Rising Profits and Low Interest Rates: What Policy Solutions Work?

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Overview:

This paper links higher markups to the decline in US interest rates over the past three decades. Markups are generally seen as a tax on the other factors of production, reducing capital and labor demand. Higher business income accrued to households at the top of the income distribution, which also have a high marginal propensity to save. A simple model accounting for the effect of growing income inequality on saving behavior demonstrates a markup shock can have a relatively large, negative impact on the equilibrium long-run interest rate due to lower capital demand and a higher saving supply. In terms of policy options, the first-best response is to restore market competition between firms. Absent this possibility, the model explores second-best options: A redistributive tax between households cannot fully offset the shock and reduces the incentive for entrepreneurship. Still, it may generate welfare gains under certain conditions. An increase in government debt can raise the equilibrium interest rate, but will further crowd out capital and depress output, leading to welfare losses. A subsidy on capital and labor costs brings the economy the closest to its competitive allocation and may also generate welfare gains.

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1. Introduction

Since the late 1980s, the share of aggregate income going to the top 5% of earners has increased by 8 percentage points in the United States.[1] Roughly one-half of this increase is explained by higher wages and one-half by rising business income. The latter case is consistent with a rising profit share and a growing body of research finds evidence for this.[2] At the same time, business ownership structures and the way that households report their income have also evolved. The first part of this paper will look at the finances of entrepreneurial households in detail.

There is strong evidence that households at the top of the income distribution save at high rates. While around 30% of aggregate income accrues to the top 5% of earners on a pre-tax basis, they own almost 60% of financial assets and 75% of tangible business assets in the economy.[3] This paper argues a rising profit share will have a significant effect on the equilibrium interest rate. With a declining capital share and an increasing savings supply, asset market clearing implies a drop in the long-term equilibrium interest rate.

Low interest rates are problematic from several different perspectives: Households increasingly channel their savings into unproductive assets, such as speculative bubbles. Government issue additional debt, which crowds out capital in a context where capital demand is depressed. Households acting as target savers may save more when the expected returns are low, depressing demand. Furthermore, monetary policy faces the zero lower bound (ZLB) more frequently in an economy with a low equilibrium interest rate. Eggertsson and Woodford (2003) find downturns are longer and more costly when the ZLB constraint is binding since the monetary policy response tends to be weaker.

Most literature on monetary policy at the ZLB considers a drop in interest rates from a temporary shock. Given a persistent shock, tax policy may also be useful, an assertion explored in this paper. In the short run, Correia et al. (2013) demonstrate any nominal interest rate policy can be implemented through a combination of labor, consumption, and capital income taxes. Eggertsson, Mehrotra, and Robbins (2019) present an economy where the ZLB permanently binds due to downward nominal

[1] Based on tabulations from the Congressional Budget Office (CBO) using administrative tax data. Business income includes self-employment, unincorporated business income, and dividend payments.

[2] There remains some skepticism about whether the labor share has decreased or if changes in social benefits and remuneration explain observed shifts. Similarly for investment, the cost of capital has declined over recent decades.

[3] The analysis also highlights that business owners at the top of the income distribution are distinct: business assets make up a large part of their savings whereas other households predominantly hold financial assets.

wage rigidities and debt overhang for household borrowers. In such a case, fiscal interventions are needed to boost aggregate demand. This includes a permanent increase in government debt or redistribution policies that act on the lifetime consumption/savings decisions of households.

The second part of this paper presents a simple overlapping generations (OLG) model with entrepreneur and worker households. In contrast to Eggertsson, Mehrotra, and Robbins, declining interest rates are explained by a rising profit share: capital demand falls and entrepreneurs save at high rates relative to workers, boosting the savings supply. This interaction leads to a large drop in interest rates, but the net effect of a higher profit share on output and welfare is positive since the economy has a low initial savings rate and benefits from the income transfer to entrepreneurs, who save at high rates. The analysis then looks at different redistribution policies – as well as an increase in government debt – and their impact on the interest rate, output, and welfare.

The rest of the paper is organized as follows: The introduction continues with an overview of household finances over recent decades. It starts from an aggregate perspective comparing the United States and other regions in section 1.1. It then turns to the US income distribution and household saving behavior more specifically in section 1.2. Section 2 provides a literature review, covering the determinants of long-term interest rates, changes in the profit share of income, and capital taxation. Section 3 presents the basline model while section 4 develops the calibration, policy counterfactuals, and robustness checks. Section 5 concludes.

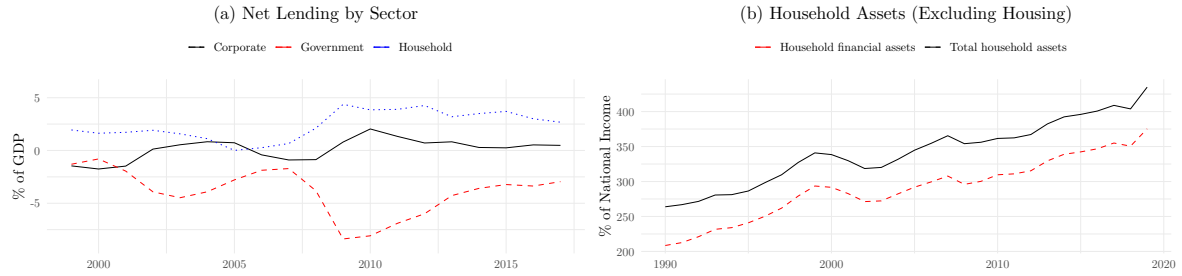
1.1. Global Trends in the Flow of Funds Between Sectors

To start, it is useful to overview the evolution of household and firm balance sheets over recent decades. Among post-industrial economies, there has been a general increase in savings by firms and households, accompanied by higher government debt. This increase in the saving supply coincided with a decline in interest rates over the 2000s and 2010s, forcing central banks to use unconventional monetary policies. With lower capital rental costs, firms in the United States increased dividend payments. In both Europe and Japan, firms used savings to pay down debt while net income flows (i.e. the sum of net dividends and net rental payments) from firms to households decreased.

1.1.1. Rising Saving, Low Capital Demand and Interest Rates

Since the 2008 financial crisis, the net lending of both households and corporates has increased, mirrored by larger government deficits (see Panel 1*a*).[4] This is associated with a decline in interest rates and implies government debt ultimately absorbed most household savings. The 2000s also witnessed large financial outflows from developing countries into advanced economies. This 'global saving glut' is associated with persistent current account deficits in the United States (as observed by Bernanke 2005 and many others). At the same time, households in advanced economies accumulated substantial financial assets as Panel 1*b* makes clear. This is partly related to demographic factors, where aging populations have pushed up demand for saving. While the average duration of retirement has plateaued in OECD countries, the share of the population over 65 is growing. This trend is expected to continue over the next 20 years, with major economies such as China and Brazil also aging rapidly. While real interest rates are higher following the Covid pandemic, low rates may both return and persist due to capital outflows from developing economies and unfavorable demographics in advanced economies. In addition to these factors, a growing body of research links inequality to the decline in interest rates (e.g. Mian, Straub, and Sufi 2020; Auclert and Rognlie 2018). Given that high-income households have a higher marginal propensity to save than low-income households, income inequality may have contributed to the saving glut.

Figure 1: Household Asset Accumulation in OECD Countries



Source: UN National Accounts (a) and World Inequality Database (b).
Notes: The aggregates are the sum of each series in USD across all countries with complete data 2000-16. Australia, Canada, and South Korea do not report the household sector and it is calculated as a residual for these countries when the other sector balances are available. See appendix for sample.

Low capital demand is another potential driver of low interest rates. The corporate sector has become a net lender of funds, a development first observed in André et al. (2007). Evidence from Chen, Karabarbounis, and Neiman (2017) shows a persistent trends following the 2008 financial

[4]Figure 16 in the appendix gives the same breakdown for the Euro Area, Japan, and the United States.

crisis where corporate savings have gone into cash holdings, debt repayment, and equity buybacks. Indeed, looking at corporate balance sheets in OECD economies, a trend increase in financial assets is evident while liabilities are stable or decreasing (see figure 2). The increase in assets is observed relative to output, capital, and total liabilities. Potential motives for deleveraging include higher R&D activity (Dao and Maggi 2018), external financing costs and liquidity needs (Zetlin-Jones and Shourideh 2017), along with problems collateralizing intangible capital (Dell'Ariccia et al. 2020; Falato, Kadyrzhanova, and Sim 2013). While the increase in corporate net lending is relatively general across countries, the United States is one of the few major regions where income flows from firms to households have significantly increased.

Figure 2: Corporate Balance Sheet Components in OECD Countries

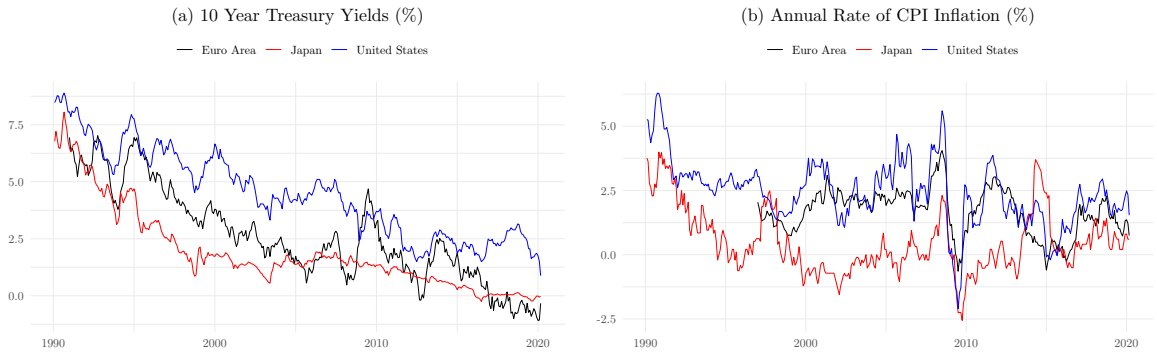
Source: UN National and Financial Accounts.
Notes: The aggregates are constructed by summing each series in USD across all countries with complete data 2000-16.

The three decades before the 2020 Covid-19 pandemic witnessed a steady decline in nominal interest rates – to less than 1% in Europe and Japan and around 2% in the United States. While CPI has been more volatile, it averaged 1-2% between 2015 and 2020 across the three regions, suggesting that real interest rates were near zero or even negative. In this low interest rate environment, quantitative easing and forward guidance became the primary tools for monetary policy. Yet there is some evidence that quantitative easing exacerbated inequality and pushed down long-term rates (Lee 2024). Meanwhile, forward guidance does not appear to strongly influence household behavior (D'Acunto, Hoang, and Weber 2020) and empirical evidence on its effectiveness remains mixed (Del Negro, Giannoni, and Patterson 2023).

Inflation remains elevated in the United States and parts of Europe in 2024 (the time of writing) but is converging towards central bank target rates and should continue to stabilize. Higher government debt and excessive deficits are placing upward pressure on interest rates and they may rise compared

to the 2010s. This is counterbalanced by low productivity growth and weakening consumer demand. While the 2010s were an exceptional period, the return of low interest rates and a near-binding ZLB in the 2020s is possible.

Figure 3: Interest Rates and CPI



Source: ECB (a) and IMF IFS (b).

1.1.2. Increase in the Profit Share of Income

Low interest rates over the 2000s and 2010s reduced capital rental payments by firms and the resulting cost savings led to higher net lending in Europe, Japan, and the United States. In the United States and Japan, the decline in capital rental costs is also associated with higher dividend payments to households. While most economic models suggest low interest rates should spur higher investment, the data indicate firms used the funds differently.[5] Here, I define the gross operating surplus (GOS) as total gross value added (GVA) less payments to labor, intermediate inputs, and taxes on production. Following this definition, OECD National Accounts are divided as follows[6]

$$\underset{B.2g+B.3g}{\textbf{gross operating surplus}} = \begin{array}{c} \textbf{net interest and rents (net rents)} \\ D.41P+D.45P-D.41R-D.45R \\ + \\ \textbf{net distributed income (dividends)} \\ D.42P+D.44P-D.42R-D.44R \\ + \\ \textbf{investment} \\ P.51P \\ + \\ \textbf{net lending} \\ B.8g-P.51P \\ + \\ \textbf{taxes and social transfers} \\ D.5P+D.62P-D.61R \end{array}$$

[5] Furthermore, Tobin's Q was generally well above one over this period, another indication investment was weak.

[6] Two components are missing: reinvested earnings on FDI and 'other' transfers. Both are small and stable over time.

Looking at the flow of funds between corporates and households, falling interest rates have reduced rental payments by firms (see table 1). Yet despite the decline in interest rates, capital formation failed to pick and net lending was positive, indicating that firms were largely self-financing investment.[7] Total savings by firms (the sum of investment and net lending) increased across Europe, Japan, and the United States. For the Euro Area, the overall evolution of the operating surplus masks some heterogeneity between countries, but all major economies (France, Germany, Italy, and Spain) follow the same trend of higher corporate saving.

Table 1: Uses of the Corporate Gross Operating Surplus, Period Averages

(a) Weighted Average of Euro Area Countries (1995-2019)

	Net Rents	Net Dividends	Net Lending	GFCF	Taxes
1995-99	0.083	0.286	-0.039	0.556	0.084
2000-4	0.070	0.290	-0.049	0.569	0.083
2005-9	0.071	0.307	-0.052	0.557	0.104
2010-14	0.037	0.262	0.044	0.548	0.093
2014-19	0.019	0.243	0.032	0.578	0.097

(b) Japan (1995-2019)

	Net Rents	Net Dividends	Net Lending	GFCF	Taxes
1995-99	0.159	0.022	-0.075	0.726	0.157
2000-4	0.063	0.024	0.137	0.646	0.128
2005-9	0.020	0.048	0.131	0.659	0.152
2010-14	0.015	0.040	0.217	0.611	0.131
2014-19	-0.002	0.067	0.163	0.646	0.144

(c) United States (1980-2019)

	Net Rents	Net Dividends	Net Lending	GFCF	Taxes
1980-89	0.161	0.106	-0.051	0.640	0.144
1990-99	0.135	0.151	-0.057	0.629	0.142
2000-9	0.120	0.173	-0.040	0.621	0.126
2010-19	0.104	0.182	0.025	0.580	0.109

Source: OECD Detailed Non-Financial Sector Accounts.

