate impact on firm value is potentially large, and even larger in the long run when retained earnings are dissipated. Yet, such redistribution raises efficiency.

Online Appendix

Appendix A An Illustrative Example

This example illustrates that the value of the firm depends both on the expected future profits as well as on the accumulated shareholder equity E which are past profits.

Table A.1: Example of firm with $\gamma = 0$ and 1

	t=1	t=2	t=3
Operating Profit	200	350	350
Investment	200	0	0
Depreciation	0	100	100
		$\gamma = 0$	
Loan	200	0	-200
E	0	0	0
Interest (5%)	0	-10	-10
Accounting Profit	200	240	240
Dividend	200	240	240
Value	680	480	240
		$\gamma = 1$	
Loan	0	0	0
E	200	450	713
Interest (5%)	0	0	13
Accounting Profit	200	250	263
Dividend	0	0	713
Value	713	713	713

Note. Firm Value is calculated *before* dividends are paid out. Investors do not discount ($\beta = 1$). In scenario 2 with $\gamma = 1$, the firm uses 200 of its equity to finance the investment, and obtains a 5% return on the remainder 450-200 = 250 that it deposits in the bank, , or a return of 12.5. Rounded to the nearest integer.

Consider a firm that lives for 3 periods with an operating profit (revenue minus cost) of 200 in period 1. It has an investment opportunity to increase operating profit by 150 for 2 periods at a cost of 200 (with annual depreciation of 100). There are two scenarios:

1. $\gamma = 0$: The firm finances the investment via a loan and pays out all profits in dividends
2. $\gamma = 1$: The firm retains all earnings and uses profits to finance the investment (or get a 5% return from the bank)

The flow of funds and the corresponding implied market value (evaluated before dividends are paid out) is listed in Table A.1. For simplicity and without loss, investors do not discount (i.e., $\beta = 1$).

The value of the firm in scenario 1 is then the sum of future profits only, since there is no shareholder equity: $V_1 = 200 + 240 + 240; V_2 = 240 + 240; V_3 = 240$. In scenario 2, the value is the sum of E and future profits: $V_1 = E_1 + \pi_2 + \pi_3 = 200 + 250 + 263; V_2 = E_2 + \pi_3 = 450 + 263; V_3 = E_3 = 713$

The value of the firm at the start is different between the two scenarios because of the interest payments: in scenario 1 the firm pays a total of 20 in interests and in scenario two, it receives a total of 13 in interest; the sum 33 is the difference between the two valuations.

The value in scenario 1 then declines because the dividends are paid out as profits realize. In period $t = 3$, the value of the firm is equal to the last remaining dividend of 240. Instead, in scenario 2, the value is constant since no dividend is paid out until the end.

Appendix B Data

Appendix B.1 Description

Compustat. We obtain firm-level financial variables of U.S. publicly listed companies active at any point during the period 1958-2022. We access the Compustat North America Fundamentals Annual and download the annual accounts for all companies through WRDS on April 15, 2024. We exclude firms that do not report their market values ($MKVALT$) and profit (NI). All financial variables are deflated with the appropriate deflators. We clean the dataset through the following steps ONLY when we compute markups: (1) we drop all firms that do not report sales, COGS, or SG&A; (2) We eliminate firms with SALE-COGS ratios in the top 1% and bottom 1%; (3) we eliminate firms with the ratio of COGS to total cost[35] in the top 1% and bottom 1%, where the percentiles are computed for each year separately. We use the output elasticity of input calculated by De Loecker et al. (2020), which provides data up to 2016. Consequently, for computing markups from 2017 to 2022, we continue to apply the elasticity values in 2016.

Worldscope. We obtain detailed financial statement data and profile data on public companies globally from 1980 to 2022. We access the Worldscope Fundamentals Annual and download the data for all companies through WRDS on April 25, 2024. We exclude countries experiencing hyperinflation during the period, like Zimbabwe and Venezuela, and countries where the firm data has obvious statistical errors, like Brazil where several firms have market values of more than one trillion dollars in the dataset of 1992.

[35] Here we define this ratio in two ways - the first one is COGS/(COGS + SG&A) and the second one is COGS/(COGS + SG&A + rK), where r is the user cost of capital and K is total tangible capital ($PPEGT$). We eliminate firms with either of these two ratios in the top 1% and bottom 1%.

U.S. Bureau of Economic Analysis (BEA) data. We download data from BEA to compute deflators and aggregate-level free cash flow. The data is public and available on BEA's webpage.

Federal Reserve Economic Data (FRED). We download data from FRED to compute risk free interest rate and user cost of capital. The data is public and available on FRED's webpage.

Appendix C Other Figures

Appendix C.1 Market Value and Profit of Top 7 Firms

Table C.2: Market value and Profits of top 7 firms in 2023

		Market Value		Profits		Market Value Increase	
		trillion $	Share	trillion $	Share	trillion $	Share
1	Apple	2.99	5.89%	0.097	3.68%	0.93	9.06%
2	Microsoft	2.79	5.49%	0.072	2.75%	1.01	9.83%
3	Alphabet	1.76	3.47%	0.074	2.80%	0.61	5.94%
4	Amazon	1.57	3.09%	0.030	1.15%	0.71	6.91%
5	Nvidia	1.22	2.40%	0.030	1.13%	0.86	8.37%
6	Meta	0.91	1.79%	0.039	1.48%	0.59	5.74%
7	Tesla	0.79	1.56%	0.015	0.57%	0.40	3.89%
Total		12.03	23.69%	0.357	13.57%	5.11	49.76%

Note. Market Values on December 31, 2023; Share: firm market value as a share of the total market value of all publicly traded firms in Compustat; Increase between December 31, 2022 and December 31, 2023; Share: firm's increase in market value as a share of the total increase of all publicly traded firms in the Compustat sample.