Other trends in the flow-of-funds differ across the three regions:

- In the United States, total payments from firms to households were stable, but their composition shifted from rental to dividend payments. Dividends coming from the financial sector also increased. Tax payments marginally decreased.

[7] While capital formation in the United States dropped relative to the operating surplus, the decline relative to GDP is less noticeable since the operating surplus has grown relative to GDP. For further discussion of declining investment in the United States and Europe, see Gutiérrez and Philippon (2017) and Kalemli-Özcan, Laeven, and Moreno (2018).

- In Europe, savings from lower net rents went into higher net lending by firms. Relative to Japan and the United States, dividends made up a larger share of total payments to households in the late 1990s. A relative decline in profitability post-2008 subsequently reduced net income flows from firms to households.
- In Japan, lower capital rental payments translated into higher net lending by firms. While net income flows from firms to households substantially declined over the 1990s and 2000s, corporate dividends increased. At the same, time dividends from the financial sector decreased and total dividends received by households were relatively stable.

A supporting analysis of the flow of funds is included in section A.2 of the appendix. The next section focuses on the US case, looking at how the changes in the composition of the flow of funds affected households.

1.2. The Finances of US Households and Firms

Higher corporate profitability disproportionately benefited households at the top of the income distribution. As will be discussed, these households save at high rates compared to the rest of the population, regardless of whether their income is derived from wages or profits. Rising profits are frequently associated with business concentration and growing market power; however, they are partly explained by changes in the tax code and the blurring of wages and profits.

1.2.1. Rising Inequality Among Households

The increase in corporate profitability shows up clearly on household balance sheets. While business income is a relatively small share of total income, it is concentrated at the top of the income distribution and is the lead driver of rising income inequality over recent decades.[8]

Table 2 shows that the top 5% of the income distribution received 32% of total income over the 2010s.[9] This share grew by 8 percentage points compared to the 1980s. Business income is the most

[8]The Congressional Budget Office (CBO) defines business income as "net income from businesses and farms operated solely by their owners, partnership income, and income from S-corporations." Labor (wage) income is defined as "wages and salaries, including those allocated by employees to 401(k) and other employment-based retirement plans; employer-paid health insurance premiums (as measured by the Census Bureau's Current Population Survey); the employer's share of Social Security, Medicare, and federal unemployment insurance payroll taxes; and the share of corporate income taxes borne by workers."

[9]The CBO does not publish standard errors for their tabulations, but the survey size is around 150,000 observations

Table 2: United States Top 5% Share of Total Income by Source, Period Averages

	Total Income	o/w Wages	o/w Business	o/w Capital Gains	o/w Other
1980-89	0.240	0.113	0.034	0.040	0.052
1990-99	0.270	0.129	0.047	0.034	0.060
2000-9	0.309	0.137	0.060	0.052	0.060
2010-18	0.320	0.142	0.069	0.046	0.063

Source: Congressional Budget Office (CBO).

Notes: Before-tax market income. Business income includes dividends.

important factor behind the rise in top incomes, accounting for 3.5 percentage points of the total increase, followed by wages. Higher business income is explained by both increasing returns and the concentration of business income at the top of the income distribution. The share of business income in total income went from 6% in the 1980s to 10% in the 2010s. Meanwhile, 71% of total business income went to the top 5% of the income distribution 2010-18 compared to 54% 1980-89.

1.2.2. Saving Behavior Across the Income Distribution

Along with income, the Survey of Consumer Finances indicates business ownership is concentrated among top incomes (table 3).[10] Around half of households in the top 5% of incomes own a business, compared to around 15% of households in the 40th to 80th income percentiles in the survey. In addition, businesses owned by high-income households are more valuable than businesses owned by other households.[11] Financial assets are similarly concentrated among top incomes.

Table 3: Selected Household Characteristics by Income Percentile, Average 2000-18

	40-80th	80-90th	90-95th	Top 5%
Age	49.3	49.2	51.2	53.7
	(0.55)	(0.66)	(0.64)	(0.74)
Has a Business	0.13	0.20	0.26	0.50
	(0.00)	(0.01)	(0.01)	(0.02)
Business Assets to Income	0.51	0.72	1.23	3.35
	(0.03)	(0.07)	(0.12)	(0.10)
Financial Assets to Income	2.44	3.14	4.10	5.05
	(0.05)	(0.10)	(0.14)	(0.10)

Source: Survey of Consumer Finances.

Notes: Standard errors are in parentheses.

for the top 5% of incomes each year on average. The standard errors should be small given a sample of this size.

[10]The same tabulation indicates 70% of the top 1% of incomes are business owners.

[11]Those in the top 5% of incomes report business assets worth 5.5x their incomes in aggregate whereas the same ratio is 3.8x for households in the 40th to 80th income percentiles with a business.

Comparing business owners and other households, total financial assets rise with income for both groups, but business owners generally hold more. Defining total non-housing wealth as the sum of business and financial assets, business owners have 2 to 3 times the wealth of their peers across income bands. There are several explanations for this difference: First, wealthier households may prefer to start businesses. It is also possible that business owners do not perceive business assets as a form of saving – for example, such assets may be forfeit given a bankruptcy. The bequest motive may be stronger for business assets than financial assets. Finally, business owners may face higher income risk and engage in higher precautionary saving. Indeed, evidence suggests that top incomes are relatively transitory, especially for households reliant on business income. A study by DeBacker, Panousi, and Ramnath (2022) finds business income has 60x the variance of wage income, mostly due to large tail risks. Over one year, around 40% of households with business income remained in the same income decile, compared to 60% for wage earners. Firm closure appears catastrophic. There is a 3.5% probability of going from the top to bottom decile for households reliant on business income. For wage earners, the equivalent transition probability is near zero.[12]

A recent study by Fagereng et al. (2019) looks at Norwegian administrative data, which includes information on both the income and wealth of households. The authors find that the marginal propensity to save across the wealth distribution is relatively constant when capital gains are excluded. Meanwhile, capital gains are almost entirely saved. If this is the general case, it is important to net out capital gains from income when tabulating saving rates to avoid conflating savings from income and existing wealth. Still, the saving rate is still notably higher at the upper end of the income distribution looking at the results reported by Fagereng et al. At the 99th income percentile in Norway, around 35% of disposable income is saved, net of capital gains, compared to 5% for the median household.[13]

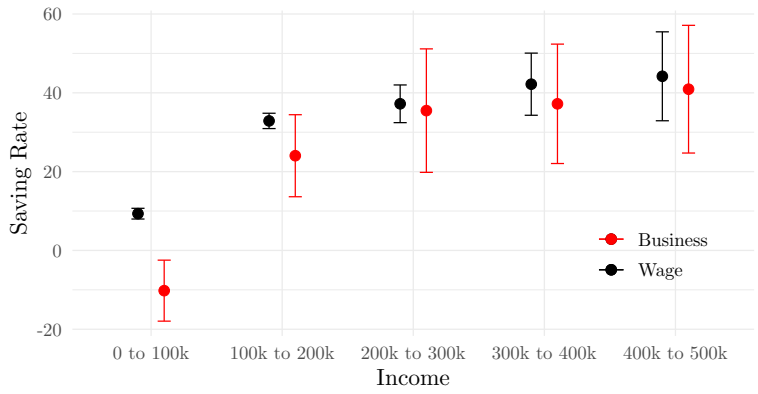
To test whether business income affects saving behavior, I tabulate saving rates across the income distribution by primary income source using the same approach as Fisher et al. (2022), which matches households in the Survey of Consumer Finances and Consumer Expenditure Survey based

[12]Most income shocks appear transitory. A decomposition by the authors suggests the risk from permanent changes to income accounts for just 20% of total income risk. These shares are similar across income sources, but the overall level of risk is much higher for business income.

[13]Disposable income net of capital gains. Fagereng et al. (2019) observes relatively low rates of net saving (under 10%) until the 90th percentile of the income distribution. Mian, Straub, and Sufi (2021b) find a saving rate around 25% of disposable income for the top decile of the US income distribution, with the aggregate saving rate at 9 percent.

on their observable characteristics. Income source is categorized depending on whether a household received two-thirds of its total market income from wages or distributed profits (including dividends), dropping intermediate observations. The results indicate income level (as opposed to source) is the main determinant of the saving rate, at least for higher income levels. Figure 4 shows the saving rate increases in after-tax income and the results are roughly comparable to Fagereng et al. (2019). While households reliant on business income save less at lower income levels, there is no measurable difference in saving rates when household incomes are above $100k. The 95-99% income percentiles fall generally between $200k and $500k over the sample period.[14] Average incomes over the 2004-16 sample period are $70k for majority wage earners compared to $150k for households with majority business income.[15]

Figure 4: Household Saving Rate by Income Level and Primary Source, 2004-16



Source: Survey of Consumer Finances and Fisher et. al (2022).
Notes: Excludes capital gains. Error bars give 95% confidence interval.

1.2.3. Profits and the Evolving Legal Structure of Businesses in the United States

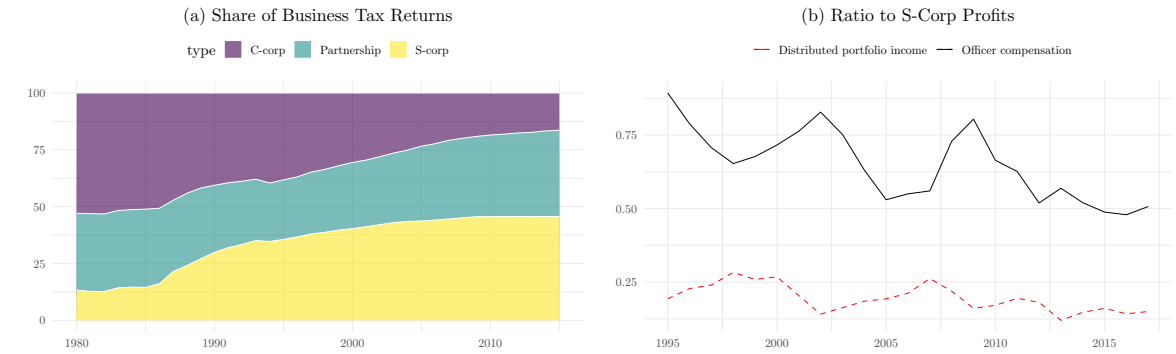
Rising business incomes in the United States do not necessarily stem from higher profits but may reflect other factors. The separation of wages and profits typical of C-corporations is less well-defined for other business entities and most growth in registered businesses has been from partnerships and S-corporations (figure 5*a*). For these firms, profits are passed through directly to owners, who have some discretion over reporting profits or wages on their tax returns. There is no large tax advantage for a given form of incorporation or income source, at least for upper tax brackets. The

[14] Standard errors remain relatively compact for incomes below $500k, but there are few observations above this level and the variance is much higher.

[15] The gap in the saving rates below $100k and dissaving among entrepreneur households stands out. This may arise due to higher expected permanent income or transitory income shocks among entrepreneur households.

combined corporate income and dividend tax rate applied to C-corporations is roughly equal to the top marginal tax rate on personal income. Still, Cooper et al. (2016) find that the effective tax rate on partnerships and S-corporations is lower than the tax rate for C-corporations, which may explain the growing preference for S-corporations.

Figure 5: Changes in the Structure of US Businesses



Source: IRS Statistics of Income.

Two adjustments are needed to ensure consistent measurement of profits over time:

First, officer compensation (i.e. payments to owner-employees) is large relative to net income in the corporate sector. For S-corporations, officer compensation averaged 70% of net income 1992-2016 while it was around 40% of net income for C-corporations. Notably, this ratio declined over time for both S- and C-corporations due to stricter enforcement of 'reasonable pay' clauses and lower effective tax rates on corporate profits (see figure 5*b* for S-corporations). One way to reduce ambiguity over the separation of wages and profits is to add officer pay to net income. This makes C- and S-corporations more comparable to partnerships and sole proprietorships, where owner-employees generally report income as profits.[16] Adding officer compensation to C-corporation profits results in a 50% upward revision for overall business profitability in the 1980s since business activity was dominated by C-corporations and officer compensation was relatively high during this period. The same adjustment increases profitability by only 20% in the 2010s. The change between periods in table 4*e* is therefore smaller than table 4*c*, due to a smaller 'within' component.

A second source of bias comes from the inclusion of portfolio income in the net income of S-corporations and partnerships. Many are set up purely as investment vehicles and the share of

[16] Guaranteed payments to owners are a small and stable share of partnership income – around 10%.

portfolio income in net income has grown over time. This leads to a potential double-counting problem and over-reporting of total business income. To mitigate this, a second adjustment takes only business (or 'ordinary') income earned by S-corporations and partnerships into account. For partnerships, portfolio income makes up almost 50% of total net income, leading to a large downward revision in profitability.

Table 4: Corporate Profitability by Business Type, Period Averages

(a) Share of Total Receipts

	1981-89	1990-99	2000-9	2010-16
C-corporation	0.833	0.742	0.665	0.625
S-corporation	0.068	0.149	0.175	0.192
Partnership	0.041	0.058	0.119	0.146
Sole proprietorship	0.058	0.051	0.041	0.038

(b) Net Income to Receipts

	1981-89	1990-99	2000-9	2010-16
Total	0.035	0.051	0.056	0.069
C-corporation	0.027	0.036	0.035	0.046
S-corporation	0.021	0.042	0.056	0.064
Partnership[a]	0.059	0.114	0.119	0.134
Sole proprietorship	0.152	0.209	0.213	0.228

(c) Shift-Share Decomposition

Within	Between	Dynamic	Total
0.026	0.000	0.008	0.034
0.016	-0.006	-0.004	0.006
0.003	0.003	0.005	0.011
0.003	0.006	0.008	0.017
0.004	-0.003	-0.002	0.000

(d) Net Income and Officer Comp. to Receipts

	1981-89	1990-99	2000-9	2010-16
Total	0.053	0.068	0.072	0.082
C-corporation	0.046	0.053	0.048	0.056
S-corporation	0.039	0.078	0.094	0.101
Partnership[a]	0.059	0.114	0.119	0.134
Sole proprietorship	0.152	0.209	0.213	0.228

(e) Shift-Share Decomposition

Within	Between	Dynamic	Total
0.020	-0.002	0.012	0.029
0.008	-0.010	-0.002	-0.004
0.004	0.005	0.008	0.017
0.003	0.006	0.008	0.017
0.004	-0.003	-0.002	0.000

(f) Net Ordinary Income and Officer Comp. to Receipts

	1981-89	1990-99	2000-9	2010-16
Total	0.051	0.064	0.062	0.071
C-corporation	0.046	0.053	0.048	0.056
S-corporation	0.035	0.069	0.083	0.095
Partnership[a]	0.031	0.069	0.058	0.067
Sole proprietorship	0.152	0.209	0.213	0.228

(g) Shift-Share Decomposition

Within	Between	Dynamic	Total
0.018	-0.005	0.008	0.020
0.008	-0.010	-0.002	-0.004
0.004	0.004	0.007	0.016
0.001	0.003	0.004	0.009
0.004	-0.003	-0.002	0.000

[a]Partnerships exclude capital gains and real estate and rental income from net income for all years.