Appendix C.2 Global Market Value and Profit

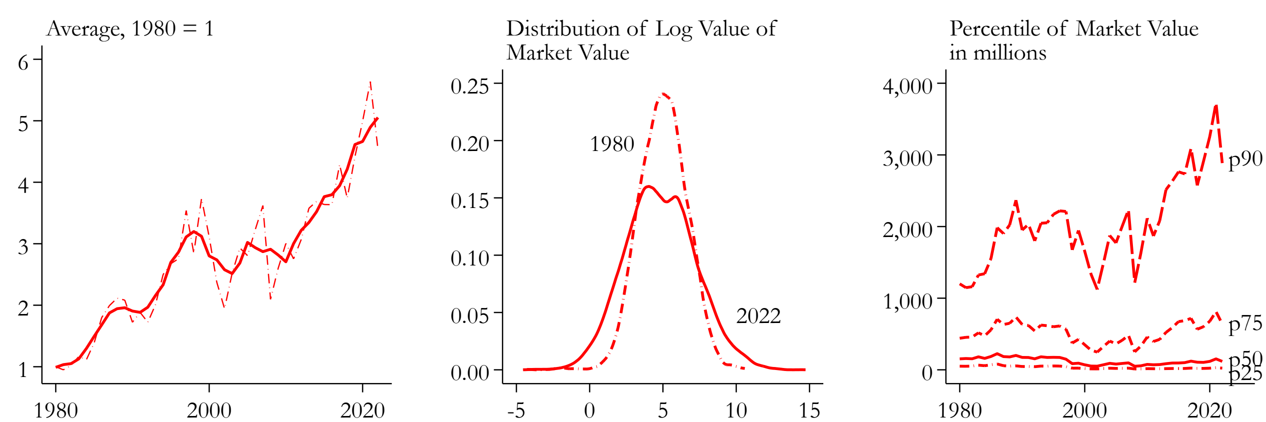

Figure C.1: Global Market Value over time: average (1980=1) and distribution

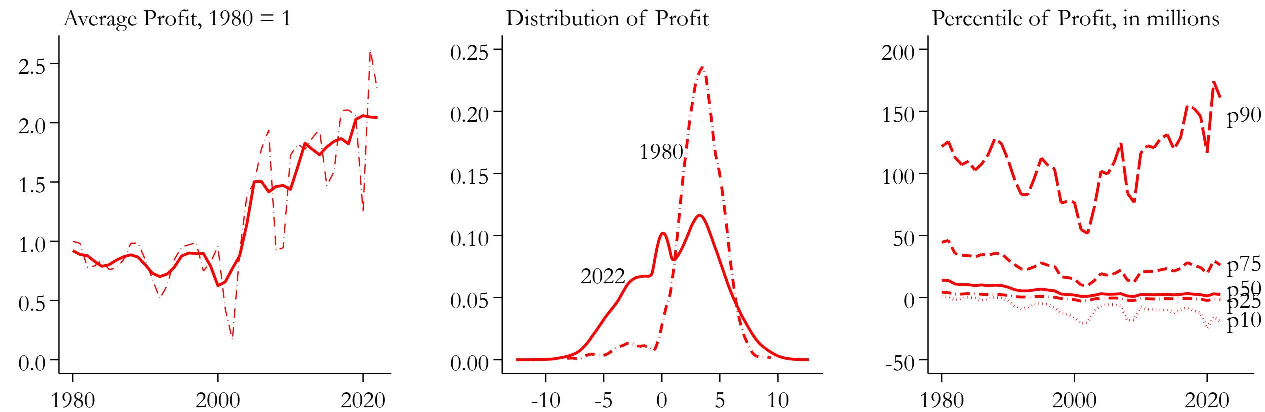

Figure C.2: Global Profit over time: average (1980=1) and distribution

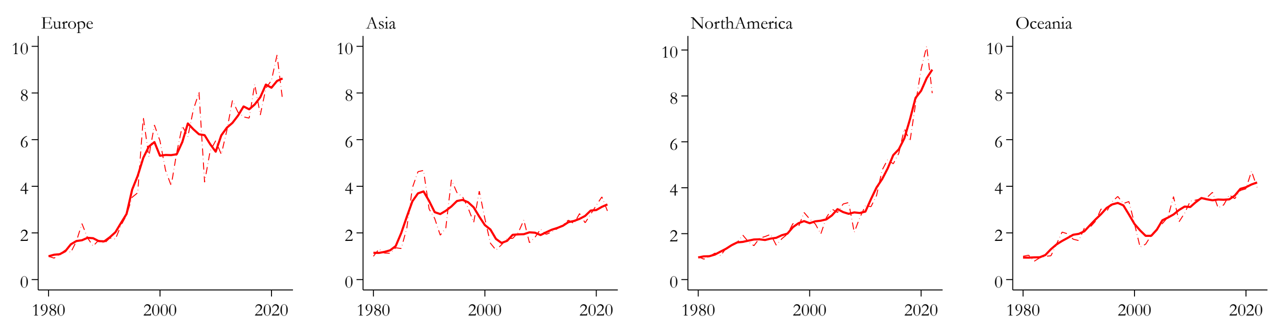

Figure C.3: Average Market value in different continents, 1980 = 1

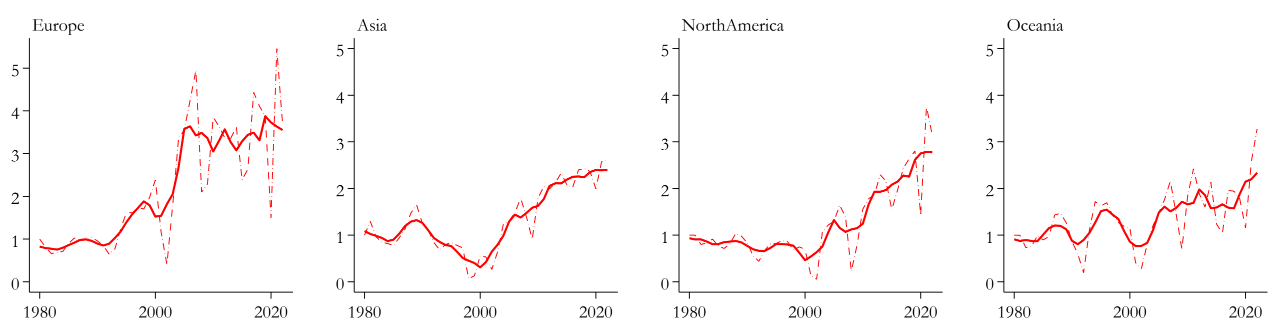

Figure C.4: Average Profit in different continents, 1980 = 1

Appendix C.3 Total market value

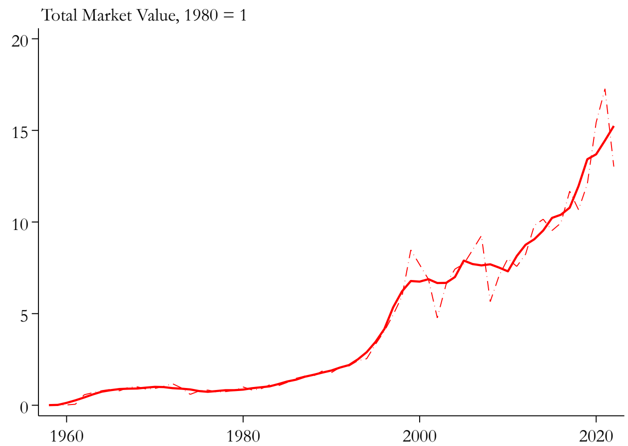

Figure C.5: Total market value over time, 1980 = 1

Appendix C.4 Percentiles of market value and profit, normalize to 1 in 1980

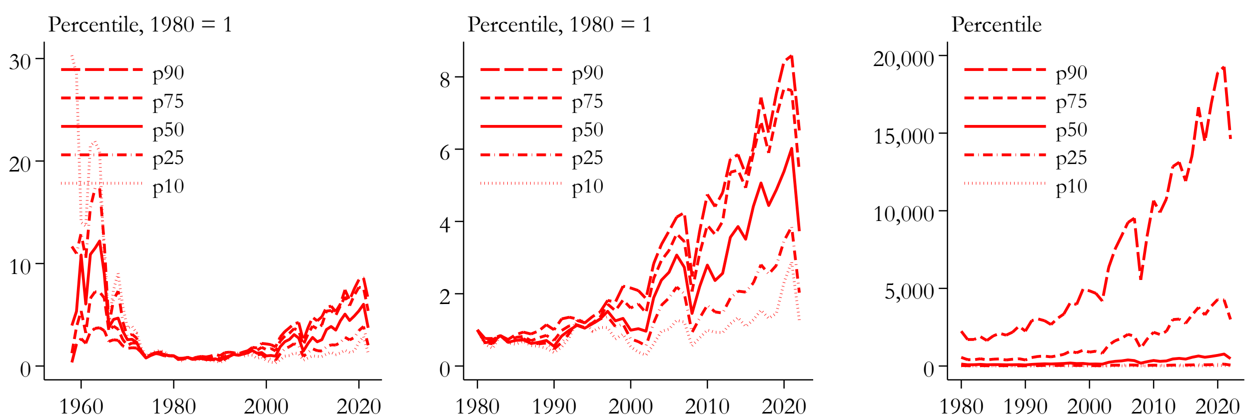

Figure C.6: Percentiles of market value

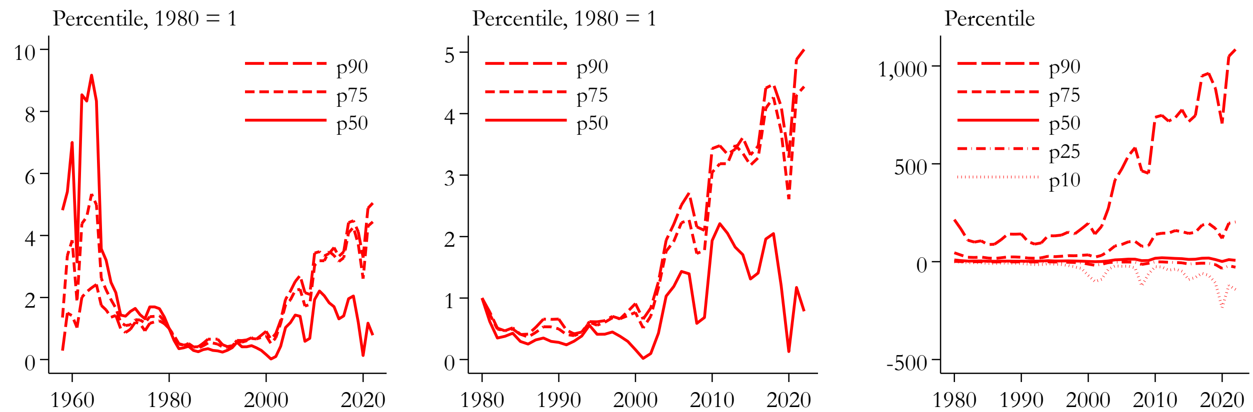

Figure C.7: Percentiles of profit (no p25 and p10 for left and middle panel due to negative profits)

Appendix C.5 Alternative economic profit and profit rate

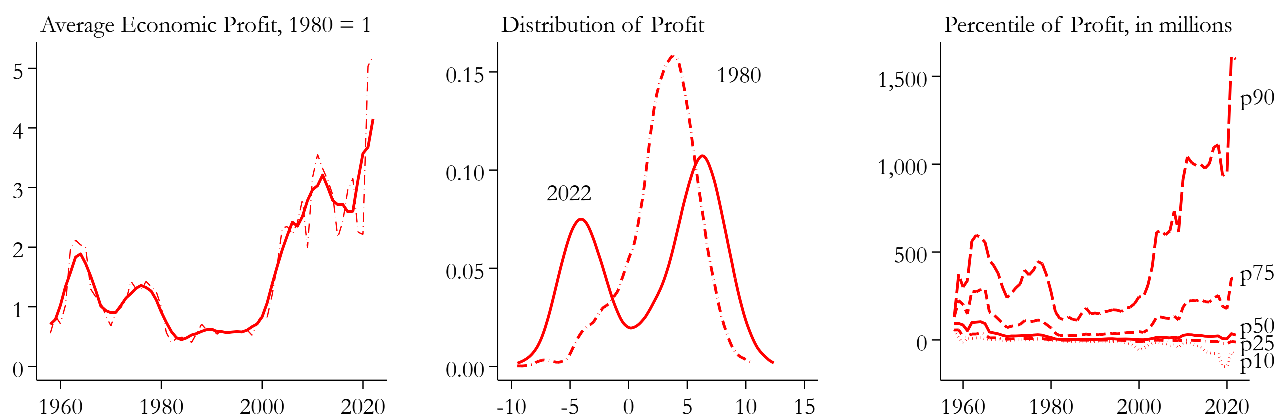

Figure C.8: Alternative economic profit π^E over time: average (1980=1) and distribution

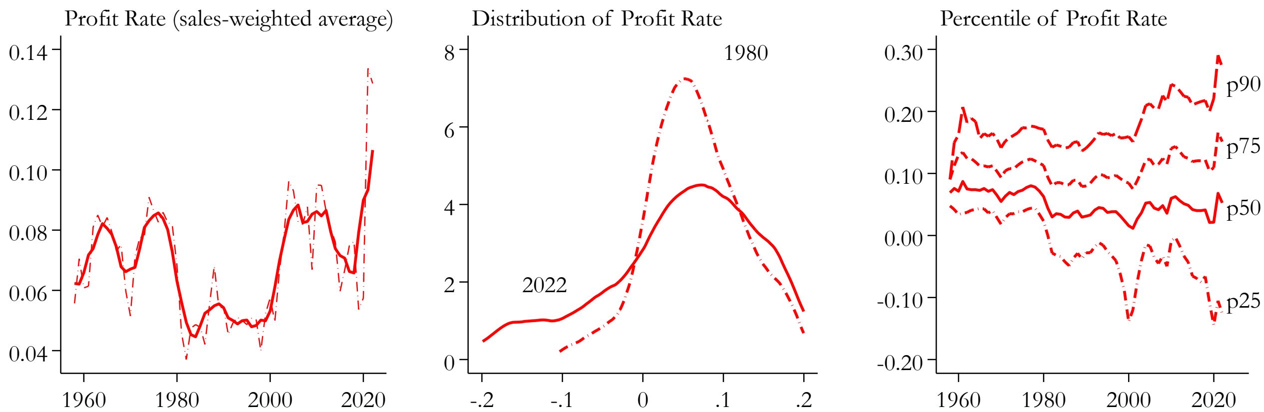

Figure C.9: Alternative economic profit rate $\frac{\pi^E}{R}$ over time: average (1980=1) and distribution