Source: IRS Statistics of Income.
Notes: The methodology of the shift-share decomposition is included in the appendix. The decomposition compares the periods 1981-9 and 2010-16.

Following these adjustments, a shift-share decomposition shows the 'within' component explains most of the change in total net income, largely due to higher profitability among C-corporations in the 2010s (see table 4*g*). Looking across the four business types, the final tabulations also show that S-corporations and partnerships were the main contributors to growth in total profits: all three

shift-share components are positive and the dynamic component for S-corporations explains a large part of total growth.

For internal consistency, the results for table 4 are given in terms of net receipts rather than GDP. The growth in net income between 1981-89 and 2010-16 is equal to around 7 percentage points of GDP when using the unadjusted total.[17] Including officer compensation lowers this slightly to 6 percentage points of GDP. Further excluding portfolio income reduces the change to 4 percentage points of GDP.[18]

Gross net income for the pass-through sector is larger in the IRS data than what CBO reports as household business income ($1.64 trillion compared to $1.01 trillion in 2016).[19] There are several explanations for the discrepancy: First, there is a well-known mismatch between personal tax records and reported business income (Internal Revenue Service 2016). Second, the CBO figure may treat some share of self-employment income as wages. Finally, the tabulations include profits going to foreign nationals, which CBO may exclude.

2. Related Literature

The first two parts of this section provide further context for the trends discussed above: the drivers of declining interest rates and then evidence for rising markups. With a binding ZLB, there has been growing interest in using fiscal policy to raise interest rates and the final part of this section provides an overview of capital taxation.

2.1. Determinants of Real Interest Rates

Platzer and Peruffo (2022) aim to holistically explain the decline in interest rates accounting for inequality, demographic change, productivity growth, public debt, and redistribution policies. The authors find that while slower productivity growth is the main driver, income inequality and demographic changes are also large, if secondary, contributors. Other studies reach similar results, including Holston, Laubach, and Williams (2017), which connects declining interest rates to low

[17] Generally, net receipts are 2.15x GDP over the 1981-2016 period. Although there is some variation in this ratio by year, there is no trend.

[18] The CBO data for households indicate a corresponding increase of 4.8 percentage points for business income (including dividends) over the same period.

[19] Note that income from C-corporations is reported as dividends by the CBO.

output growth, and Carvalho, Ferrero, and Nechio (2016), which looks at demographics in detail. Other studies have pointed to the risk premium and changing household preferences, noting the marginal product of capital has been stable despite the fall in interest rates (Caballero, Farhi, and Gourinchas 2008).

Looking at inequality more specifically, Straub (2019) argues the marginal propensity to consume is decreasing in permanent income.[20] Accordingly, rising inequality has resulted in high saving and low aggregate demand, pushing down interest rates. Song et al. (2018) observe that income inequality in the United States results from higher dispersion in the individual fixed component, i.e. permanent returns to skills or abilities. Differences in the skills of younger generations are more pronounced than in the past. On this point, Auclert and Rognlie (2018) find the effects of inequality on saving/consumption are small if caused by individual fixed component but are large if caused by higher income risk. Rising inequality may also reflect income gaps between generations or grow within certain generations. Hallaert et al. (2018) find that income inequality has increased both within and between generations in Europe. This also appears to be the case in the United States, although the trend for wealth is much more pronounced than for income (Fisher et al. 2022).

Bequests account for the majority of private wealth and are an important determinant of capital accumulation. Alvaredo, Garbinti, and Piketty (2017) provide evidence that bequests have followed a U-shaped pattern over recent decades in several major economies – France, Germany, the United Kingdom, and the United States. Since the 1980s, there has been a trend increase in inherited wealth relative to total private wealth in these countries, although the pattern is most evident in France and Germany.[21] Studies by Boserup, Kopczuk, and Kreiner (2016) and Elinder, Erixson, and Waldenström (2018) use population register data on inheritances to estimate their impact on wealth inequality, the former in Denmark and the latter in Sweden. Both find that inheritances increase the absolute dispersion of wealth, but reduce inequality as measured by the top wealth share or a Gini coefficient. While the wealthy inherit larger amounts, the less wealthy inherit more relative to their pre-inheritance wealth.

[20] Most of the literature assumes a linear relationship between permanent income and consumption.

[21] Brülhart, Dupertuis, and Moreau (2018) shows a similar pattern for Switzerland. In Europe, the share of inherited wealth went from 40% in the 1970-80 period to 50-60% over the 2000s. In the United States, it increased around 5 percentage points according to the benchmark estimate, although it may have been much higher (10-15 percentage points) depending on the imputation.

There is a consensus productivity growth in both Europe and the United States has slowed since the mid-2000s, at least by standard measures. The 2008 financial crisis appears as one inflection point. Both Cerra and Saxena (2008) and Reinhart and Reinhart (2010) note output losses are persistent following financial crises. A subsequent analysis by Duval et al. (2020) finds the decline in TFP was larger for firms that entered the 2008 financial crisis with weak balance sheets and firms located in countries with tighter credit conditions post-crisis. In addition, the study finds financially weak firms cut investment in intangibles more than their peers, which suggests financial constraints are a driver of slow TFP growth. In this vein, Ikeda and Kurozumi (2019) develop a framework where tighter financial constraints on firms reduces endogenous TFP growth since firms borrow to fund development costs. Accordingly, tighter financial constraints result in a permanent decline in output. This also connects to Autor et al. (2017) and Decker et al. (2018), which find productivity dispersion (within industry) in the United States has expanded in recent years. Firms at the "productivity frontier" are still seeing strong gains, but employment has not reallocated from low- to high-productivity firms and dispersion in output per worker has increased.

Along with the aftermath of the 2008 crisis and tighter borrowing conditions, financial frictions related to the rising intangible share in investment are likely another driver of lower productivity and depressed capital demand. Difficulty collateralizing intangibles has changed the financial structure of firms. Dell'Ariccia et al. (2020) observe banks have restricted lending to firms with intangible assets and that financing has switched to venture capital and private equity.[22] Gutiérrez and Philippon (2017) observe a high Tobin's Q over the 2000s and 2010s relative to rates of investment. The authors attribute this to "rising intangibles, decreased competition, and changes in corporate governance that encourage payouts instead of investment." They estimate around one-quarter of the investment gap is explained by intangibles. Finally, the price of capital has declined, making it easier for firms to cover depreciation costs. This could reduce the investment rate and result in lower real interest rates, as in Rachel and Smith (2019).

[22]These financing arrangements generally protect intellectual property better than public equity. Also, the shift in capital towards intangibles may lead to a wedge in returns that benefits large private and institutional investors to the detriment of traditional banks and retail investors.

2.2. Rising Profits and Role of Pass-Through Income

Along with accounting profits, a growing body of literature finds markups increased over recent decades (notably Autor et al. 2017; De Loecker and Eeckhout 2017).[23] There is also evidence that low investment is linked to weakening competition dynamics (Gutiérrez and Philippon 2017). Two recent papers have noted that rising markups may result from changes in the consumption basket. Döpper et al. (2021) find consumers have become less sensitive to markups over time. Lower marginal costs allowed for a 25% increase in markups between 2006 and 2019 without a strong response from consumers. Similarly, Sangani (2022) finds the price elasticity of consumers declines in income, with rising income inequality explaining 30% of the rise in markups. Eggertsson, Robbins, and Wold (2018) outline the macroeconomic implications of a markup shock and demonstrate rising markups are consistent with the observed declines in the labor and capital shares, a rising Tobin's Q, and increasing financial wealth. Edmond, Midrigan, and Xu (2018) find the welfare costs of markups are large. Around two-thirds of the costs are due to the resulting 'tax' on the other factors of production and one-third is due to misallocation since larger and more efficient firms face less competition and raise prices.

The allocation of entrepreneurial income is a non-trivial question given its role in the rising capital share of income. As discussed, the shift to pass-through income explains higher aggregate profitability to a large extent. Smith et al. (2022) find around one-third of the decline in the labor share is explained by pass-through income.[24] Additionally, the increase in business income is not necessarily explained by higher economic rents since the labor, capital, and 'entrepreneurial' components of income are increasingly mixed. Higher pass-through income may reflect returns to human capital rather than financial capital according to a study by Smith et al. (2019). Still, the debate on whether returns to skills or rent-seeking explains higher profits remains open and an area for future research.

2.3. An Overview of Capital Taxation

With a near-binding ZLB over the 2010s, there was growing discussion on whether tax and fiscal policy could complement monetary policy (Correia et al. 2013). This touches on a much older

[23] While rising industry concentration is well documented, there is no direct measure for markups and results are not consistent across approaches. See Basu (2019) for an overview.

[24] These are generally partnerships and S-corporations. There is no tax at the firm level on profits and firm owners are individually taxed on distributed profits.

debate on how tax incentives affect the real economy. By the 1980s, there was a general consensus among economists that capital taxes were less efficient than taxes on labor. This stemmed from two main observations: First, capital accumulated over time and therefore distortions to investment would compound. Second, labor income could be taxed more efficiently. Judd (1985) and Chamley (1986) solidified the view that capital taxes are costly over the long run. Both papers use a neoclassical growth model with an infinitely lived agent who works in each period and saves to smooth consumption. Any tax on capital reduces the expected return on saving and thereby depresses investment in the economy. The second conclusion follows from Atkinson and Stiglitz (1976), which suggests progressive income taxation can be Pareto efficient under certain assumptions. Like the Judd-Chamley result, the policy implications of the Atkinson-Stiglitz framework have been heavily debated. Stiglitz (2017) revisits the original paper and shows a tax on capital may be less distortionary than alternatives under a different set of assumptions.

Most empirical studies find negative impacts from higher capital taxes on wages, suggesting either complementarity between capital and labor or burden sharing between firm owners and employees. Suárez Serrato and Zidar (2016) use variation in US state corporate tax rates to estimate how the tax burden is distributed and find around 30-35% of tax increases are absorbed by labor. Other studies support this finding and produce similar (if not higher) estimates, solidifying the view that corporate income taxes affect wages. Examples include Felix and Hines (2009); Arulampalam, Devereux, and Maffini (2012); Liu and Altshuler (2013); and Fuest, Peichl, and Siegloch (2018). Capital taxes also influence the financial structure of firms. Generally, the literature finds that higher tax rates on corporate income encourage firms to take on debt since interest payments are deductible (e.g. Rajan and Zingales 1995). Heider and Ljungqvist (2012) exploit variation in corporate income tax rates across US states over time and find tax differences are a major determinant of firms' capital structure. Djankov et al. (2010) use a fictional company to impute effective tax rates across countries. The authors find evidence higher effective tax rates reduce corporate investment and leads firm to use debt as opposed to equity finance.

Looking specifically at dividends, Yagan (2015) tests whether the 2003 dividend tax cut in the United States stimulated corporate investment and/or affected labor earnings. Using data from corporate tax returns from 1996-2008, the study finds that the tax cut caused no change in corporate investment

or employee compensation.[25] The effects of dividend taxation on investment and firm behavior have been debated since the 1970s with two leading theories. The 'old' view holds that dividend taxation affects capital costs (i.e. the returns on equity) and thereby distorts investment decisions (as in Harberger 1962; Feldstein 1970). In the 'new' view dividend taxes are less relevant to firms' investment decisions since investments are generally financed from retained earnings and equity is trapped within the corporation (as in King et al. 1977; Auerbach 1979; Bradford 1981).[26] The analysis in this paper generally follows the 'new' view where a dividend tax does not distort firm owners' profit maximization objective.

As with the paper here, OLG frameworks have long been used to investigate the effects of redistribution, starting with Atkinson and Sandmo (1980). There, the authors show a tax on capital income can increase the saving supply when households act as target savers. Since the capital tax is effectively a transfer from the old generation to the young, unanticipated changes in tax rates redistribute income. Similarly, Erosa and Gervais (2002) use a life cycle economy model to look at optimal age-dependent taxation and redistribution from old to young. If age-dependent taxes on labor are not possible, a tax on capital income is an imperfect substitute. Krueger, Ludwig, and Villalvazo (2021) look at optimal capital taxation in an OLG economy with excess precautionary saving against idiosyncratic income risk. In this case, the excess savings lower the utility of the current generation, but future generations benefit whenever capital is below the golden rule. Higher capital taxes may increase present utility, at least if oriented towards social insurance, yet these gains come at the expense of future generations.

2.3.1. Households at the Zero Lower Bound

Empirical research indicates households are much more responsive to tax incentives than unconventional monetary policies. Using a difference-in-differences approach, D'Acunto, Hoang, and Weber (2020) show sales tax changes affected household inflation expectations and spending to a much larger extent than forward guidance. The evidence also indicates Ricardian equivalence and the permanent income hypothesis do not hold when households are constrained. Theory suggests the marginal propensity to consume from transitory income will either be near zero or one (Jappelli and

[25] A study by Isakov, Pérignon, and Weisskopf (2021) arrives at a similar conclusion for Switzerland.
[26] Notably, capital gains taxes remain relevant to investment decisions under the 'new' view.

Pistaferri 2010). Unconstrained households will increase consumption proportional to the change in lifetime income resulting from the one-time transfer, which will typically be near zero. By contrast, constrained hand-to-mouth consumers will have a marginal propensity to consume close to one. Coibion, Gorodnichenko, and Weber (2020) look at how United States consumers spent one-time transfers during the initial Covid-19 outbreak and the evidence generally aligns with this view. There is a similar pattern in Sahm, Shapiro, and Slemrod (2012), who look at household transfers during the 2008 financial crisis.