Appendix C.6 Book Value

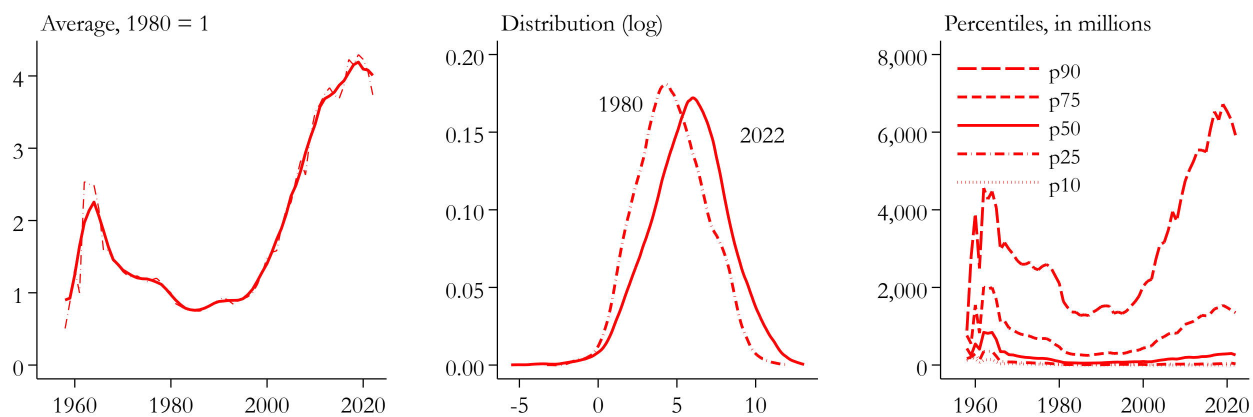

Figure C.10: Book Value ($BKVAL_{it}$) over time: average and distribution

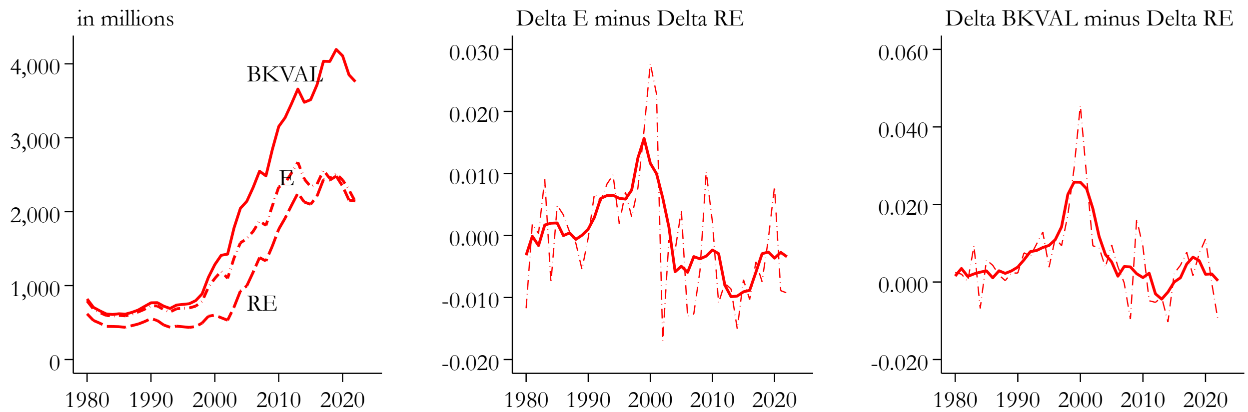

Figure C.11: Average $BKVAL$, E and RE, together with $\Delta E_{it} - \Delta RE_{it}$ and $\Delta BKVAL_{it} - \Delta RE_{it}$ as a ratio of total assets over time

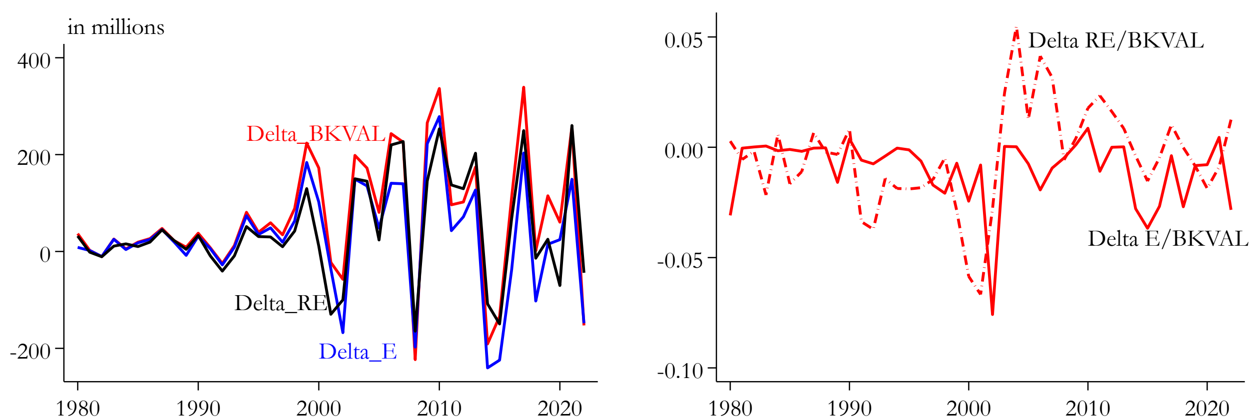

Figure C.12: Average $\Delta BKVAL, \Delta RE, \Delta E$ (left panel) and average $\Delta \frac{\sum RE}{\sum BKVAL}, \Delta \frac{\sum E}{\sum BKVAL}$ over time (right panel)

Appendix C.7 Shareholder Equity, Retained Earnings and Bookvalue

Appendix C.8 Goodwill

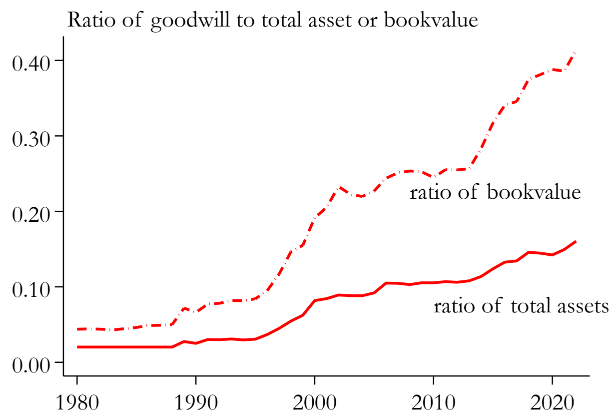

Figure C.13: Goodwill as a ratio of total assets and as a ratio of bookvalue

Appendix C.9 Shareholder Equity and Book Value as a share of Total Assets.

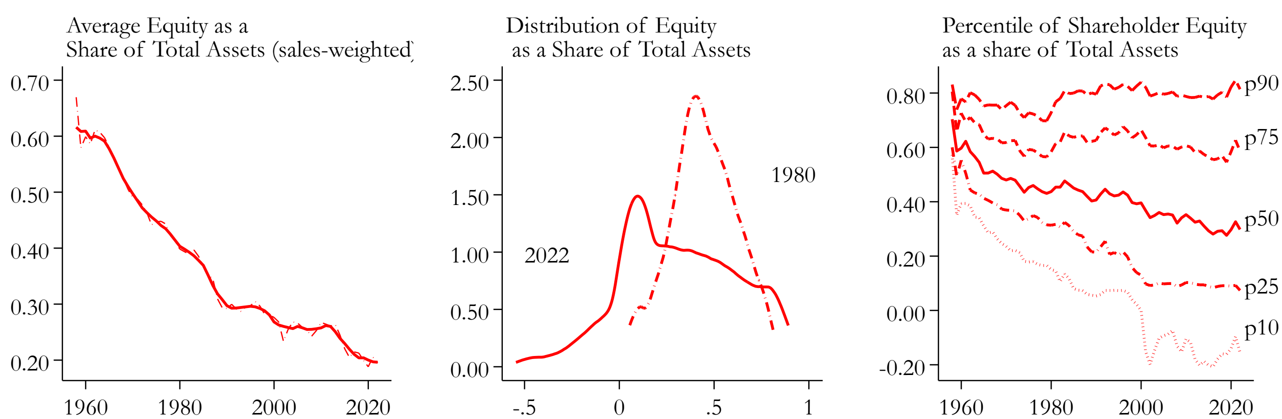

Figure C.14: Shareholder Equity as a share of total assets less goodwill $\frac{E_{it}}{E_{it}+D_{it}}$ over time: average and distribution

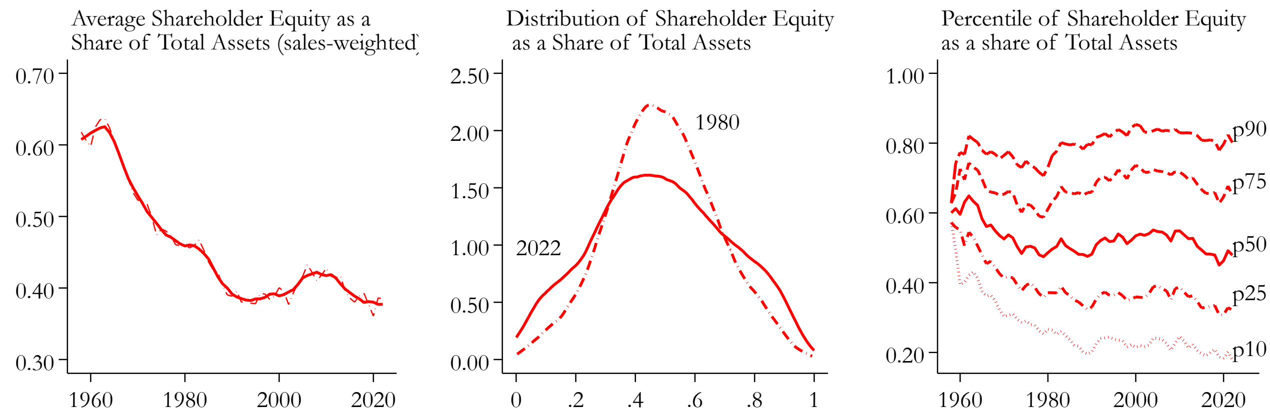

Figure C.15: $BKVAL_{it}$ as a share of total assets $\frac{BKVAL_{it}}{BKVAL_{it}+D_{it}}$ over time: average and distribution

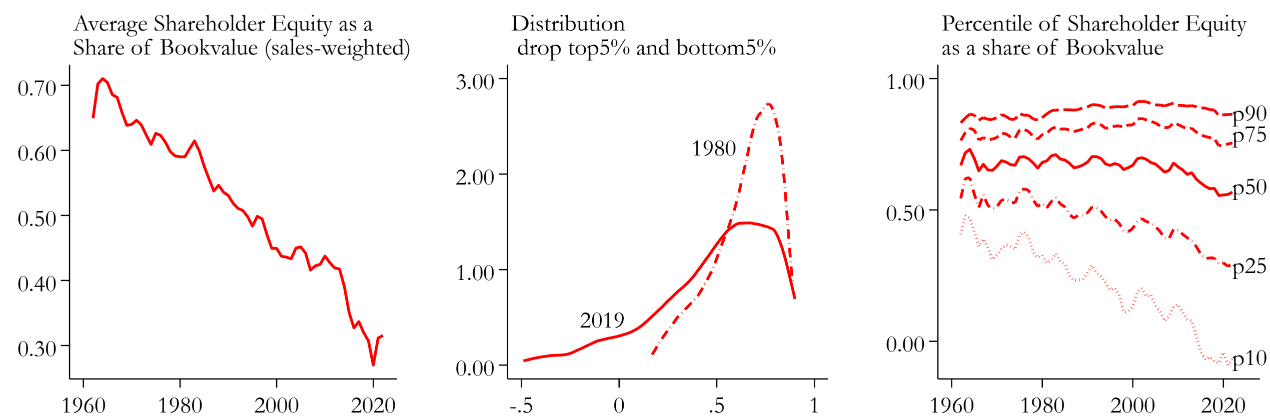

Figure C.16: Equity E_{it} as a share of total physical capital, intangible capital (both derived using PIM), Current Assets less Debt over time: average and distribution

Note that the plot of Bookvalue as a share of Total Assets is in Figure C.15 as well as the plot of Shareholder Equity as a share of total capital computed using the Permanent Inventory Method is in Figure C.16.