3. A Two Period OLG Model with Workers and Entrepreneurs

The setup here explores the interconnection between higher monopoly power and interest rates. As the profit share increases, it affects the asset market and equilibrium interest rate – household saving increases while capital demand weakens. OLG households act as target savers. Monopolistic competition is assumed and profits are paid to entrepreneurs, who are distinct from worker households. Generally, the saving rate of worker households is below the golden rule while entrepreneur households save at much higher rates. At first, entrepreneurship and the household savings rate are treated as exogenous. In a later extension, each household receives a productivity draw that determines whether the household selects into entrepreneurship, similar to Levine and Rubinstein (2018).[27] A final extension models the saving rate as a function of household income level.

3.1. Monopolistic Firms

Monopolistic competition is assumed and firms generate some profit margin over their cost. Each firm is managed by an entrepreneur household and operates for one period.

3.1.1. Production

There is a continuum of intermediate goods producers owned by the entrepreneur households and a final retailer. The intermediate good y has a Cobb-Douglas production function

$$y_{it} = z_{it}^{\frac{1}{\sigma_t - 1}} k_{it}^{\alpha} n_{it}^{1-\alpha} \tag{1}$$

[27] Jaimovich and Rebelo (2017) undertakes a similar exercise as well.

where k is capital, n is labor. The parameter α represents the capital share in production. The firm's productivity z aligns with the productivity of the entrepreneur who owns it. In the baseline scenario, this is equal across firms. A final retailer combines the intermediate inputs into a final consumption good Y using a CES technology

$$Y_t = \left[\int_i y_{it}^{\rho_t} di\right]^{\frac{1}{\rho_t}} \quad \text{where} \quad \rho_t = \frac{\sigma_t - 1}{\sigma_t} \tag{2}$$

The elasticity of substitution across goods σ is treated as an exogenous variable and varies between periods. Firms set their price based on aggregate demand conditions

$$\max_{\{y_{it}\}} \quad Y_t - \int_i p_{it} y_{it} di \tag{3}$$

The resulting price p is

$$p_{it} = \left(\frac{Y_t}{y_{it}}\right)^{\frac{1}{\sigma_t}} \tag{4}$$

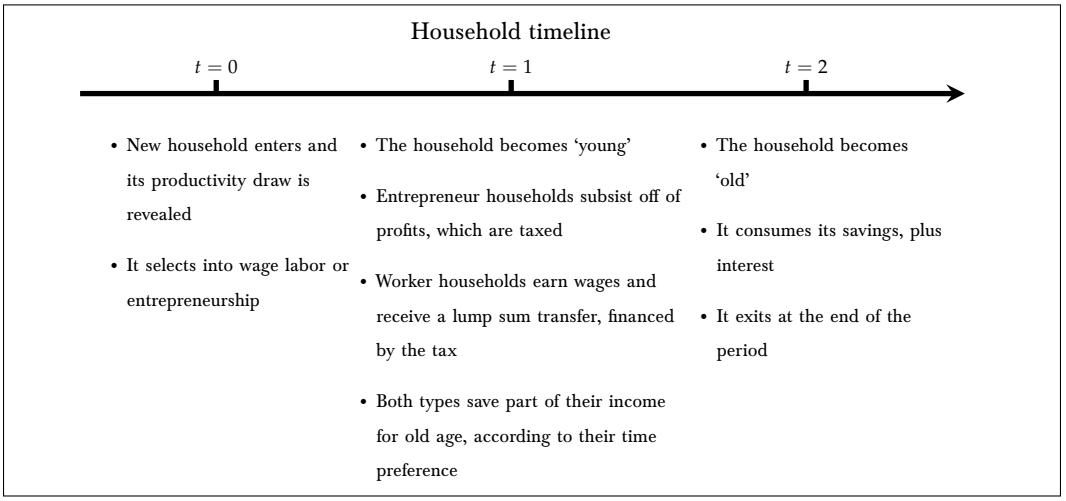
The firm's budget constraint takes the following form.

$$\pi_{it} = p_{it} y_{it} - w_t n_{it} - (r_t + \delta) k_{it} \tag{5}$$

Firms pay a rental rate r on capital and bear the cost of depreciation δ while π_{it} represents economic rents extracted by firm owners.

3.2. OLG Households

Households have overlapping generations that live for two periods. A new young generation enters at the beginning of each period and the old generation exits at the end. Within each generation, households either earn wages as workers or profits as entrepreneurs. There is no population growth and each generation has size $i + j$ where i is the index of entrepreneurs and j is the index of workers. The total population is large and households perceive themselves as atomistic.



3.2.1. Workers

The consumption of the young workers is denoted c^y and the old c^o. The old live off of deposits d made when young. The parameter β represents the worker household time discount factor. Worker households may receive a transfer $\mathcal{T}$ financed by a tax on firm profits, with aggregate profits denoted Π. In the baseline, a flat tax τ is applied across firms. Tax revenues are redistributed across worker households on an equal basis, where the index $j \in \{1, ..., z^*\}$. There is no variation in labor income and log utility is assumed.

$$\max_{\{c^y_{jt}; c^o_{jt+1}; d_{jt}\}} \quad \mathbb{E}_t \left[\log \left(c^y_{jt} \right) + \beta \log \left(c^o_{jt+1} \right) \right]$$

subject to

$$c^y_{jt} + d_{jt} = w_t n_{jt} + \mathcal{T}_{jt} \quad \text{where} \quad \mathcal{T}_{jt} = \frac{\tau_t \Pi_t}{z^*} \tag{6}$$

$$c^o_{jt} = (1 + r_t) d_{jt-1} \tag{7}$$

3.2.2. Entrepreneurs

Each entrepreneur owns a firm and income is derived from profits π which are a function of each household's productivity draw. Like worker households, entrepreneurial households face a dynamic trade-off between consuming profits when young and saving for old age. Their time discount is given

by ζ. A higher saving rate for entrepreneurs is consistent with $\zeta > \beta$.

$$\max_{\{c_{it}^y; c_{it+1}^o; d_{it}\}} \quad \mathbb{E}_t \left[\log \left(c_{it}^y \right) + \zeta \log \left(c_{it+1}^o \right) \right]$$

subject to

$$c_{it}^y + d_{it} = (1 - \tau_t)\pi_{it} \tag{8}$$

$$c_{it}^o = (1 + r_t) d_{it-1} \tag{9}$$

3.3. Market Clearing

Total consumption across households (workers and entrepreneurs) is given by

$$C_t = \int_i \left(c_{it}^y + c_{it}^o \right) di + \int_j \left(c_{jt}^y + c_{jt}^o \right) dj \tag{10}$$

Aggregate employment equals total labor demanded by individual firms. This also equals total labor provided by worker households.

$$N_t = \int_i n_{it} di = \int_j n_{jt} dj \tag{11}$$

Total profits are given by

$$\Pi_t = \int_i \pi_{it} di \tag{12}$$

Similarly, aggregate capital equals the total capital rented by individual firms

$$K_t = \int_i k_{it} di \tag{13}$$

The asset market clears when household savings equals capital

$$D_t = K_{t+1} \quad \text{where} \quad D_t = \int_i d_{it} di + \int_j d_{jt} dj \tag{14}$$

All markets clear in equilibrium. The resource constraint of the economy must satisfy

$$C_t + I_t = Y_t \quad \text{where} \quad I_t = \delta K_t \tag{15}$$

where consumption and investment equal output.

3.3.1. Competitive Equilibrium

Equilibrium is achieved when capital supply and demand align. Generally, household savings as a share of output are unaffected by the interest rate, while capital demand from firms is decreasing.

Solving the firm budget constraint (equation 5) for optimal labor gives

$$w_t n_{it} = \rho_t (1-\alpha) Y_t^{1-\rho_t} y_{it}^{\rho_t} \tag{16}$$

Aggregating labor and output across firms

$$w_t \int_i n_{it} di = \rho_t (1-\alpha) Y_t^{1-\rho_t} \int_i y_{it}^{\rho} di \quad \Longrightarrow \quad w_t N_t = \rho_t (1-\alpha) Y_t \tag{17}$$

This is simply the labor share of total output. Similarly, solving for capital gives

$$K_t = \frac{\alpha \rho_t}{r_t + \delta} Y_t \tag{18}$$

The sum of the income shares equals total output, accordingly the remainder gives the profit share

$$\Pi_t = (1-\rho_t) Y_t \tag{19}$$

3.3.2. Capital Supply and Demand

The solution for worker and entrepreneur savings can be stated as

$$d_{jt} = \frac{\beta}{1+\beta} \left(w_t n_{jt} + \mathcal{T}_{jt} \right) \tag{20}$$

$$d_{it} = \frac{\zeta}{1+\zeta} (1-\tau_t) \pi_{it} \tag{21}$$

Aggregating each gives the share of total output that is saved Ω

$$D_t = \frac{\beta}{1+\beta}\left(w_t N_t + \tau_t \Pi_t\right) + \frac{\zeta}{1+\zeta}\left(1-\tau_t\right)\Pi_{it} \tag{22}$$

$$= \Omega_t Y_t \quad \text{where} \quad \Omega_t = \frac{\beta}{1+\beta}\big(\rho_t(1-\alpha) + \tau_t(1-\rho_t)\big) + \frac{\zeta}{1+\zeta}(1-\tau_t)(1-\rho_t) \tag{23}$$

Solving $K = D$ for the equilibrium interest rate r^* yields a simple analytic expression

$$r^* = \alpha\rho\,\Omega^{-1} - \delta \tag{24}$$

Already, this result indicates a relationship between the monopoly power of firms and the interest rate:

$$\frac{\partial r^*}{\partial \rho} = \Omega^{-1}\left(r^*+\delta\right)\Bigg[\underbrace{\frac{\alpha}{r^*+\delta}}_{\text{cap. demand}} + \underbrace{\frac{\zeta}{1+\zeta}}_{\text{ent. saving}} - \underbrace{(1-\alpha)\frac{\beta}{1+\beta}}_{\text{worker saving}} - \tau\underbrace{\left[\frac{\zeta}{1+\zeta} - \frac{\beta}{1+\beta}\right]}_{\text{saving gap } (>0)}\Bigg] > 0 \tag{25}$$

Thus, r^* is decreasing as the profit share $1-\rho$ increases. Using the equation above, the decline in r^* can be attributed to (i) lower capital demand and (ii) more saving by entrepreneur households. This is partially offset by less saving by worker households and redistribution from entrepreneur households to workers. In the absence of redistribution ($\tau = 0$) and assuming the profit share is around 8%, the baseline calibration implies that lower capital demand explains around half the decline in interest rates and higher saving by entrepreneur households the other half. If all income were transferred from entrepreneurs to worker households ($\tau = 1$) then

$$\frac{\partial r^*}{\partial \rho} = \alpha\,\Omega^{-1}\left(r^*+\delta\right)\left[\frac{1}{r^*+\delta} + \frac{\beta}{1+\beta}\right] > 0 \tag{26}$$

This implies the negative effects of a higher profit share on interest rates are not offset by a redistributive tax, both due to lower capital demand and residual effects on labor income. It is also

useful to find the elasticity of the interest rate to changes in the corporate tax rate

$$\frac{\partial r^*}{\partial \tau} = \Omega^{-1} \left(r^* + \delta\right) \left(1 - \rho\right) \underbrace{\left(\frac{\zeta}{1+\zeta} - \frac{\beta}{1+\beta}\right)}_{\text{saving gap}} > 0 \tag{27}$$

The result here shows the change in interest rates from the tax is proportional to the size of the profit share $1 - \rho$ and the saving gap. Given the baseline calibration and reasonable settings for ρ and τ of 0.92 and 0.15, respectively, the response of the interest rate to a change in markups in equation 25 is clearly much larger than its response to redistribution in equation 27. In other words, a large tax increase is needed to offset the effect of a relatively small increase in markups on interest rates.

4. Policy Responses to a Markup Shock

Table 5 presents the baseline calibration used across cases. The calibration is standard and a household is assumed to remain active for 30 years. According to the CBO, the share of business income and dividends in total income went from around 5.5% in the early 1980s to 10.3% in the mid-2010s, with the period average being around 8%. The saving rate for worker and entrepreneur households is estimated using the replication files from Fisher et al. (2022). Households reliant on business income had an aggregate saving rate around 42% between 2004 and 2016. Households reliant on wage income saved around 24% of their income. Solving for the saving share of income given by ζ and β in the model gives 42.5% and 25.5%, respectively. The aggregate saving rate (as a share of output) is 20.6%, which is close to the US rate of investment over this period. It is also well below the saving rate implied by the golden rule where the capital share of income is set at 27%.

The model introduces a flat tax on profits of 15%. This corresponds to an 8% observed gap in reported taxes between households in the Survey of Consumer Finances and assumes dividends from C-corporations are taxed at 25% before they are distributed.[28] The capital share matches the value estimated by the Bureau of Economic Analysis (BEA) for the early 1980s, with all subsequent changes attributed to a rising profit share. The capital depreciation rate approximates 'consumption of fixed capital' as reported by the BEA.

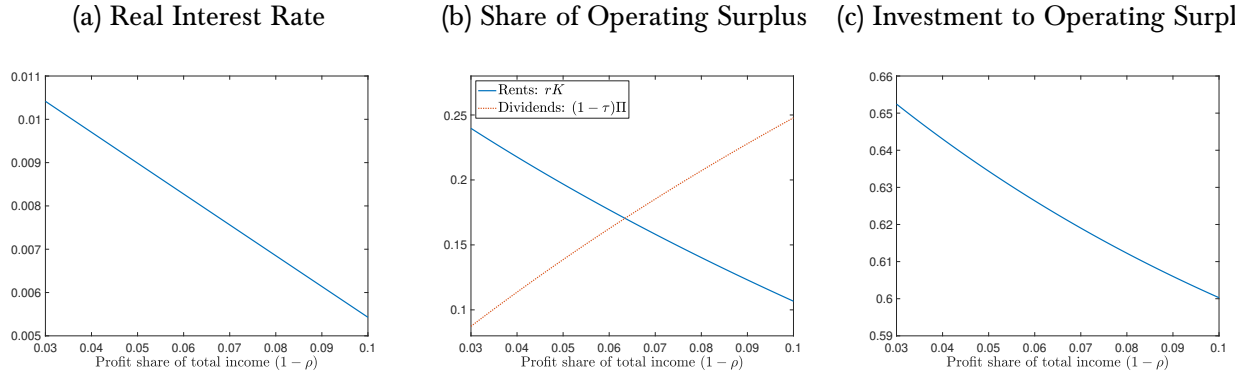
[28]The average effective tax rate on corporate income over the 2010s was around 25%. Although entrepreneur households face lower taxes than wage earners with the same income level, they generally fall into higher tax brackets as a group.

Table 5: Parameter Values

Parameter	Value	Description
n	30	Years between generations
α	0.27	Capital share
β	0.965^n	Worker time discount
ζ	0.99^n	Entrepreneur time discount
δ	$1 - 0.85^n$	Capital depreciation rate

The results reported in figure 6 are directly comparable to the changes reported in table 1 for the United States. An increase in the profit share of 5 percentage points leads to a 35 basis point decline in the equilibrium interest rate. The decline can be equally attributed to weaker capital demand and the increase in the saving supply. While the increase in dividend payments is mechanical, the declines in net rents and the investment share of the operating surplus are consistent with observed outcomes. The model also predicts a 1 percentage point increase in investment to output. While investment increased marginally over recent years, it is volatile and there is no clear trend.

Figure 6: The Effect of Markups on Interest Rates and Payments by Firms ($\tau = 0.15$)



The x-axis gives the change in the profit share of income. The left-hand panel gives the real interest rate, while the center and right-hand panels scale outcomes as a share of the gross operating surplus, defined as profits plus investment (δK). Targets are given in table 1 for the United States.

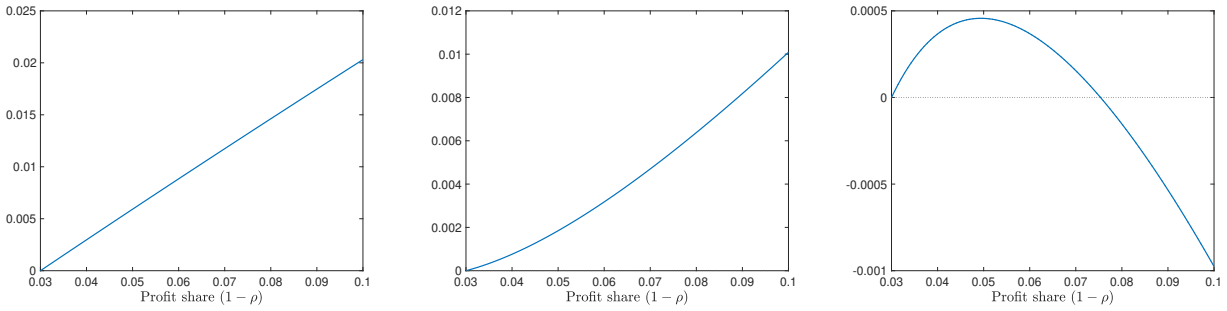
Due to a limited saving supply, the effect of a higher profit share on output is positive: while it reduces capital demand, entrepreneurs save at high rates and this increases capital and output (figure 7a). As a consequence, the lifetime utility of young households improves, although a declining interest rate adversely impacts consumption in old age (figures 7*b*).[29] This assumes incomes are equal across

[29]The welfare estimate in figure 7b assumes that income remains equal across all worker and entrepreneur households. As the profit share increases, so does the number of entrepreneur households.

households and the underlying welfare estimate is discussed in the appendix (section A.3). If the increase in the profit share leads to higher inequality, the welfare effects are ambiguous. Figure 7*c* starts from an equal income allocation across households when $1-\rho = 0.03$ and holds this allocation constant. It shows that a rising profit share initially increases aggregate welfare but it eventually turns negative. The initial gains reflect rising aggregate saving and output. However, the income gains are concentrated among a small group and their marginal utility from higher consumption is diminishing. Welfare losses for worker households from lower wages begin to dominate. Their old-age consumption also drops due to lower interest rates.

Figure 7: The Effect of Markups on Output and Welfare, % Deviation ($\tau = 0.15$)

(a) Output (b) Welfare: Equal Society (c) Welfare: Higher Inequality



The x-axis gives the change in the profit share of income, which goes from 3% to 10%. The y-axis gives the percent deviation from an economy with a 3% profit share. The welfare calculation in the center panel assumes the number of worker/entrepreneur households changes in line with their income shares. The welfare calculation in the right-hand panel holds the number of households constant, based on their allocation for a 3% profit share.

The following section looks at how different tax policies interact with the markup shock. While these do not address the economy's structural weaknesses – low rates of saving and growing markups – they can be welfare improving in some cases.

4.1. Tax Policies

Three different policies are considered: a redistributive tax, a subsidy on capital and labor, and increasing government debt. For the initial exercises involving comparative statics, the number of worker and entrepreneur households is held fixed and firms have identical productivity. These assumptions are later relaxed. Under redistribution, profits are taxed and given to worker households as a lump-sum transfer. Because worker households save at low rates, this reduces the capital supply and raises interest rates. The second policy applies a subsidy to capital and labor. This boosts both labor and capital demand, leading to higher wages and interest rates. In the final scenario, revenue

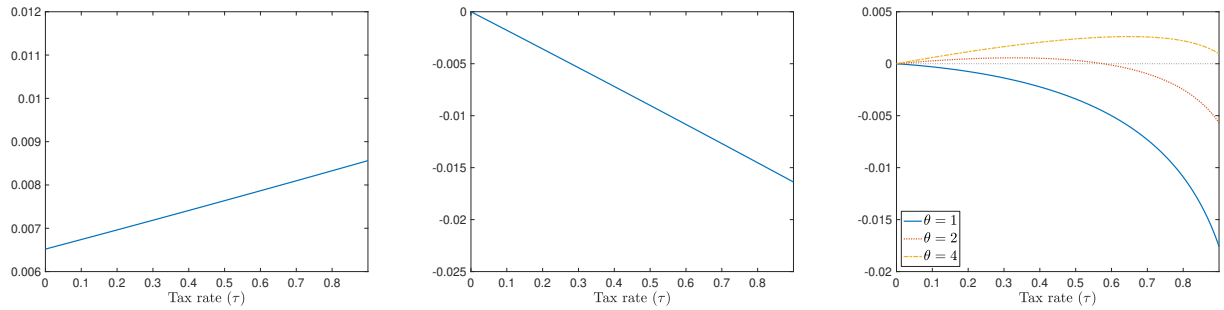
from the corporate tax is allocated towards servicing government debt. The resulting debt stock crowds out capital, pushing up the equilibrium interest rate. While the welfare gains from these policies are ambiguous when the economy is below the golden rule, an economy above it would see much larger welfare gains.

4.1.1. Redistribution

The redistributive tax was already described in the setup of the model and the results from changes in the tax rate are presented in figure 8*a*. They indicate redistributive taxation has a relatively weak effect on the interest rate, as implied by equation 27. While income is diverted to households with low rates of saving, the tax does not directly influence capital demand. Taking labor as numeraire, an increase in the tax rate from 15% to 35% lowers output by around 0.4 percentage point. Despite these losses, the tax can raise aggregate welfare if income is concentrated among entrepreneur households. Here, I define θ as the ratio of entrepreneur household income to worker household income (π_i / wn_j). If household income is equal across types (i.e. $\theta = 1$) then redistribution generally leads to welfare losses. As θ increases, the welfare gains from redistribution become more prominent.

Figure 8: The Effect of a Redistribution Tax on Interest Rates, Output, and Welfare ($1 - \rho = 0.08$)

(a) Real Interest Rate (b) Output (% dev.) (c) Welfare (% dev.)



The x-axis gives the change in the tax rate on entrepreneur income, which goes from 0 to 90%. Both output and welfare are scaled by their deviation from the zero-tax case. The right-hand panel includes outcomes for an equal society $\theta = 1$ where the share of entrepreneurs and workers aligns with their income share. It looks at welfare as inequality increases. With $\theta = 2$, there are fewer entrepreneurs and their income is double worker income, etc.

4.1.2. Capital and Labor Subsidies

Rather than redistribution, the tax can be used to subsidize labor and capital.[30] This increases labor demand and worker income, resulting in a lower aggregate saving supply. The subsidy also increases capital demand. The combined effect on the equilibrium interest rate is relatively large compared to

[30]The lump-sum transfer $\mathcal{T} = 0$ in this case as well as government debt (section 4.1.3).

redistribution. The firm budget constraint from equation 5 is modified so that

$$\pi_{it} = p_{it}y_{it} - (1 - s_t)\left[w_t n_{it} - (r_t + \delta)\, k_{it}\right] \tag{28}$$

The revenue constraint for the subsidy is

$$s_t\left[w_t N_t + (r_t + \delta)\, K_t\right] = \tau \Pi_t \qquad \Longrightarrow \qquad s_t = \frac{1 - \rho_t}{\rho_t}\tau_t \tag{29}$$

The firm optimization problem in section 4.2 shows this avoids distorting the relative allocation of capital and labor. Total payments to capital and labor are given by

$$K_t = \frac{\alpha \rho_t}{(1 - s_t)(r_t + \delta)} Y_t \qquad\qquad w_t N_t = \frac{\rho_t(1 - \alpha)}{1 - s_t} Y_t \tag{30}$$

In this case, total saving is given by $D_t = \Gamma_t Y_t$ where the saving rate

$$\Gamma_t = \frac{\beta}{1 + \beta}\frac{\rho_t(1 - \alpha)}{1 - s_t} + \frac{\zeta}{1 + \zeta}(1 - \tau_t)(1 - \rho_t) \tag{31}$$

The equilibrium interest rate is given by

$$r^* = \frac{\alpha \rho}{(1 - s)\Gamma} - \delta \tag{32}$$

The subsidy shifts both labor and capital demand towards their competitive allocation. If all profits are fully taxed ($\tau = 1$) then

$$\frac{\partial r^*}{\partial \rho} = 0 \tag{33}$$

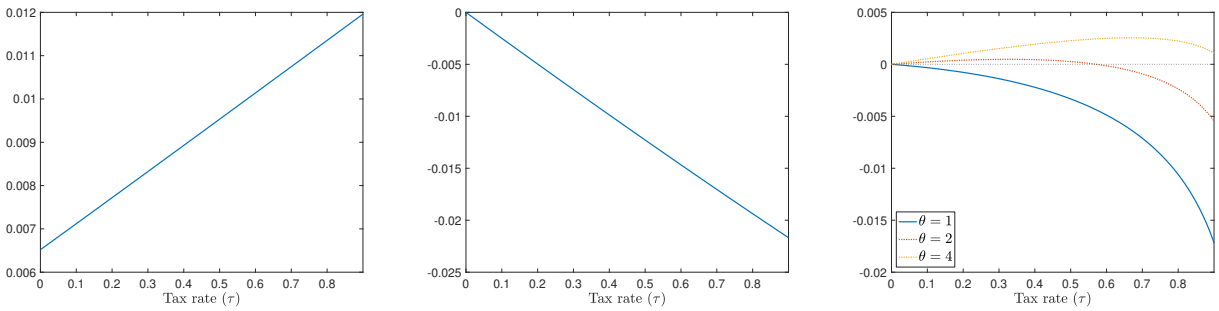
Here, the subsidy perfectly offsets the change in the capital share, unlike redistribution (equation 26).

Looking at figure 9, output falls due to a lower saving supply while the interest rate increases. Welfare is initially rising in the tax and then falling, as with redistribution. Compared to redistribution, output losses are larger – higher interest rates boost the consumption of the old generation, which does not save, lowering the capital supply. However, higher consumption in old age does lead to

some short-run welfare gains, a mitigating factor. Again, income inequality plays an important role and the welfare gains from the subsidy are positive only if entrepreneur income is concentrated.

Figure 9: The Effect of a Subsidy on Interest Rates, Output, and Welfare ($1 - \rho = 0.08$)

(a) Real Interest Rate (b) Output (% dev.) (c) Welfare (% dev.)



The x-axis gives the change in the tax rate on entrepreneur income, which goes from 0 to 90%. Both output and welfare are scaled by their deviation from the zero-tax case. The right-hand panel includes outcomes for an equal society $\theta = 1$ where entrepreneur and worker incomes are equal. It looks at welfare as inequality increases. With $\theta = 2$, entrepreneur income is double worker income, etc.

4.1.3. Government Debt

The government can also allocate revenue from the tax on entrepreneurs towards its debt service. To capture this outcome, the asset market clearing can be modified so that

$$D_t = K_{t+1} + B_t \tag{34}$$

where B_t is government debt. The government budget constraint is given by

$$\tau_t \Pi_t + B_t = (1 + r_t) B_{t-1} + \Delta G_t \tag{35}$$

where tax revenue and increases in debt (ΔB_t) finance increases in government spending (ΔG_t) and payments on existing debt.[31] In the steady state

$$B = \frac{\tau \Pi}{r^*} \tag{36}$$

[31] I leave government revenue and spending outside the model. This can be completely neutral so that taxes and transfers cancel out.