Appendix C.10 The relationship between E and π.

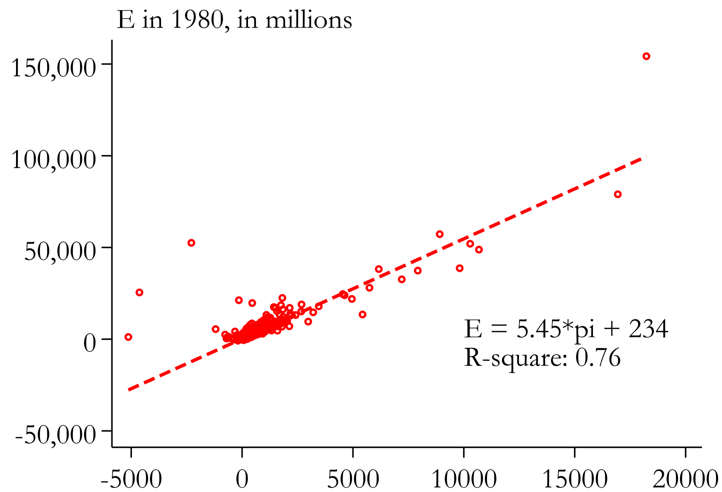

Figure C.17: Linear regression of E on π in 1980

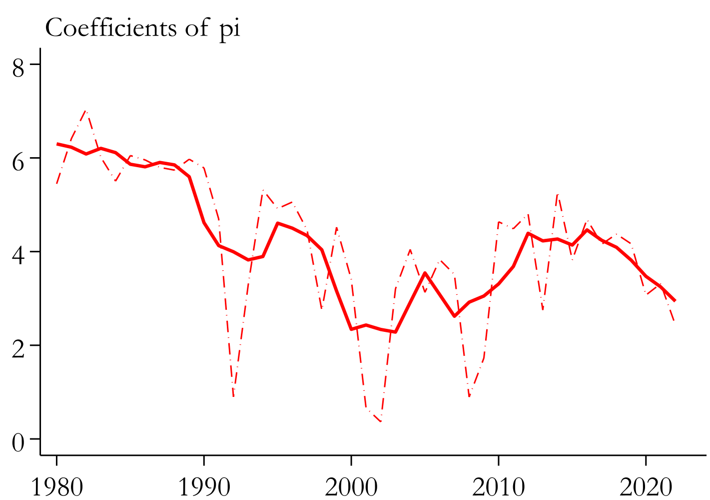

Figure C.18: Coefficients of the linear regression over time

Appendix C.11 EBIT as a profit measure

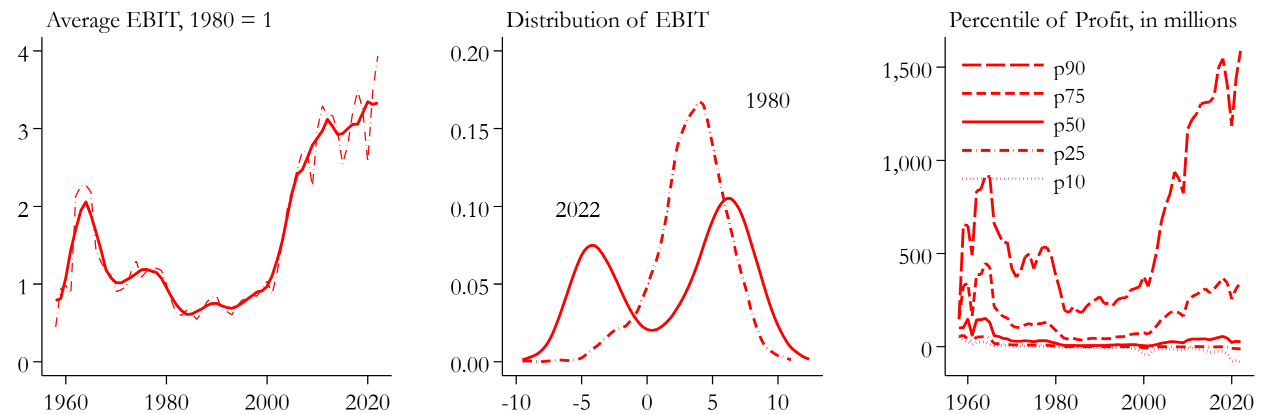

Figure C.19: Accounting EBIT over time: average and distribution

Notes. For the left panel, the solid line is the 5-year moving average of the average EBIT and the thin line is the annual average EBIT. For the middle panel, profits are on a log scale, and we use the Inverse Hyperbolic Sine (IHS) tranformation to deal with the log of negatives profits.

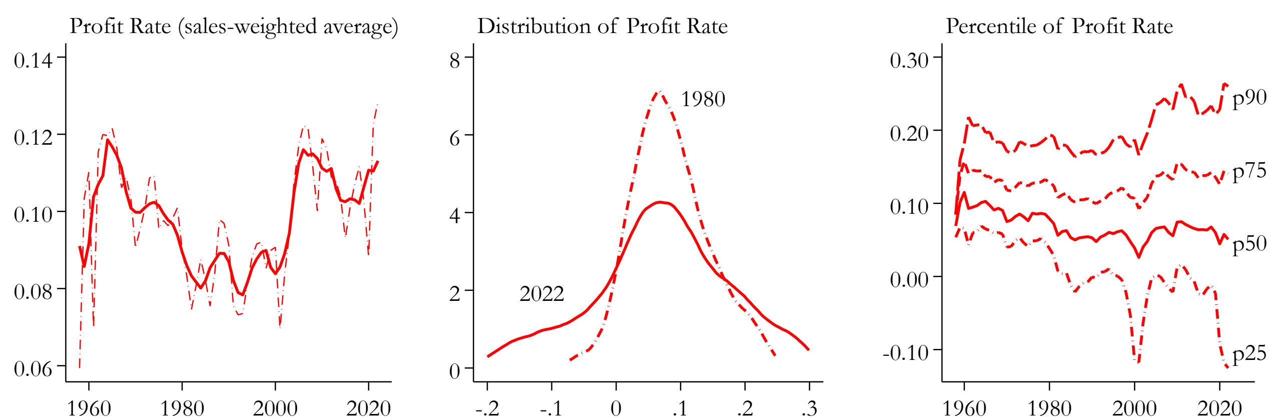

Figure C.20: Accounting Profit rate $\frac{EBIT}{R}$ over time: sales-weighted average and distribution

Notes. For the left panel, the solid line is the 5-year moving average of $\frac{EBIT}{R}$ and the thin line is the annual $\frac{EBIT}{R}$. For the middle panel, we limit the range of profit rate within [-0.2, 0.2].

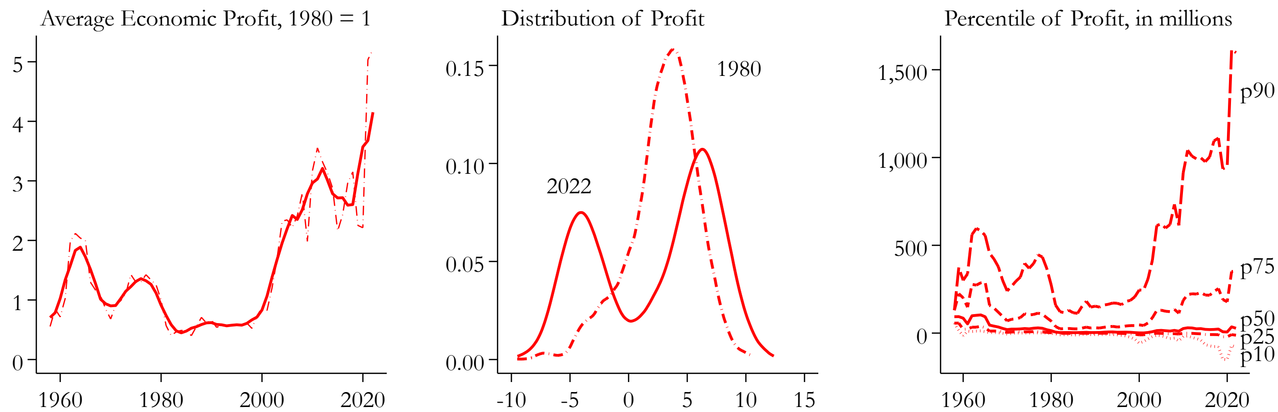

Figure C.21: Economic profits π^{E2} over time: average and distribution

Notes. For the left panel, the solid line is the 5-year moving average of the average profit and the thin line is the annual average profit. For the middle panel, profits are on a log scale, and we use the Inverse Hyperbolic Sine (IHS) tranformation to deal with the log of negatives profits.