I assume debt has a maturity of 30 years to align with the general timing of the model. Solving for the equilibrium interest rate gives

$$r^* = \tau(1-\rho)\left(\Theta - \frac{\alpha\rho}{r^*+\delta}\right)^{-1} \quad \text{where} \quad \Theta_t = \frac{\beta}{1+\beta}\rho_t(1-\alpha) + \frac{\zeta}{1+\zeta}(1-\tau_t)(1-\rho_t)$$

To fully solve for the equilibrium interest rate, assume there is some multiplier $\delta = vr^*$ in the steady state where $v \geq 0$ so that

$$r^* = \frac{\alpha\rho + \tau(1-\rho)(1+v)}{\Theta(1+v)}$$

Since $\frac{\partial\delta}{\partial v} > 0$ (assuming $r^* > 0$) and $\frac{\partial r^*}{\partial v} < 0$, there is a unique solution for v, thereby r^*. Taking the simplifying case where $\delta = 0$, the change in the interest rate from a higher profit share is

$$\frac{\partial r^*}{\partial \rho} = \Theta^{-1} r^* \Bigg[\underbrace{\frac{\alpha\beta}{1+\beta}}_{\text{worker saving}} + \underbrace{\left(\frac{\zeta}{1+\zeta} - \frac{\beta}{1+\beta}\right)}_{\text{saving gap}} - \underbrace{\frac{\tau\zeta}{1+\zeta}}_{\text{ent. saving}} - \underbrace{\frac{\tau-\alpha}{r^*}}_{\text{crowding out}} \Bigg] \tag{37}$$

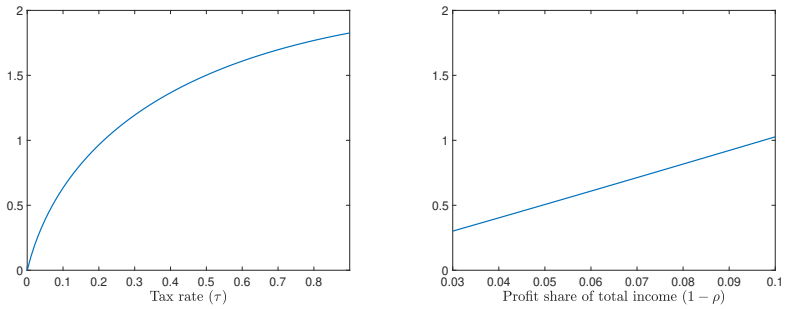
The change in interest rates from a higher tax is given by

$$\frac{\partial r^*}{\partial \tau} = \Theta^{-1} r^* (1-\rho) \Bigg[\underbrace{\frac{1}{r^*}}_{\text{crowding out}} + \underbrace{\frac{\zeta}{1+\zeta}}_{\text{ent. saving}} \Bigg] > 0 \tag{38}$$

This is strictly larger than the change in interest rates from redistribution (equation 27). As might be expected, increasing taxes allows the government to finance a substantially higher debt level (figure 10). The same is true if the profit share of income increases.

Figure 10: Steady State Debt Levels (% of Output)

(a) Higher Tax Rate ($\rho = 0.08$) (b) Higher Profit Share ($\tau = 0.15$)

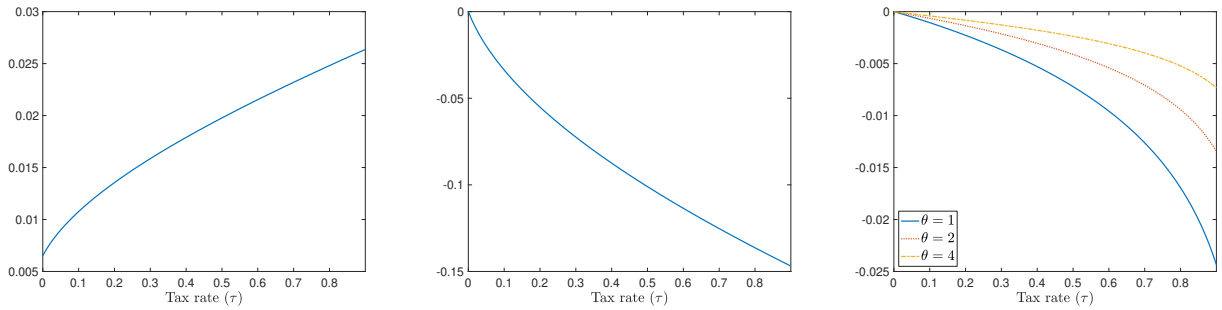


The x-axis for the left-hand panel gives the change in the tax rate on entrepreneur income, which goes from 0 to 90%. For the right-hand panel, it gives the change in the profit share of income, which goes from 3% to 10%. The y-axis for both panels gives the ratio of government debt to output.

Expanding the government debt stock has a large effect on the equilibrium interest rate, but also crowds out capital and lowers aggregate output and welfare (figure 11). Compared to the other policies, raising debt appears the worst for welfare. There are welfare losses even when inequality is high. The following sections will relax assumptions on selection into entrepreneurship and household saving behavior and test if outcomes for redistribution policies hold under a more realistic setting.

Figure 11: The Effect of Debt on Interest Rates, Output, and Welfare ($\rho = 0.08$)

(a) Real Interest Rate (b) Output (% dev.) (c) Welfare (% dev.)



The x-axis gives the change in the tax rate on entrepreneur income, which goes from 0 to 90%. Both output and welfare are scaled by their deviation from the zero-tax case. The right-hand panel includes outcomes for an equal society $\theta = 1$ where entrepreneur and worker incomes are equal. It looks at welfare as inequality increases. With $\theta = 2$, entrepreneur income is double worker income, etc.

4.2. Solving for the Marginal Entrepreneur

This section revisits redistribution from entrepreneur households to workers. Until now, the share of entrepreneur and worker households was set exogenously. However, if households are free to choose their type, then redistribution will affect their allocation. This has general equilibrium effects. As entrepreneurs switch to their type, an expanding labor supply depresses the equilibrium

wage. Furthermore, the profit share becomes concentrated among fewer entrepreneur households, whcih raises inequality. To capture these effects, I assume households have different productivity as entrepreneurs. Households select into entrepreneurship if their after-tax income from profits exceeds income for worker households, which receive uniform wages and the lump-sum transfer. Solving the firm's problem for optimal capital gives

$$\frac{k_{it}}{Y_t} = z_{it}\kappa_t \quad \text{where} \quad \kappa_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{\rho_t(1-\alpha)} \left(\frac{\alpha}{r_t+\delta}\right)^{1-\rho_t(1-\alpha)}\right]^{\sigma_t} \tag{39}$$

Similarly, for labor

$$\frac{n_{it}}{Y_t} = z_{it}\varphi_t \quad \text{where} \quad \varphi_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{1-\rho_t\alpha} \left(\frac{\alpha}{r_t+\delta}\right)^{\rho_t\alpha}\right]^{\sigma_t} \tag{40}$$

Each firm's share of output is given by

$$\frac{p_{it}y_{it}}{Y_t} = z_{it}\Psi_t \quad \text{where} \quad \Psi_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{1-\alpha} \left(\frac{\alpha}{r_t+\delta}\right)^{\alpha}\right]^{\sigma_t-1} \tag{41}$$

Profits are a constant markup over marginal cost, adjusted by each entrepreneur's productivity

$$\pi_{it} = z_{it}\psi_t Y_t \quad \text{where} \quad \psi_t = (\Psi_t - w_t\varphi_t - (r_t+\delta)\kappa_t) \tag{42}$$

There are a total of $i+j$ active households, where each has a productivity draw. Households with a low productivity draw will prefer to work and households with high draws will prefer to act as entrepreneurs. Total output Y is a function of the total number of workers in the economy and productivity. To find the equilibrium wage for a given productivity distribution, it is necessary to solve

$$\int_i z_{it}di = \frac{1}{\Psi(w_t, r_t^*)} \tag{43}$$

This follows from aggregating equation 41 and normalizing total output to unity. The equilibrium interest rate r^* can be solved using income shares, which remain fixed (see section 3.3.2). The average number of hours worked $\bar{n}_t$ is a function of the equilibrium wages and the number of worker households

$$w_t \bar{n}_t = \frac{\rho_t(1-\alpha)Y_t}{j} \tag{44}$$

Indexing households in ascending order by their productivity $z \in \{z_1, ..., z_{i+j}\}$ gives the marginal household z^* where labor and entrepreneurial income are equal:

$$w_t \bar{n}_t + \mathcal{T}_t = (1-\tau_t)\pi_{it} \quad \Longrightarrow \quad z^*_{it} = \frac{\rho_t(1-\alpha) + \tau_t(1-\rho_t)}{j \times (1-\tau_t)\psi(w_t, r^*_t)} \quad \text{(using equation 44)} \tag{45}$$

The system contains three equations (43, 44, and 45) and three unknowns (w^*, $\bar{n}$, and z^*). All households below z^* on the index become workers while those above become entrepreneurs, giving j and i respectively. Dividing the solution for firm-level capital (equation 39) by labor (equation 40) gives effective capital, which is an input in the welfare calculation

$$\frac{K_t}{N_t} = \frac{\kappa_t(w^*_t, r^*_t)}{\varphi_t(w^*_t, r^*_t)} \quad \text{where} \quad N_t \equiv j \times \bar{n} \tag{46}$$

From equation 45, it is clear that a higher tax rate displaces the marginal entrepreneur, which affects wages and the number of hours worked.

4.3. Tax Distortion to Entrepreneurship

Turning to the calibrated model, productivity follows a log-normal PDF.

$$z_t \sim lognormal(\mu_z, \sigma^2_z)$$

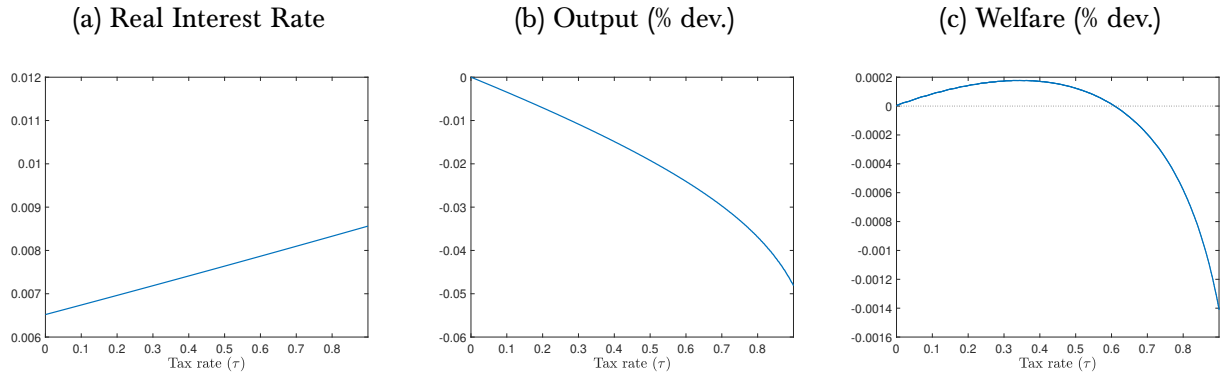
The settings are stylized but reflect the highly skewed nature of the firm size distribution and household income. Average incomes for entrepreneurs are 2.1x higher than workers – in line with results from the Survey of Consumer Finances. A more complete description is included in section A.6 of the appendix.

Table 6: Additional Parameter Values

Parameter	Value	Description
μ_z	0	Median productivity $= \exp(\mu_z)$
σ_z^2	3	Productivity dispersion

The allocation of workers and entrepreneurs is determined by the size of the profit share and each household's productivity draw. This is distorted by the redistributive tax, which reduces entrepreneurial income and raises the income of worker households. Accordingly, low-productivity entrepreneurs exit and become workers. The effect on aggregate productivity is positive since capital and labor are redirected towards more productive firms. However, firms may face diminishing returns to scale and the net effect could be positive or negative and I hold aggregate productivity constant. Furthermore, the model also assumes that firm exit has no impact on competition (the profit share remains fixed) and that firm owners cannot pass the tax burden onto workers or consumers. Relaxing any of these assumptions may lead to a different outcome. Finally, a progressive tax on profits could avoid displacing entrepreneur households entirely, given the simplistic nature of the model. In this case, the results would correspond to the static exercise in section 4.1.1.

Figure 12: The Effect of Redistribution on Interest Rates, Output, and Welfare ($\rho = 0.08$)



The results reflect both endogenous selection into entrepreneurship. Tax revenue is redistributed to worker households. The x-axis gives the change in the tax rate on entrepreneur income, which goes from 0 to 90%. Both output and welfare are scaled by their deviation from the zero-tax case. The right-hand panel includes outcomes for an equal society $\theta = 1$ where entrepreneur and worker incomes are equal. It looks at welfare as inequality increases. With $\theta = 2$, entrepreneur income is double worker income, etc.

Figure 12 shows how endogenous selection into entrepreneurship can change the results for redistribution. While the interest rate is dictated by income shares, which remain fixed, output and welfare are affected by changes in the labor supply. Output losses from a higher tax rate are significant due

to an increasing labor supply and lower capital. Still, redistribution results in modest welfare gains when taxes are low.

Changes in welfare are noticeably smaller compared to the static exercise. As entrepreneurs exit, the profit share becomes more concentrated, which reduces the weight of entrepreneur households in the welfare calculation.[32] This offsets the other impacts. It is also important to note that hours worked increase while wages decrease in response to the tax. Worker households are indifferent to this, but a labor-leisure trade-off would result in lower welfare.

4.4. Income-Dependent Saving Behavior

There is strong evidence the marginal propensity to consume declines with income and that high-income households save more. In the household utility function, this can be captured by changing the specification for old age for both household types, so that

$$\max_{\{c^y_{it}; c^o_{it+1}; d_{it}\}} \quad \mathbb{E}_t \left[\log \left(c^y_{it} \right) + \beta \, \chi \left(c^o_{it+1}, c_0 \right) \right]$$

Next, it is possible to define $\eta(c_i, c_0) = \chi'(c_i, c_0)\, c_i$ where c_0 is the old-age consumption target for a household, as done in Mian, Straub, and Sufi (2021a). In this case, the standard Euler equation for the young generation can be written as

$$\frac{c^o_{it+1}}{c^y_{it}} = \beta(1 + r_t)\, \eta(c^o_{it+1}, c_0) \tag{47}$$

Setting $\eta = 1$ is equivalent to specifying log utility for old age. If η is increasing in income, then households will save at higher rates. An activation function can be specified as

$$\eta(c_i, c_0) = 1 + \frac{1}{\lambda_2} \log \left(1 + e^{\lambda_1 (c_i - c_0)} \right) \tag{48}$$

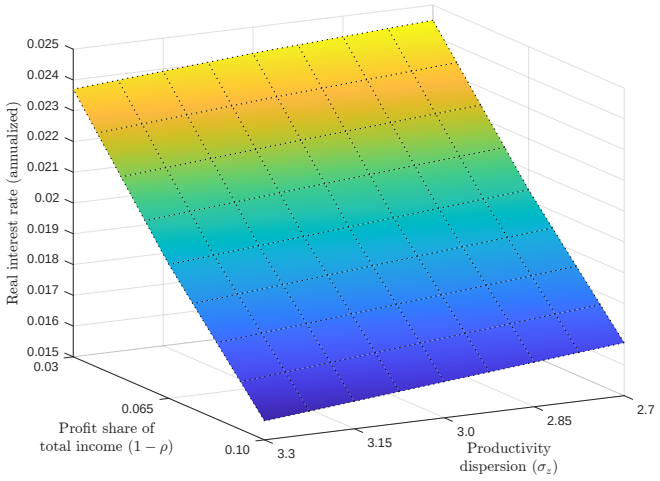
Households with consumption above the threshold value c_0 will have an above-average propensity to save out of income, where λ_1 and λ_2 are calibrated to match observed saving rates across the income distribution. In the calibrated model, the saving rate of the 99th income percentile is 40%, comparable to the value reported by Fagereng et al. (2019). Otherwise, endogenous selection into

[32] Note that as entrepreneurs change type, I hold their time discount preference constant.

entrepreneurship is assumed. High-income households put more weight on old-age consumption and I hold this constant when evaluating changes in welfare from the tax. The saving rate is allowed to vary. Details are in the appendix (section A.3).