Appendix C.12 $\frac{\sum_i \pi_i}{\sum_i R_i}$, $\frac{\sum_i \Delta RE_i}{\sum_i R_i}$, $\frac{\sum_i (\pi_i - \Delta RE_i)}{\sum_i R_i}$ and γ by age (full-age sample)

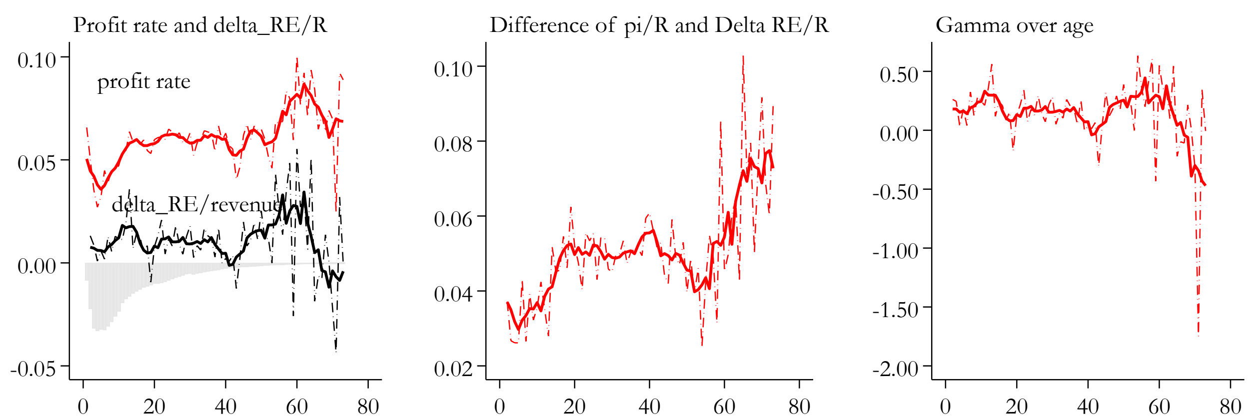

Figure C.22: $\frac{\sum_i \pi_i}{\sum_i R_i}$, $\frac{\sum_i \Delta RE_i}{\sum_i R_i}$, $\frac{\sum_i (\pi_i - \Delta RE_i)}{\sum_i R_i}$ and γ by age, 5-age MA. The grey area is the histogram of the number of firms by firm age

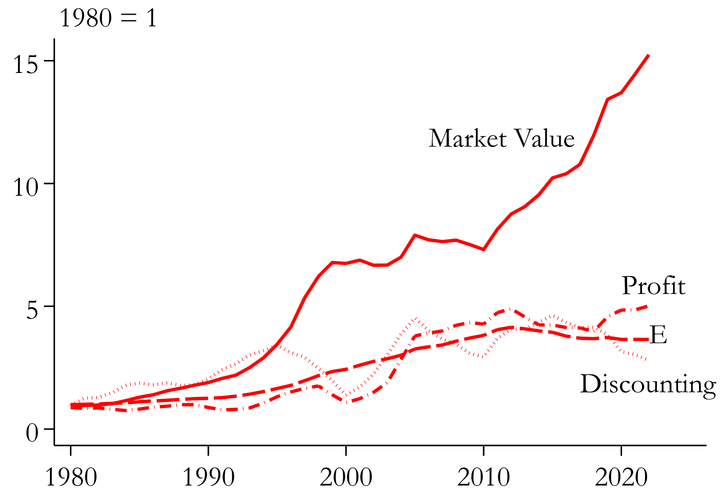

Figure C.23: Trend of total V, π, E and $\frac{1}{1-\beta_t^F \beta_t^S}$ (where β_t^S is the median from model **A**)

Appendix C.13 Trend of total V, π, E and $\frac{1}{1-\beta_t^F \beta_t^S}$

Appendix C.14 Real total market value and four counterfactual market value

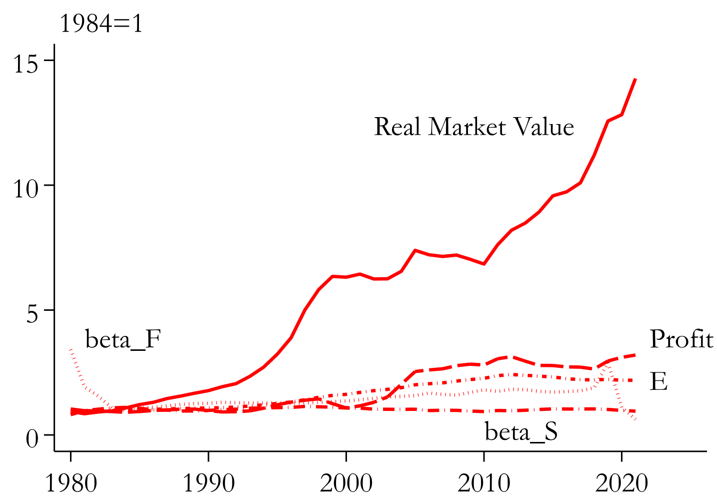

Figure C.24: Real total market value and four counterfactual market value over time, 5-year moving average (Model **A**, aggregate level)

Appendix C.15 Alternative way to compute counterfactual market value

We also construct other measures fixing only one component at their 1980 level, while varying other component. In particular, we construct the following four counterfactual market values in model **A**:

$$V_t^E = \beta_t^F \beta_t^S \frac{\pi_t}{1-\beta_t^F\beta_t^S} + E_0 \qquad V_t^{\pi} = \beta_t^F \beta_t^S \frac{\pi_0}{1-\beta_t^F\beta_t^S} + E_t \tag{C.1}$$

$$V_t^{\beta^F} = \beta_0^F \beta_t^S \frac{\pi_t}{1-\beta_0^F\beta_t^S} + E_t \qquad V_t^{\beta^S} = \beta_t^F \beta_0^S \frac{\pi_t}{1-\beta_t^F\beta_0^S} + E_t \tag{C.2}$$

Then the contribution of each of the four components is defined as a percentage of the total spread between real market value and the counterfactual market value. For example, we measure the fraction of π^E in the decomposition as (and likewise for the other components):

$$\Delta V_t^{\pi} = \frac{V_t - V_t^{\pi}}{4V_t - (V_t^{\pi} + V_t^E + V_t^{\beta^F} + V_t^{\beta^S})} \tag{C.3}$$

In Figure C.25, we plot the contribution of four components on the left panel, and then view β^S and β^F as a whole and plot the contribution of profit, equity and discounting on the right panel.

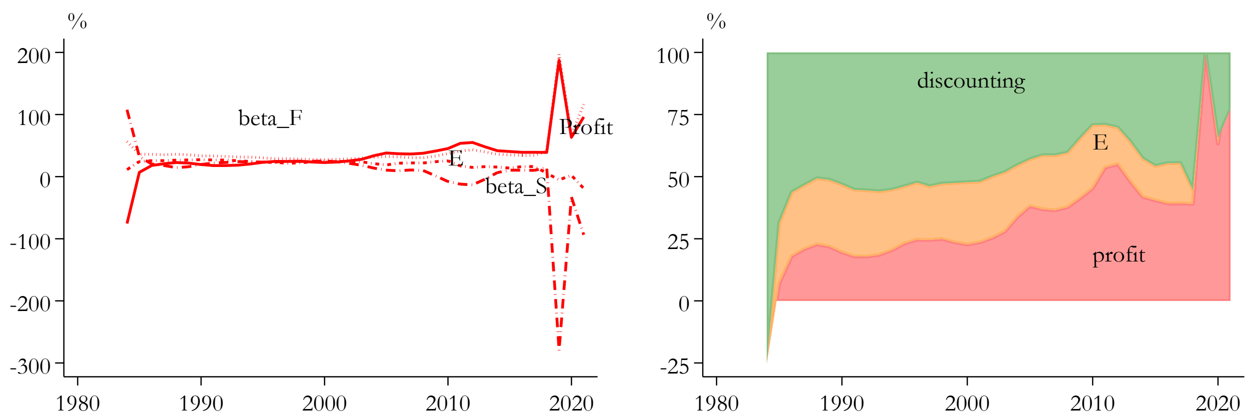

Figure C.25: Alternative way to compute counterfactual market value and contribution of different components under model **A**

In Figure C.26, we compute similar measures for model $\mathbf{B}(T)$ through the following equations and plot the contribution of different components:

$$V_t^{\pi}(\mathbf{B}(T)) = E_t + \sum_{\tau=1}^{T-1} (\beta_t^F \beta_t^S)^{\tau} \pi_{0+\tau} + (\beta_t^F \beta_t^S)^T (V_t^{\pi}(\mathbf{B}(T)) - E_t)$$
$$V_t^{E}(\mathbf{B}(T)) = E_0 + \sum_{\tau=1}^{T-1} (\beta_t^F \beta_t^S)^{\tau} \pi_{t+\tau} + (\beta_t^F \beta_t^S)^T (V_t^{\pi}(\mathbf{B}(T)) - E_0)$$
$$V_t^{\beta^F}(\mathbf{B}(T)) = E_t + \sum_{\tau=1}^{T-1} (\beta_0^F \beta_t^S)^{\tau} \pi_{t+\tau} + (\beta_0^F \beta_t^S)^T (V_t^{\pi}(\mathbf{B}(T)) - E_t)$$
$$V_t^{\beta^S}(\mathbf{B}(T)) = E_t + \sum_{\tau=1}^{T-1} (\beta_t^F \beta_0^S)^{\tau} \pi_{t+\tau} + (\beta_t^F \beta_0^S)^T (V_t^{\pi}(\mathbf{B}(T)) - E_t)$$

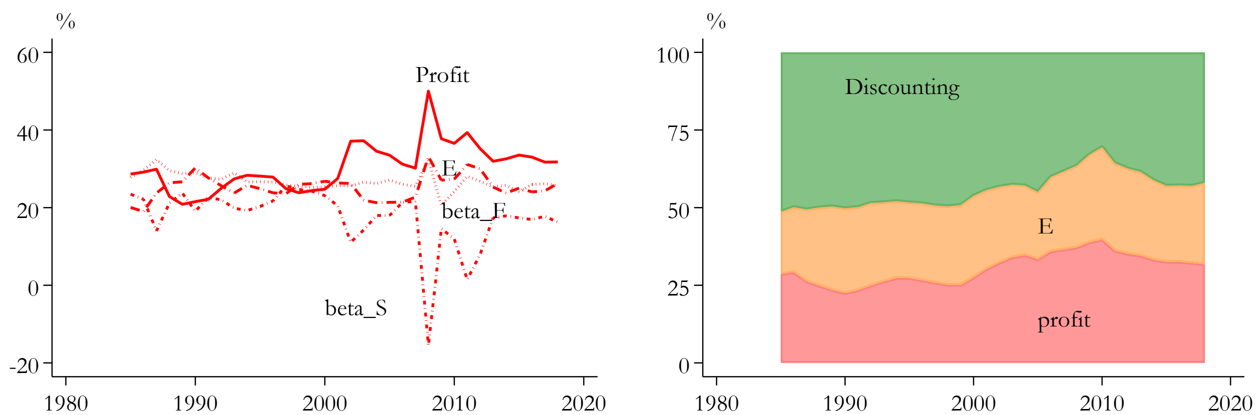

Figure C.26: Alternative way to compute counterfactual market value and contribution of different components under model $\mathbf{B}(T)$

Appendix C.16 Data: Distributed Earnings

In Compustat, Retained Earnings includes the following terms: Accumulated earnings/deficit; Additional Minimum Liability for underfunded pension plans; Appropriated retained earnings; Cumulative translation adjustments effect; Dividends paid on Employee Stock Ownership Plan (ESOP) shares; Earnings retained for use in the business - earned surplus; Employee stock ownership plan shares purchased with debt; Issuable stock; Miscellaneous notes receivable, except for subscription stock receivables; Noncorporate proprietorship; Notes receivable under stock purchase plan; Reacquired capital stock; Reserve for self insurance; Reserve for shares to be issued when included in the Equity section of the Balance Sheet; Stock options, warrants, and rights; Unappropriated retained earnings; Unrealized gain/loss on investments. And it excludes the following terms: Notes receivable under all Common/Ordinary Stock (Capital) purchase plans, including stock purchase plans, included in Capital

Surplus; Notes receivable under all preferred stock purchase plans; ESOPs and Notes Receivables from ESOPs; Reserve account for shares to be repurchased, included in Capital Surplus; Subscription stock receivables, included in Capital Surplus.

Appendix D Model appendix

Appendix D.1 Common Ownership

The owner of firm i in market j has also an ownership stake in other firms within the same market, through investor k, $k = 1, 2, .., K$. The weighted average of shareholder portfolio profits, which is defined as a k dimensional vector with each element defined as follows,

$$SPP_k = \sum_i \tilde{s}_{ijk} \pi_{ijk}$$

Where $\tilde{\mathbf{s}}_{\mathbf{ij}}$ is a vector denoting the proportion of shares of firm ij owned by investor k,

$$\tilde{\mathbf{s}}_{\mathbf{ij}} = \begin{bmatrix} \tilde{s}_{ij1} & \tilde{s}_{ij2} & \ldots & \tilde{s}_{ijk} \end{bmatrix}'$$

And it satisfied the following constraint by definition,

$$\sum_k \tilde{s}_{ijk} = 1$$

Firms act in the interest of all common owners, thus, in our model, firms objective is the values all the K investors owned in it,

$$\tilde{\pi}_{ij} = \sum_k \tilde{s}_{ijk} SPP_k$$

Then firm i has the following objective function when making quantity decisions,

$$\max_{\{y_{ij}\}} \tilde{\pi}_{ij} = \tilde{\mathbf{s}}'_{\mathbf{ij}} \tilde{\mathbf{s}}_{\mathbf{hj}} \pi_{ij} + \sum_{h \neq i} \tilde{\mathbf{s}}'_{\mathbf{ij}} \tilde{\mathbf{s}}_{\mathbf{ij}} \pi_{hj}$$

There are two assumptions here, firstly, each firm produces a single product. And most importantly, although firm h holds shares in firm i, manager i always has the absolute right of management, this assumption makes the model tractable and are consistent with the real world situations as well. Under the second assumption, manager i would choose the optimal y_{ij} by maximizing gross profit, given $\mathbf{y}_{-\mathbf{ij}}$, rather than choosing y_{ij}, y_{hj}. And the common ownership weights α has a range of $[0, 1]$.

Where $\tilde{\pi}_{ij}$ is the gross profit for firm ij. Now, we define the common ownership weights α_{ih} equals to

$$\alpha_{ih} = \frac{\tilde{\mathbf{s}}_{\mathbf{ij}}' \tilde{\mathbf{s}}_{\mathbf{hj}}}{\tilde{\mathbf{s}}_{\mathbf{ij}}' \tilde{\mathbf{s}}_{\mathbf{ij}}}$$

Firms would maximize the following,

$$\tilde{\pi}_{ij} \propto \pi_{ij} + \sum_{h \neq i} \alpha_{ijh} \pi_{hj}$$

It could be proved that firm's maximization of $\tilde{\pi}_{ij}$ is the same as the maximization of RHS of the above expression due to the exogenous $\tilde{\mathbf{s}}_{\mathbf{ij}}$. Take all α_{ih} equals to a constant α, by assumption, then it means in our simplified version of common ownership model setup, all other firms in the same market with firm i, have identical shares ratios. To keep the assumption that manager i always has the absolute managing right, that is, manager h won't be able to decide how much to produce for firm i, the range of α is restricted within 0 to 1.

Appendix D.2 Household solution

The household utility is:

$$\max_{\{c_{ij}\},L} U\left(C, L\right) \quad , \quad \text{s.t.} \quad \int_0^J \left(\sum_{i=1}^{I_j} p_{ij} c_{ij} \right) dj \leq WL + \Pi.$$

Because there is a continuum of identical households, any single household cannot influence profits, Π. They will take those aggregates as given in optimizing their utility. We start our analysis by deriving the aggregate labor supply function.

Labor supply. Given any wage W and price index P, the household chooses labor supply L to maximize utility:

$$\max_L U = \frac{WL + \Pi}{P} - \overline{\varphi}^{-\frac{1}{\varphi}} \frac{L^{1+\frac{1}{\varphi}}}{1 + \frac{1}{\varphi}},$$

which incurs first order condition:

$$\frac{W}{P} = \overline{\varphi}^{-\frac{1}{\varphi}} L^{\frac{1}{\varphi}} \quad \Leftrightarrow \quad L = \overline{\varphi} \left(\frac{W}{P} \right)^{\varphi}. \tag{D.1}$$

Inverse demand function. We then derive the inverse demand function by solving households' cost-minimization problem. There are two steps, first is at the market level and then is at the economy level. Within each market j and given utility $\bar{c}_j$, the household will choose the consumption bundle to minimize the expenditure:

$$\min_{\{c_{ij}\}} E = \sum_i p_{ij} c_{ij} \quad \text{s.t.} \quad c_j(c_{ij}) = \bar{c}_j.$$

The FOC gives:

$$I_j^{-\frac{1}{\eta}} c_{ij}^{\frac{\eta-1}{\eta}} c_j^{\frac{1}{\eta}} = \lambda_j^{-1} p_{ij} c_{ij} \quad \Rightarrow \quad c_j = \lambda_j^{-1} \sum_i p_{ij} c_{ij},$$

where λ_j is the shadow price for goods at market j. Hence, we further define λ_j as the price index for this market. The FOCs lead to:

$$c_{ij} = I_j^{-\frac{1}{\eta}} \left(\frac{p_{ij}}{p_j} \right)^{-\eta} \bar{c}_j \quad \text{and} \quad p_j = \left[\sum_i \frac{1}{I_j} p_{ij}^{1-\eta} \right]^{\frac{1}{1-\eta}}. \tag{D.2}$$

Similarly, we can solve the expenditure minimizing problem at the economy level,

$$\min_{\{c_j\}} E = \int_j p_j c_j \quad \text{s.t.} \quad C(c_j) = \overline{C}.$$

which incurs:

$$c_j = J^{-\frac{1}{\theta}} \left(\frac{p_j}{P} \right)^{-\theta} \overline{C} \quad \text{and} \quad P = \left[\int_0^J \frac{1}{J} p_j^{1-\theta} dj \right]^{\frac{1}{1-\theta}}. \tag{D.3}$$

Combining equation (D.2) and (D.3), we get the demand system from the household side:

$$y_{ij} = \frac{1}{J} \frac{1}{I_j} \left(\frac{p_{ij}}{p_j} \right)^{-\eta} \left(\frac{p_j}{P} \right)^{-\theta} Y. \tag{D.4}$$

$$p_{ij} = I^{-\frac{1}{\eta}} J^{-\frac{1}{\theta}} \left(\frac{y_{ij}}{y_j} \right)^{-\frac{1}{\eta}} \left(\frac{y_j}{Y} \right)^{-\frac{1}{\theta}} P \tag{D.5}$$

Appendix D.3 Firm-side solution and market equilibium

In this section, we derive the output market equilibrium in the common ownership setting with parameter α. To begin with,We have the firm-level FOC:

$$p_{ij} A_{ij} = \mu_{ij} W \quad \text{where} \quad \mu_{ij} := \left[1 - \frac{1}{\eta} + \left(\frac{1}{\eta} - \frac{1}{\theta} \right) \left(s_{ij} + \alpha \sum_{h \neq i} s_{hj} \right) \right]^{-1}, \tag{D.6}$$

where the second equation comes from the elasticity of demand function (D.4). The CES structure incurs following property:

$$s_{ij} = \frac{p_{ij}^{1-\eta}}{\sum_{i'} p_{i'j}^{1-\eta}}. \tag{D.7}$$

Combining equation (D.6) and (D.7), we can solve for markups μ_{ij} (or equivalently, sales shares s_{ij}) directly from TFP A_{ij} by:

$$s_{ij} = \frac{\left(\mu_{ij}/A_{ij}\right)^{1-\eta}}{\sum_{i'} \left(\mu_{i'j}/A_{i'j}\right)^{1-\eta}}.$$

Therefore, we will take μ_{ij} and s_{ij} as the primitives for the subsequent analysis.

Output market clearing. As we take the price index as the numeraire, the goods clearing condition simply requires the prices implied by markups are consistent with this normalization, i.e.,

$$\left[\int_0^J \frac{1}{J}\left(\frac{1}{I_j}\sum_i p_{ij}^{1-\eta}\right)^{\frac{1-\theta}{1-\eta}} dj\right]^{\frac{1}{1-\theta}} = P \quad , \quad \text{where} \quad p_{ij} = \mu_{ij}\frac{W}{A_{ij}}.$$

This condition gives us the equilibrium wage:

$$\frac{W}{P} = \left[\left(\int_0^J \frac{1}{J}\left[\frac{1}{I_j}\sum_i \left(\frac{\mu_{ij}}{A_{ij}}\right)^{1-\eta}\right]^{\frac{1-\theta}{1-\eta}} dj\right)^{\frac{1}{1-\theta}}\right]^{-1}. \tag{D.8}$$

The equilibrium wage is the marginal revenue product of labor *without* markups. To see this more clearly, imagine a homogenous economy where $A_{ij} \equiv A$ and $\mu_{ij} \equiv \mu$. The equation (D.8) becomes $W = AP/\mu$, where the term AP is marginal revenue of labor, while the markup μ puts a wedge that becomes the gross profit of the firms. Furthermore, the term $1/I_j$ and $1/J$ neutralize the effect of love of variety — it prevents the change in I_j and J from directly influencing equilibrium wage. As a result, all changes in wages W are due to the evolution of markups and productivities.