Figure 13 shows that an increase in productivity dispersion can further depress interest rates. Entrepreneurial income is directly linked to firm productivity in the model.[33] As top incomes become more extreme, savings rates also increase. The interaction of a higher profit share along with higher income dispersion may have accelerated the decline in interest rates seen over the 1990s and 2000s.[34] In the numerical exercise, it generates a decline of up to 90 basis points – around one-third of the observed decline. The results also indicate that a rising profit share is the main contributor.

Figure 13: The Effect of Higher Productivity Dispersion and Profit Share on r^* ($\tau = 0.15$)



		σ_z^2		
		3.3	3	2.7
$1-\rho$	0.03	0.0237	0.0242	0.0245
	0.065	0.0193	0.0199	0.0203
	0.10	0.0156	0.0162	0.0167

Figure 14 shows how redistribution affects economic outcomes when both endogenous selection into entrepreneurship and income-dependent saving behavior are considered. Because the tax significantly reduces top incomes, the aggregate saving rate falls. Whereas households save around 20% of their income in the absence of any tax, this drops to 18% with a tax rate of 50%. Still, the

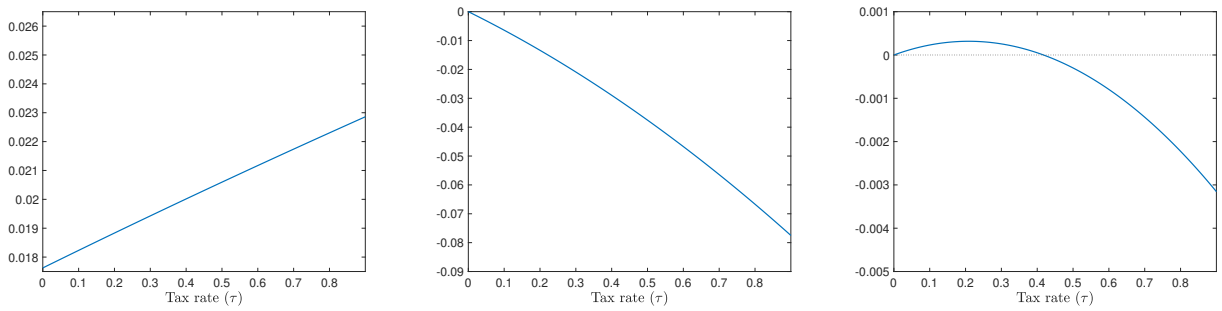
[33] The calibration matches saving rates across the income distribution closely. However, income for worker households is equal by assumption and the calibration does not match the aggregate saving supply for this reason.

[34] Increasing wage dispersion is well documented (e.g. Scanlon 2020) and exceeds 20% between the 1980s and 2010s. Preliminary tabulations of the SCF suggest a similar, if not stronger trend for business income over the 2000s.

impact on interest rates is modest – a welfare-neutral increase in the tax rate on entrepreneurial income from 0 to 40% leads to around a 25 basis point increase in the interest rate – offsetting around one-third of the decline resulting from a 5% higher profit share.

Figure 14: The Effect of Redistribution on Interest Rates, Output, and Welfare ($\rho = 0.08$)

(a) Real Interest Rate (b) Output (% dev.) (c) Welfare (% dev.)

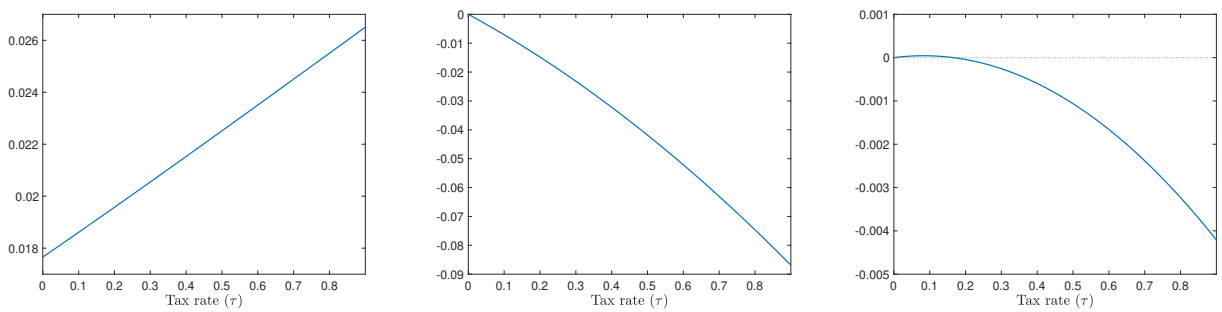


The results reflect both endogenous selection into entrepreneurship and income-dependent saving behavior. Tax revenue is redistributed to worker households. The x-axis gives the change in the tax rate on entrepreneur income, which goes from 0 to 90%. Both output and welfare are scaled by their deviation from the zero-tax case. The right-hand panel includes outcomes for an equal society $\theta = 1$ where entrepreneur and worker incomes are equal. It looks at welfare as inequality increases. With $\theta = 2$, entrepreneur income is double worker income, etc.

A final exercise looks at how income-dependent saving affects outcomes for the subsidy. Compared with redistribution, a similar pattern holds and the results are presented in figure 15. In this case, an increase in the tax rate from 0 to 40% remains close to welfare neutral and leads to a 40 basis point increase, offsetting around one-half the decline in the interest rate from a higher profit share. The policy avoids the large negative impacts on output and welfare compared with higher government debt.

Figure 15: The Effect of a Subsidy on Interest Rates, Output, and Welfare ($\rho = 0.08$)

(a) Real Interest Rate (b) Output (% dev.) (c) Welfare (% dev.)



The results reflect both endogenous selection into entrepreneurship and income-dependent saving behavior. Tax revenue is allocated towards capital and labor subsidies. The x-axis gives the change in the tax rate on entrepreneur income, which goes from 0 to 90%. Both output and welfare are scaled by their deviation from the zero-tax case. The right-hand panel includes outcomes for an equal society $\theta = 1$ where entrepreneur and worker incomes are equal. It looks at welfare as inequality increases. With $\theta = 2$, entrepreneur income is double worker income, etc.

5. Conclusion

This paper shows that changes in the US flow of funds are consistent with a markup shock and that rising profits accrued to top incomes. There is strong evidence households with high incomes generally save more than others. A modeling exercise shows the combined impact of a higher saving supply and lower capital demand results in a large drop in interest rates. An increase in the profit share of 5 percentage points along with a 20% increase in income dispersion is consistent with a 60 basis point drop in equilibrium interest rates. This explains around one-quarter of the overall decline in real rates between the 1980s and 2010s.

I assume higher market power is entrenched and use a simple OLG model to explore policy alternatives. High levels of redistribution are needed to raise interest rates, except if taxes fund higher government debt. However, government debt appears the worst option in terms of household welfare. In a situation where capital demand is already weak, debt further crowds out capital and lowers output. Among the alternatives, redistribution raises aggregate welfare the most but has a modest impact on interest rates. Meanwhile, capital and labor subsidies improve welfare and are effective at raising interest rates. The results hold when introducing both selection into entrepreneurship and income-dependent saving behavior. While I use a static welfare measure, the dynamic gains may be large when the ZLB is near-binding. In addition, two extensions may be useful: First, there appears a link between firm exit, market concentration, and productivity. Second, the welfare analysis could account for changes in the wage distribution and a labor/leisure trade-off.

To conclude, a markup shock is problematic in the context of low interest rates and a near-binding ZLB. While fiscal policy can help address the shock, this paper cautions against expanding government debt when investment is low. A simple exercise looking at welfare suggests well-targeted subsidies and household transfers are better alternatives, along with policies supporting stronger market competition.

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A. Appendix

A.1. Shift-Share Decomposition

The shift-share decomposition takes the following form:

$$\Delta X_{it} = \underbrace{\sum_j (\Delta X_{ijt})\omega_{jt-1}}_{within} + \underbrace{\sum_j (\Delta \omega_{jt}) X_{ijt-1}}_{static\ reallocation} + \underbrace{\sum_j (\Delta X_{ijt})(\Delta \omega_{jt})}_{dynamic\ reallocation}$$

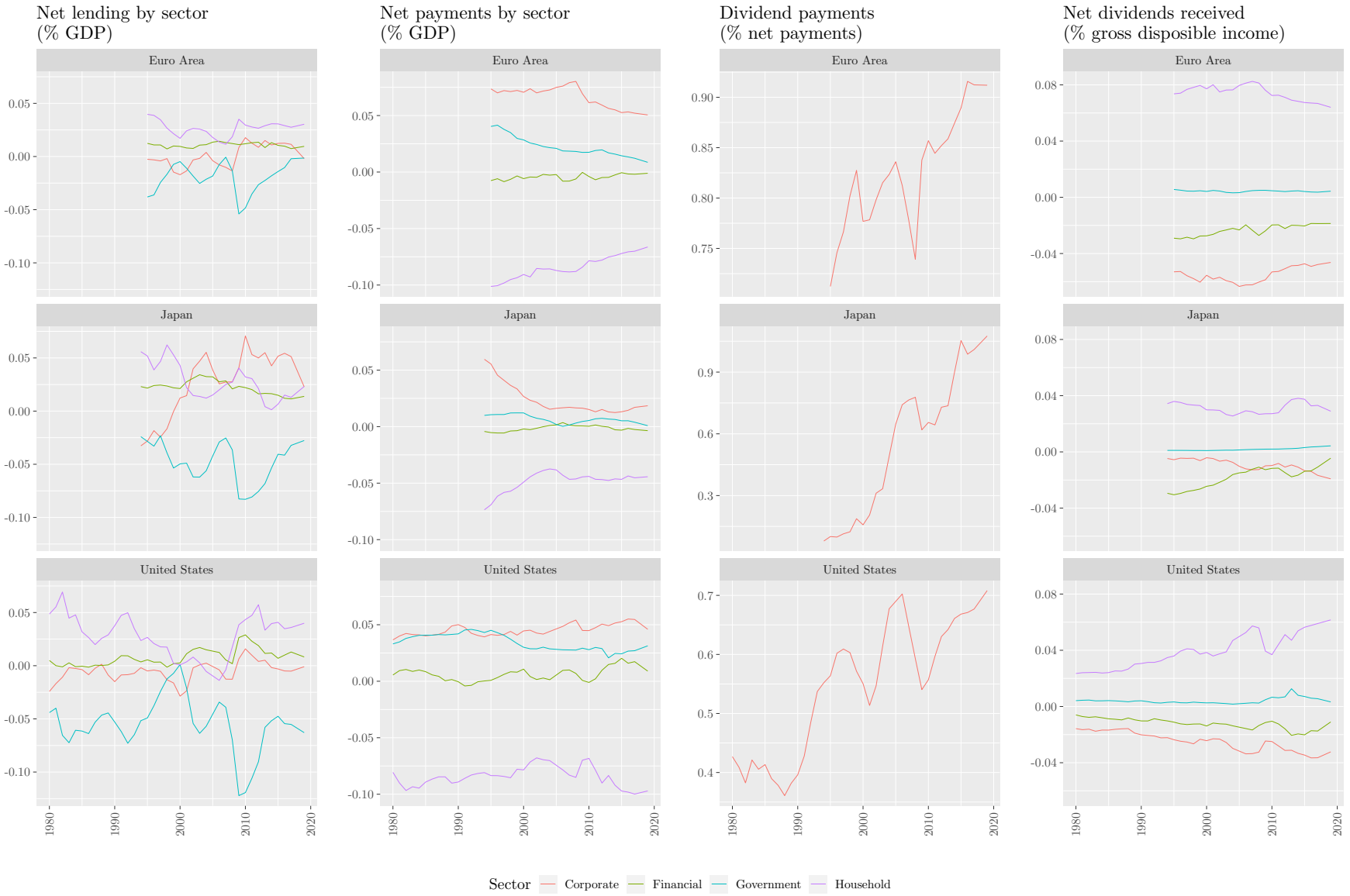
$$\Delta X_t = \sum_i \Delta X_{it} \quad X_{it} = \text{profits / receipts for entity } i \text{ where } \omega_{it} = \text{its share of total profits}$$

A.2. Evolution of Sector Balances

Figure 16 shows the flow of funds between the household, government, and corporate sectors for the main regions in the analysis. Net lending to GDP is given for each sector. In the United States and Euro Area, government deficits correspond to higher household savings.[35] Meanwhile, corporate saving has absorbed deficits in Japan. 'Net payments' combines income from interest, rents, and dividends and shows a declining trend in the Euro Area and Japan from lower corporate profitability. In the United States, payments from the corporate sector are stable. Low interest rates reduced the return on government assets and income from the government declined despite increasing debt levels. As a consequence, the corporate sector generated the bulk of returns for households towards the end of the sample period. Due to declining interest rates, income flows out of the corporate sector transitioned from rental to dividend payments. Not all corporate income went directly to households and some was intermediated through the financial sector, which also distributed profits to households.

[35] Higher saving is equivalent to positive net lending.