Labor market clearing. Finally, labor market clearing pins down the aggregate labor supply L, using the household's labor supply decision (D.1) in conjunction with the equilibrium wage:

$$\overline{\varphi} W^{\varphi} = \int_0^J \left[\sum_i \frac{1}{A_{ij}} \underbrace{\frac{1}{J}\frac{1}{I_j}\left(\frac{p_{ij}}{p_j}\right)^{-\eta}\left(\frac{p_j}{P}\right)^{-\theta} Y}_{\text{Output } y_{ij}}\right] dj. \tag{D.9}$$

The LHS is the labor supply function and the RHS is the aggregate labor demand function. This condition eventually pins down the output level Y. We would be able to solve for the aggregate output Y using the following equations:

$$s_{ij} = \frac{p_{ij}y_{ij}}{\Sigma_k(p_{kj}y_{kj})} = I^{-\frac{1}{\eta}}(\frac{y_{ij}}{y_j})^{1-\frac{1}{\eta}} \tag{D.10}$$

$$p_{ij} = \left(\frac{1}{J}\right)^{\frac{1}{\theta}} \left(\frac{1}{I}\right)^{\frac{1}{\eta}} \left(\frac{y_{ij}}{y_j}\right)^{-\frac{1}{\eta}} \left(\frac{y_j}{Y}\right)^{-\frac{1}{\theta}} P \tag{D.11}$$

$$y_{ij} = A_{ij}l_{ij} \tag{D.12}$$

$$\sum_{i,j} l_{ij} = \overline{\varphi}\left(\frac{W}{P}\right)^{\varphi} \tag{D.13}$$

From (D.10) we can get

$$y_j = I^{\frac{1}{1-\eta}} s_{ij}^{\frac{\eta}{1-\eta}} y_{ij} \tag{D.14}$$

Introduce (D.14) into (D.11) to eliminate y_j,

$$y_{ij} = \left(\frac{1}{I}\right)^{\frac{\theta-1}{\eta-1}} \left(\frac{1}{J}\right) \left(\frac{P}{p_{ij}}\right)^{\theta} s_{ij}^{-\frac{\theta-\eta}{\eta-1}} Y \tag{D.15}$$

Combining (D.12) and (D.13), we can get

$$\sum_{i,j} \frac{y_{ij}}{A_{ij}} = \overline{\varphi}\left(\frac{W}{P}\right)^{\varphi} \tag{D.16}$$

Then introduce (D.15) into (D.17),

$$\sum_{i,j} \frac{\hat{\alpha}_{ij}}{A_{ij}} Y = \overline{\varphi}\left(\frac{W}{P}\right)^{\varphi} \tag{D.17}$$

where

$$\hat{\alpha}_{ij} = \left(\frac{1}{I}\right)^{\frac{\theta-1}{\eta-1}} \left(\frac{1}{J}\right) \left(\frac{P}{p_{ij}}\right)^{\theta} s_{ij}^{-\frac{\theta-\eta}{\eta-1}} \tag{D.18}$$

Therefore,

$$Y = \overline{\varphi} \left(\frac{W}{P} \right)^{\varphi} \Big/ \sum_{i,j} \frac{\hat{\alpha}_{ij}}{A_{ij}} \tag{D.19}$$

After pinning down aggregates W and Y, other equilibrium objects can be further derived from the inverse demand function and production function.

Appendix D.4 Additional Comparative Statics Exercises

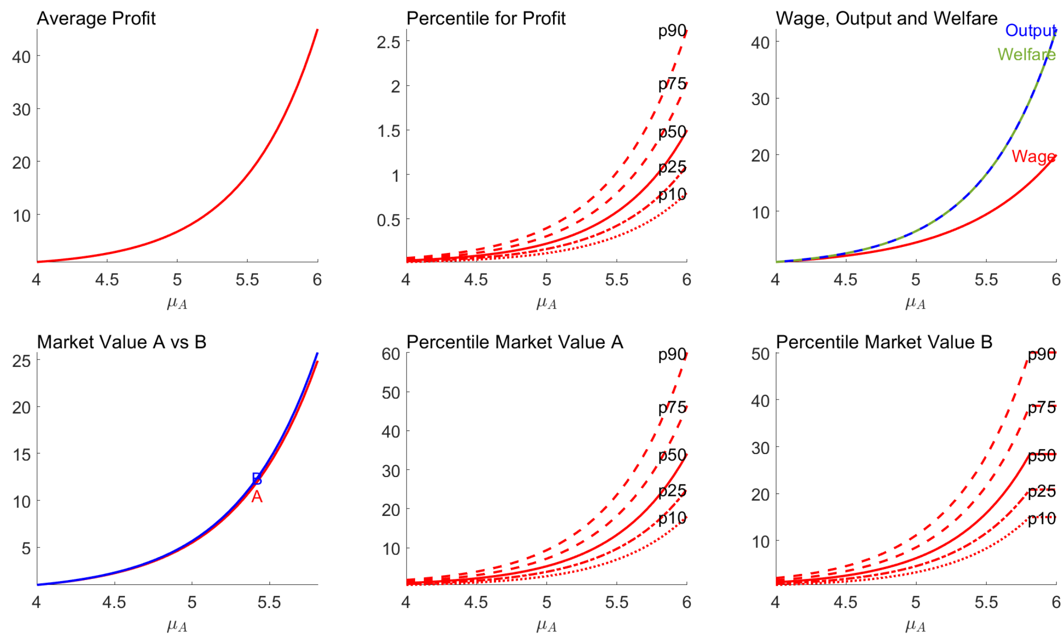

Figure D.1: Sector-level (log) TFP shock mean $\mu_A \in [4, 6]$

Appendix D.5 Lemma ??: production transformation

We prove Lemma **??** by solving the cost minimization problem of firms. The Lagrangian problem can be written as:

$$\mathcal{L}(l_{ij}, m_{ij}, k_{ij}; \overline{y}_{ij}) = Wl_{ij} + P^m m_{ij} + Rk_{ij} - \lambda_{ij} \left[A_{ij} \left(l_{ij} + m_{ij} \right)^{\zeta} k_{ij}^{1-\zeta} - \overline{y}_{ij} \right],$$

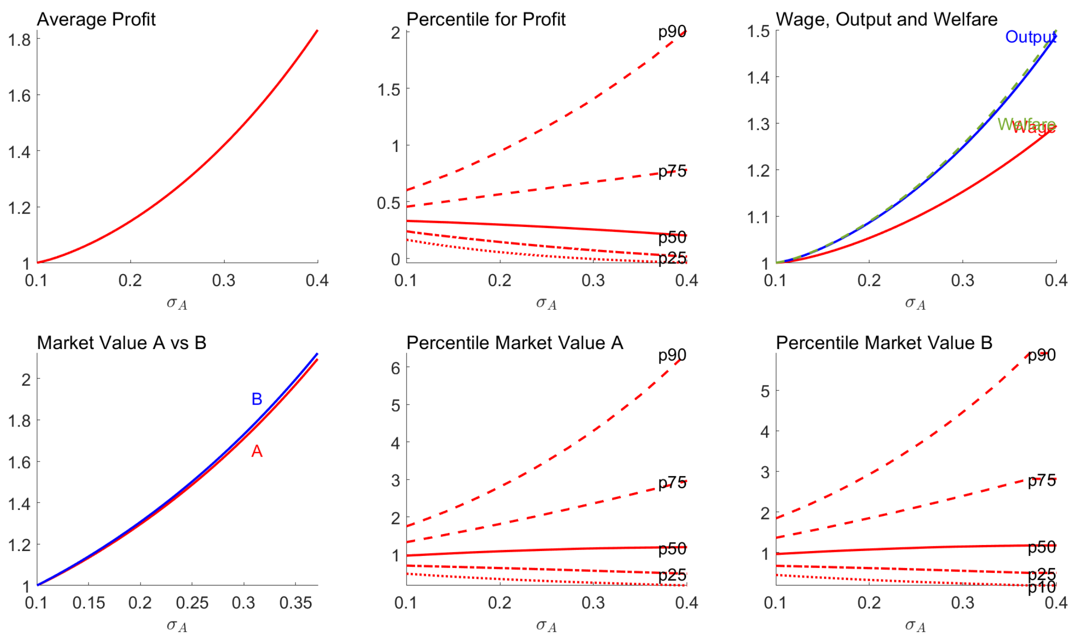

Figure D.2: Sector-level (log) TFP shock variance $\sigma_A \in [0.1, 0.4]$

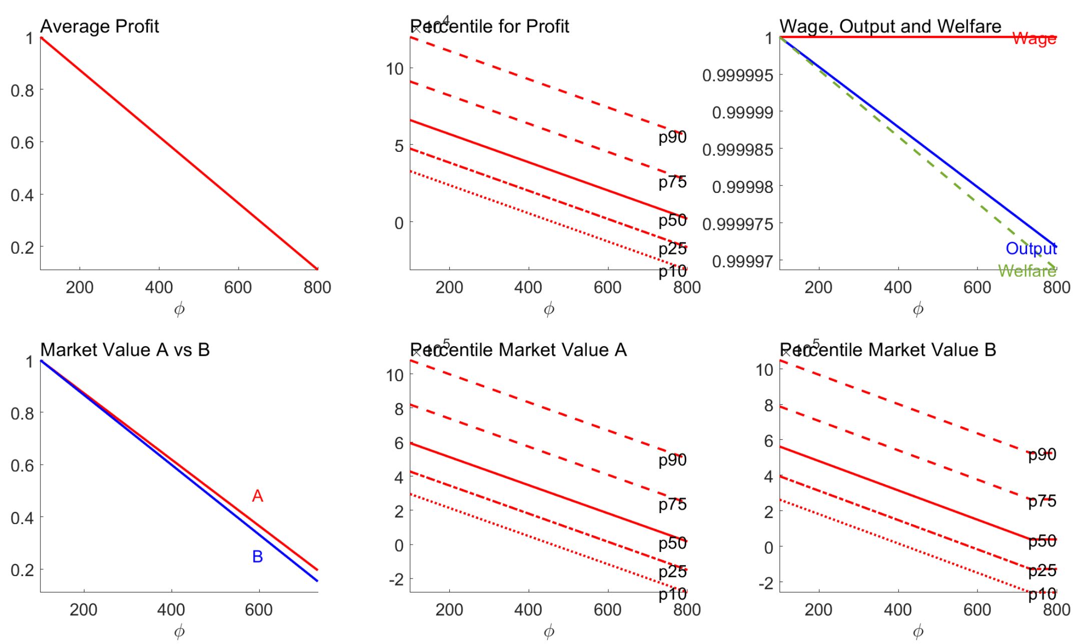

Figure D.3: Overhead cost ratio $\phi \in [200, 800]$

with FOCs:

$$\frac{\partial \mathcal{L}}{\partial l_{ij}} = W - \frac{\lambda_{ij}\zeta}{l_{ij}+m_{ij}} \left[A_{ij}\left(l_{ij}+m_{ij}\right)^{\zeta} k_{ij}^{1-\zeta}\right] = 0,$$
$$\frac{\partial \mathcal{L}}{\partial m_{ij}} = P^{m} - \frac{\lambda_{ij}\zeta}{l_{ij}+m_{ij}} \left[A_{ij}\left(l_{ij}+m_{ij}\right)^{\zeta} k_{ij}^{1-\zeta}\right] = 0,$$
$$\frac{\partial \mathcal{L}}{\partial k_{ij}} = R - \frac{\lambda_{ij}(1-\zeta)}{k_{ij}} \left[A_{ij}\left(l_{ij}+m_{ij}\right)^{\zeta} k_{ij}^{1-\zeta}\right] = 0,$$

where P^m is the price for materials. This set of FOCs give us the optimal inputs choices:

$$m_{ij} = \frac{1-\psi}{\psi} l_{ij} \quad \text{and} \quad k_{ij} = \frac{1}{\psi}\frac{W/\zeta}{R/(1-\zeta)} l_{ij}, \tag{D.20}$$

where $\psi := l_{ij}/(l_{ij}+m_{ij})$ is an exogenous parameter for all firms. Note also that since labor and materials are perfectly substitutable, at equilibrium we must have $P^m = W$.

Moreover, solving this cost minimization problem gives us the marginal cost of production:

$$mc_{ij} = \frac{1}{\psi}\frac{1}{\zeta}\frac{W}{\widehat{A}_{ij}}, \tag{D.21}$$

which further leads to the gross profit:

$$\widetilde{\pi}_{ij} = (\mu_{ij}-1) mc_{ij} y_{ij} = \frac{1}{\psi}\frac{1}{\zeta}(\mu_{ij}-1) W l_{ij}. \tag{D.22}$$

Compared to the labor-only model, the gross profit (D.22) is scaled by the production elasticity of material and capital, which indicates the final decomposition of manager pay in equation (**??**).

Appendix E Other Facts and Figures

Appendix E.1 Share of Capital and it's components to sales

Appendix E.2 Gross Capital (GK) and Equity-financed Capital (EK)

To measure the real capital owned by firms, we construct a new variable, ***Gross Capital***, which is the summation of three main components: physical capital, intangible capital and current asset. The measurement of current asset is derived from Compustat but we construct new measurements for the stock of physical capital and intangible capital at firm-level using Perpetual Inventory Method (PIM).

For physical capital, we estimate its stock using the following equation:

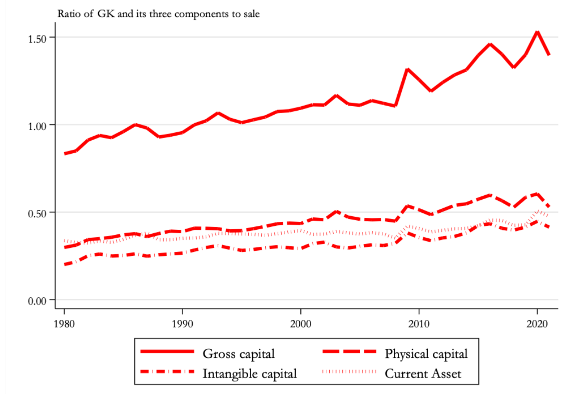

Figure E.1: Ratio of GK and Its Components to sale

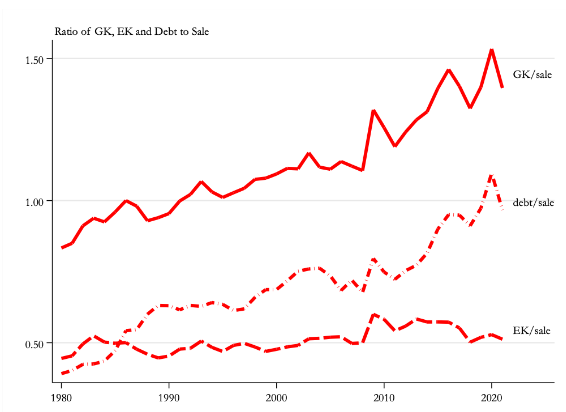

Figure E.2: Time series of GK, EK and debts

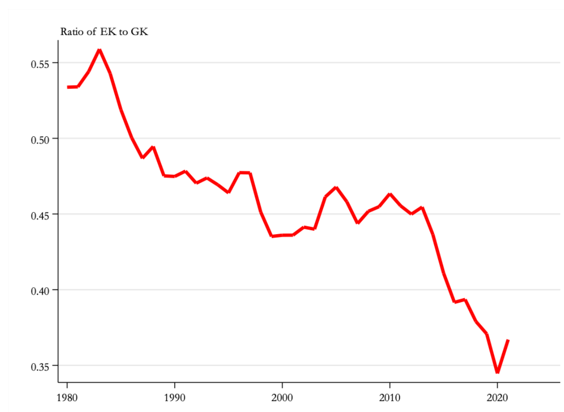

Figure E.3: Ratio of EK to GK from 1980 to 2021

$$K_{p,t} = (1 - \delta_p)K_{p,t-1} + I_{p,t-1}$$

where $K_{p,t}$, I_{t-1} and δ_p denote the stock of physical capital in period t, investment in physical capital in period $t-1$ and depreciation rate of physical capital, respectively.

We choose $PPEGT$ and $PPENT$ in Compustat to help us construct the measurement. The former variable measures the total investment in physical capital (property, plant and equipment) and the latter one measures physical capital stock after depreciation. For the entry year of an individual firm, we choose $PPEGT$ as its initial physical capital stock while for following years, we estimate the net physical capital investment in period $t-1$ (namely, $\delta_p K_{p,t-1} + I_{p,t-1}$) through the equation $PPENT_t - PPENT_{t-1} = \delta_p K_{p,t-1} + I_{p,t-1}$. Both of these two variables are deflated by Fixed Investment deflator.

For intangible capital, we use PIM to accumulate $XSGA$ as its stock. $XSGA$ is a variable in Compustat which measures selling, general and administrative expense of an individual firm. Many components of this variable can produce cash flow in the future, such as advertising expense, directors' fees and remuneration, research and development expenses, etc. That's the reason why we accumulate it as our measurement for intangible capital. Similar to the estimation of physical capital, we also use the equation $K_{i,t} = (1-\delta_i)K_{i,t-1} + I_{i,t-1}$ to help us construct the measurement of intangible capital. For the entry year of an individual firm, we suppose that its intangible capital stock is zero while for following years, its $XSGA$ expenses will be considered as the gross investment in intangible capital. $XSGA$ is deflated by Intellectual Property Product deflator and we set $\delta_i = 0.28$, derived from Ewens, Peters, and Wang (2019).

Figure E.1 shows the ratio of GK and its three components to sale, which illustrates that the ratio of GK to sale has increased from 0.83 in 1980 to 1.40 in 2021 and its three parts account for roughly the same share.

However, what we really care about is the capital owned by stockholders since a large portion of Gross Capital is financed by debt. We define the capital owned by stockholders as ***Equity-financed Capital***, which is the difference between gross capital and total debts. The measurement of total debts is derived directly from the balance sheet of each individual firm and we can also estimate the average cost of debt through dividing total interest expenses by total debts, which can be viewed as the opportunity cost of equity. Figure **??** shows time series of this cost, decreasing from about 5% in 1980 to about 1.5% in 2021. At the same period, the debt-to-sale ratio has more than doubled while the EK-to-sale ratio has little increase, leading to a decreasing trend of capital share owend by stockholders, as Figure E.2 and Figure E.3 have shown.

Appendix E.3 Potential Explanations for β_{sub}'s Increasing

From the above analysis, we find that the subjective discounting factor has a great influence on the change of market value, as shown in Figure E.4 and Figure E.5. To explain the change of subjective discounting factor, we propose the following theories, which need our further discussions and consideration: Stochastic process (z_{ij}); Beliefs (model 2 & 3); Risk-free β_f; Participation in stock market; Preferences.

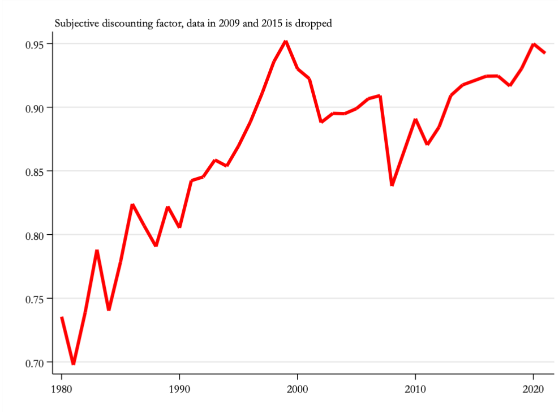

Figure E.4: Trend of β_{sub}

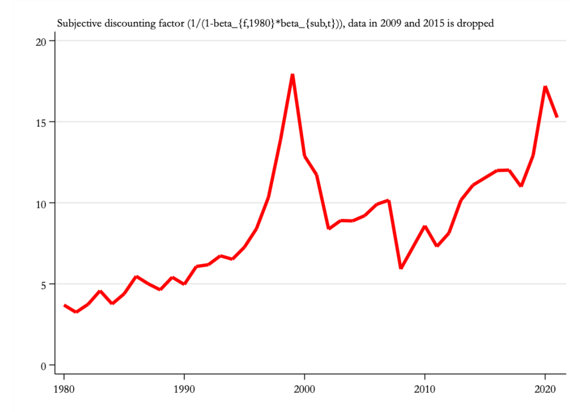

Figure E.5: Trend of $(1 - \beta_{f,1980}\beta_{sub,t})^{-1}$

Appendix F Quantification

Appendix F.1 Fit of model and data moments

Appendix F.2 Comparative static

Appendix G Robustness

Appendix H Accounting Identity

Accounting identity concerning shareholders' equity. There are five main components of shareholders' equity (E_t^S): common stock($CSTK_t$), capital surplus($CAPS_t$), retained earnings (RE_t), preferred stock($PSTK_t$) and treasury stock($TSTK_t$). Define $STOCK_t = CSTK_t + CAPS_t + PSTK_t - TSTK_t$, then

$$E_t^S = RE_t + STOCK_t$$

In addition to profits and dividends, there are some other factors like the issuance of new shares and share buyback that affect the shareholders' equity. And the profit (net income) will go into RE_t after paying dividends to shareholders, which is

$$\Delta RE_t = \pi_t - Div_t$$

In our construction, we have

$$(1 + r_t)E_{t-1}^S + \Delta STOCK_t + \pi_t^E = Div_t + E_t^S$$

Therefore,

$$Div_t = \pi_t^E + r_t E_{t-1}^S - \Delta E_t^S + \Delta STOCK_t$$

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