Figure 16: Flow of Funds Between Sectors (OECD National Accounts)



A.3. Evaluating Welfare

For all scenarios, output is evaluated using the expression

$$\frac{Y}{N} = \left(\frac{K}{N}\right)^{\alpha}$$

where productivity is normalized to 1. For the static exercises, labor is also normalized to 1. For the exercises with endogenous selection into entrepreneurship, the labor supply is normalized by the zero-tax case N_0. Welfare uses the lifetime utility of young workers and entrepreneurs. For workers

$$U_w = log(c_w^y) + \beta\, log(c_w^o)$$

In the static exercise for redistribution, the consumption of young and old workers is given by the labor share (plus transfers) divided by the number of households:

$$c_w^y = \frac{1}{1+\beta}\frac{\rho(1-\alpha)+\tau(1-\rho)}{j}\frac{Y}{Y_0} \qquad \text{and} \qquad c_w^o = \frac{\beta}{1+\beta}\frac{\rho(1-\alpha)+\tau(1-\rho)}{j}(1+r)\frac{Y}{Y_0}$$

For entrepreneurs, utility has the same form and consumption is given by

$$c_e^y = \frac{1}{1+\zeta}\frac{(1-\tau)(1-\rho)}{i}\frac{Y}{Y_0} \qquad \text{and} \qquad c_e^o = \frac{\zeta}{1+\zeta}\frac{(1-\tau)(1-\rho)}{i}(1+r)\frac{Y}{Y_0}$$

Aggregate utility weighs individual households equally

$$U = j \times U_w + i \times U_e$$

When selection into entrepreneurship is introduced, the zero-tax allocation for i and j is used as the baseline and the total population is fixed. While some households switch from entrepreneurs to workers as taxes increase, I hold their time preference constant. The same is true for income-dependent saving behavior where the zero-tax preference for each household $\beta_i = \beta\chi(c_0^o)/log(c_0^o)$ is fixed when evaluating changes in welfare.

$$U = log(c^y) + \beta_i\, log(c^o)$$

A.4. Household Optimization

A.4.1. Workers

The supply of savings from households is determined by the Euler equation of the young

$$\mathcal{L} = \log\left(c_{jt}^{y}\right) + \beta \log\left(c_{jt+1}^{o}\right) - \Lambda_{1,t}\left(c_{jt}^{y} + d_{jt}^{w} - w_t n_{jt} - \mathcal{T}_t\right) - \Lambda_{2,t+1}\left(c_{jt+1}^{o} - (1 + r_{t+1}) d_{jt}^{w}\right)$$

where Λ_1 and Λ_2 are the shadow values of the budget constraint for young and old respectively

$$\frac{\partial \mathcal{L}}{\partial c_{jt}^{y}} = 0 \implies c_{jt}^{y} = \frac{1}{\Lambda_{1,t}} \tag{49}$$

$$\frac{\partial \mathcal{L}}{\partial c_{jt+1}^{o}} = 0 \implies c_{jt}^{o} = \frac{\beta}{\Lambda_{2,t}} \tag{50}$$

$$\frac{\partial \mathcal{L}}{\partial d_{jt}^{w}} = 0 \implies \Lambda_{1,t} = \Lambda_{2,t+1}(1 + r_{t+1}) \tag{51}$$

Combining elements in the system

$$\frac{c_{jt+1}^{o}}{c_{jt}^{y}} = \beta(1 + r_{t+1}) \tag{52}$$

Solving the young and old household budget constraints for deposits d gives

$$\frac{c_{jt+1}^{o}}{1 + r_{t+1}} = w_t \bar{n} + \mathcal{T}_t - c_{jt}^{y} \tag{53}$$

Using the Euler equation

$$\beta c_t^{y} = w_t n_{jt} - c_{jt}^{y} \quad \implies \quad c_{jt}^{y} = \frac{1}{1 + \beta}(w_t n_{jt} + \mathcal{T}) \tag{54}$$

For deposits, the young household budget constraint imples

$$d_{jt}^{w} = \frac{\beta}{1 + \beta}(w_t n_{jt} + \mathcal{T}_t) \tag{55}$$

A.4.2. Firm Owners

An individual firm's optimization problem is given by the following system

$$\mathcal{L} = \log\left(c_{it}^{y}\right) + \zeta \log\left(c_{it+1}^{o}\right) - \Lambda_{1,t}\left(c_{it}^{y} + d_{it}^{e} - \Pi_{it} - \mathcal{T}_t\right) - \Lambda_{2,t+1}\left(c_{it+1}^{o} - (1 + r_{t+1})d_{it}^{e}\right)$$

In addition to lifetime consumption and deposits, firm owners maximize profits

$$\frac{\partial \mathcal{L}}{\partial c_{it}^{y}} = 0 \implies c_{it}^{y} = \frac{1}{\Lambda_{1,t}} \tag{56}$$

$$\frac{\partial \mathcal{L}}{\partial c_{it+1}^{o}} = 0 \implies c_{it}^{o} = \frac{\zeta}{\Lambda_{1,t}} \tag{57}$$

$$\frac{\partial \mathcal{L}}{\partial d_{it}^{e}} = 0 \implies \Lambda_{1,t} = \Lambda_{2,t+1}(1 + r_{t+1}) \tag{58}$$

$$\frac{\partial \mathcal{L}}{\partial n_{it}} = 0 \implies \Lambda_{1,t}\frac{\partial \Pi_{it}}{\partial n_{it}} = 0 \tag{59}$$

$$\frac{\partial \mathcal{L}}{\partial k_{it}} = 0 \implies \Lambda_{1,t}\frac{\partial \Pi_{it}}{\partial k_{it}} = 0 \tag{60}$$

Combining terms

$$\frac{c_{it+1}^{o}}{c_{it}^{y}} = \zeta(1 + r_{t+1}) \tag{61}$$

As with households

$$d_{it}^{e} = \frac{\zeta}{1 + \zeta}\left(\Pi_{it} + \mathcal{T}_t\right) \tag{62}$$

For individual firms, the optimality condition for labor is

$$n_{it} = \left(\rho_t(1 - \alpha)(z_{it}Y_t)^{\frac{1}{\sigma_t}} k_{it}^{\rho_t \alpha} w_t^{-1}\right)^{\frac{1}{1 - \rho_t(1-\alpha)}} \tag{63}$$

For capital,

$$k_{it} = \left(\rho_t \alpha (z_{it}Y_t)^{\frac{1}{\sigma_t}} n_{it}^{\rho_t(1-\alpha)} (r_t + \delta)^{-1}\right)^{\frac{1}{1 - \rho_t \alpha}} \tag{64}$$

Putting the expressions together and solving for capital gives

$$\frac{k_{it}}{Y_t} = z_{it}\kappa_t \quad \text{where} \quad \kappa_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{\rho_t(1-\alpha)} \left(\frac{\alpha}{r_t+\delta}\right)^{1-\rho_t(1-\alpha)}\right]^{\sigma_t} \tag{65}$$

Similarly, for labor

$$\frac{n_{it}}{Y_t} = z_{it}\varphi_t \quad \text{where} \quad \varphi_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{1-\rho_t\alpha} \left(\frac{\alpha}{r_t+\delta}\right)^{\rho_t\alpha}\right]^{\sigma_t} \tag{66}$$

For intermediate output

$$\frac{p_{it}y_{it}}{Y_t} = z_{it}\Psi_t \quad \text{where} \quad \Psi_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{1-\alpha} \left(\frac{\alpha}{r_t+\delta}\right)^{\alpha}\right]^{\sigma_t-1} \tag{67}$$

Thus profits are given by

$$\frac{\Pi_{it}}{Y_t} = z_{it}\left(\Psi_t - w_t\varphi_t - (r_t+\delta)\kappa_t\right) \tag{68}$$

A.5. Income Shares Using CES Production

Following Karabarbounis and Neiman (2013), the production function is specified using a more flexible CES specification where capital and labor can act as substitutes or complements

$$y_{it} = \left(\alpha k_{it}^{\frac{\omega-1}{\omega}} + (1-\alpha)n_{it}^{\frac{\omega-1}{\omega}}\right)^{\frac{\omega}{\omega-1}} \tag{69}$$

Solving the competitive equilibrium gives

$$K_t = \left(\frac{\alpha\rho_t}{r_t+\delta}\right)^{\omega} Y_t \quad \Longrightarrow \quad (r_t+\delta)K_t = (\alpha\rho_t)^{\omega}(r_t+\delta)^{1-\omega} Y_t \tag{70}$$

$$N_t = \left(\frac{\rho_t(1-\alpha)}{w_t}\right)^{\omega} Y_t \quad \Longrightarrow \quad w_t N_t = [\rho_t(1-\alpha)]^{\omega} w_t^{1-\omega} Y_t \tag{71}$$

Factor shares in the model can be specified as

$$s_t^K = \frac{(r_t + \delta)K_t}{Y_t} = \rho_t \frac{(r_t + \delta)K_t}{w_t N_t + (r_t + \delta)K_t} \tag{72}$$

$$s_t^L = \frac{w_t N_t}{Y_t} = \rho_t \frac{w_t N_t}{w_t N_t + (r_t + \delta)K_t} \tag{73}$$

$$s_t^\Pi = \frac{\Pi_t}{Y_t} = 1 - \rho_t \tag{74}$$

Using the solutions from before

$$s_t^K = (\alpha \rho_t)^\omega (r_t + \delta)^{1-\omega} \tag{75}$$

$$s_t^L = [\rho_t(1-\alpha)]^\omega w_t^{1-\omega} \tag{76}$$

$$s_t^\Pi = 1 - s_K - s_L \tag{77}$$

This implies that

$$s_t^L = \rho_t - s_t^K \tag{78}$$

Therefore, the asset market clearing gives

$$\left(\frac{\alpha \rho_t}{r_t + \delta}\right)^\omega = \frac{\beta}{1+\beta}\left(\rho_t - s_t^K + \tau_t(1-\rho_t)\right) + \frac{\zeta}{1+\zeta}(1-\tau_t)(1-\rho_t) \tag{79}$$

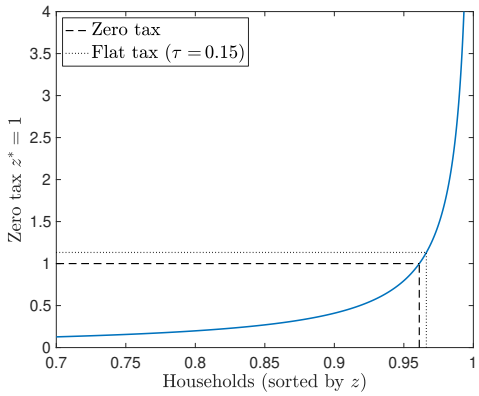
Solving the baseline model using $\omega = 0.8$ (as indicated in the meta-study by Knoblach and Stöckl 2020) does not substantially change the results. The magnitude of the decline in r^* is similar – around 40 basis points for a 5% increase in markups. Other results are also similar to the baseline.

A.6. Finding the Marginal Entrepreneur

Figure 17 shows how the tax dislocates the marginal entrepreneur. The blue line gives the household's productivity draw, which determines its entrepreneurial income. On the y-axis, the dashed black line gives the household where the zero-tax wage and entrepreneurial income are equal, which is normalized to 1. On the x-axis, the dashed black line gives the share of households that elect to become workers (to the left) and the share that become entrepreneurs (to the right). Since the tax

raises worker income and lowers income from profits, it dislocates the marginal entrepreneur and their share is given by the dotted line.

Figure 17: The Effects of a Flat Tax on the Marginal Entrepreneur



While the model predicts that a greater profit share will lead more households to enter into entrepreneurship, this is not necessarily the case if productivity dispersion also increases. That is, if σ_z increases as $1 - \rho$ increases, there may be no effect on the share of entrepreneurs in the economy.

A.7. Linking Wages to Productivity

It is also possible to model individual wages as a function of the household's ability $w_{jt} = f(z_{jt})w_t$. Individual firms are assumed to hire a bundle of labor reflecting the entire worker ability distribution. The budget constraint for workers in equation 6 becomes

$$c^y_{jt} + d_{jt} = w_{jt}n_{jt} + \mathcal{T}_{jt} \tag{80}$$

Aggregate wages are given by

$$w_t \bar{n}_t \int_j f(z_{jt})dj = \rho_t(1-\alpha)Y_t \quad \text{where} \quad \int_j f(z_{jt})dj = j \tag{81}$$

Indexing households in ascending order by their productivity $z \in \{z_1, ..., z_{i+j}\}$ gives the marginal household z^* where labor and entrepreneurial income are equal. For the case where $f(z_t^*)w_t\bar{n}_t + \mathcal{T}_t = (1-\tau_t)\pi_t^*$

$$z_t^* = \frac{f(z_t^*)\rho_t(1-\alpha) + \tau_t(1-\rho_t)}{j \times (1-\tau_t)\psi_t} \tag{82}$$

If the wage distribution is modeled, is also assumed that

$$\frac{\partial \pi(z_t)}{\partial z_t} > \frac{\partial f(z_t)}{\partial z_t} \quad \text{whenever} \quad z_t > z_t^* \tag{83}$$

In the baseline, a flat tax only discourages low-productivity entrepreneurs. This trade-off becomes more complicated when a wage distribution is introduced. The gap between entrepreneur and wage income becomes the deciding factor for selection into a type.

A.8. Composition of Saving Across the Income Distribution

Table 7 shows the main asset classes held by US households at different points in the income distribution. The top of the income distribution holds the majority of high-return assets, such as stock and mutual funds.

Table 7: Composition of Financial Assets by Income Percentile, Average 2000-18

	40-80th	80-90th	90-95th	Top 5%
Share of Financial Assets	0.201	0.124	0.119	0.500
	(0.022)	(0.019)	(0.018)	(0.038)
o/w Liquid	0.029	0.015	0.014	0.052
	(0.005)	(0.004)	(0.004)	(0.008)
o/w Bonds	0.003	0.002	0.003	0.030
	(0.002)	(0.002)	(0.003)	(0.008)
o/w Stocks	0.021	0.013	0.015	0.109
	(0.007)	(0.005)	(0.006)	(0.018)
o/w Mutual Funds	0.022	0.014	0.018	0.106
	(0.006)	(0.006)	(0.006)	(0.022)
o/w Quasi-Liquid (IRA)	0.087	0.063	0.054	0.132
	(0.009)	(0.008)	(0.010)	(0.016)
o/w Other	0.040	0.017	0.015	0.071
	(0.008)	(0.005)	(0.005)	(0.013)

Source: US Federal Reserve Survey of Consumer Finances.
Notes: Standard errors are in parentheses.