Linking Higher Markups to the Saving Glut of the Rich

Evidence from Corporates and Households

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Abstract

In the case of the United States, there is strong evidence for a shock to markups over 1990s and 2000s. Low interest rates did not translate into higher investment. Instead, corporate savings were distributed as profits. These profits accrued to high-income households–a major component behind the rise in inequality. Households at the top of the income distribution also have a high marginal propensity to save. Therefore, growing profitability is not only associated with reduced capital demand but an increase in the saving supply. This paper shows a markup shock is consistent with observed trends among both firms and households. Furthermore, a model accounting for heterogeneity in saving behavior across households demonstrates the shock can have a relatively large effect on the equilibrium interest rate due to the combined effect on capital demand and supply. In terms of policy responses, a redistributive tax cannot fully offset the shock and may reduce household welfare if it causes firms to exit. An increase in government debt can raise interest rates but will further crowd out capital and depress output. A subsidy on capital and labor costs can restore the economy to its original allocations, but also leads to some trade offs.

1 Introduction

Since the late 1980s, the share of aggregate income going to the top 5% of earners has increased 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.[2] The former results from increasing concentration of labor income among top earners, while the latter follows from both growth in profit share of income and increasing concentration. If higher markups explain growth in the profit share–an assertion supported by a growing body of research–a decrease in the capital and labor shares are a natural consequence.[3]

There is strong evidence that households at the top of the income distribution save more. 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. Therefore, a markup shock is not only associated with a declining capital share, but an increase in the saving supply. The following sections will provide evidence for weakening capital demand, evolving factor shares and changes in the income distribution, and also demonstrate profitability has increased.

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[1] Based on tabulations from the Congressional Budget Office (CBO) using administrative tax data.

[2] Business income includes self-employment, unincorporated business income, and dividend payments.

[3] There also remains some skepticism about whether income shares have 'truly' changed or if changes in social benefits and remuneration could explain the apparent shifts. Similarly for investment, the cost of capital has declined over recent decades.

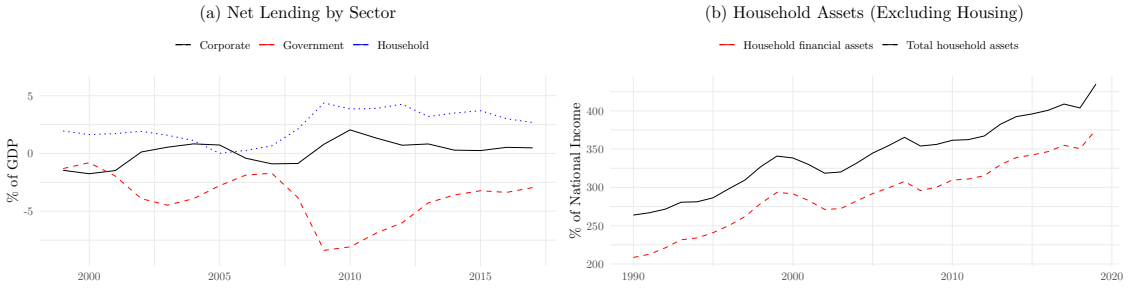
1.1 Global Trends in the Flow of Funds between Sectors

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 saving by firms and households, accompanied by higher government debt. A large supply of household saving has pushed interest rates to extremely low levels, forcing central banks to use unconventional monetary policies. On the side of firms, a rise in profitability and weakening investment are particular to the United States. Both Europe and Japan have witnessed greater deleveraging by firms.

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 1a). This is associated with a decline in interest rates and implies government debt ultimately absorbed most household saving. The 2000s also witnessed large financial inflows from developing countries to advanced economies. This 'global saving glut' has supported 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 1b makes clear. In part, this is related to demographic factors, where aging populations have pushed up demand for saving. While average years in retirement has plateaued in OECD countries, the share of the population over 65 has continued to expand. This aging trend is expected to continue over the next 20 years, with major economics such as China and Brazil aging rapidly. Low global interest rates may persist as a consequence of capital outflows from these countries. In addition to demographic factors, growing inequality may explain the decline in interest rates to some degree (e.g. Mian, Straub, and Sufi 2020; Auclert and Rognlie 2018). Given high income households have a higher marginal propensity to save than low income households, growth in top incomes has also contributed to the saving glut.

Figure 1: Household Asset Accumulation in OECD Countries

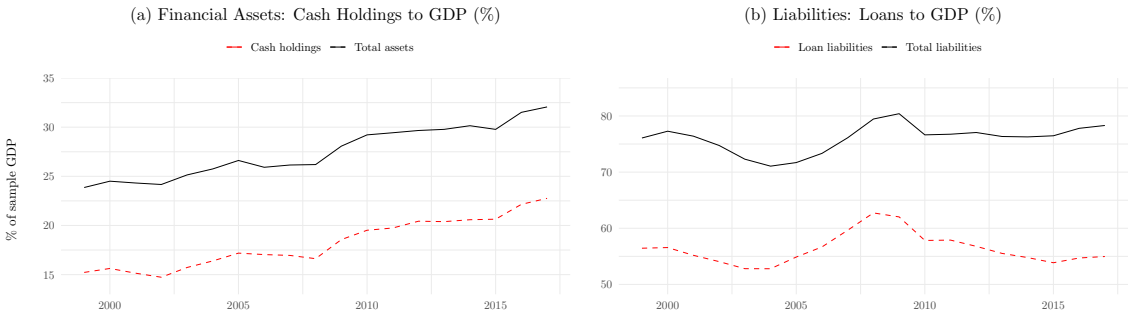


Notes: The aggregates are the sum of each series in USD across all countries with complete data 2000-16. Australia, Canada, and South Korea do not report the household sector and it is calculated as a residual for these countries when the other sector balances are available. See appendix for sample.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

Along with demographic factors, low capital demand is another potential driver of low interest rates. The corporate sector has become net lender of funds, a development first observed in André et al. (2007). Evidence from Chen, Karabarbounis, and Neiman (2017) indicates a wider deleveraging process where corporate saving has 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, which makes up a growing share of the overall capital stock (Dell'Ariccia et al. 2020; Falato, Kadyrzhanova, and Sim 2013). While the increase in corporate net lending is relatively general across countries, there has not been a uniform increase in distributed profits. The United States is one of the few major economic regions where payments from firms to households have significantly increased.

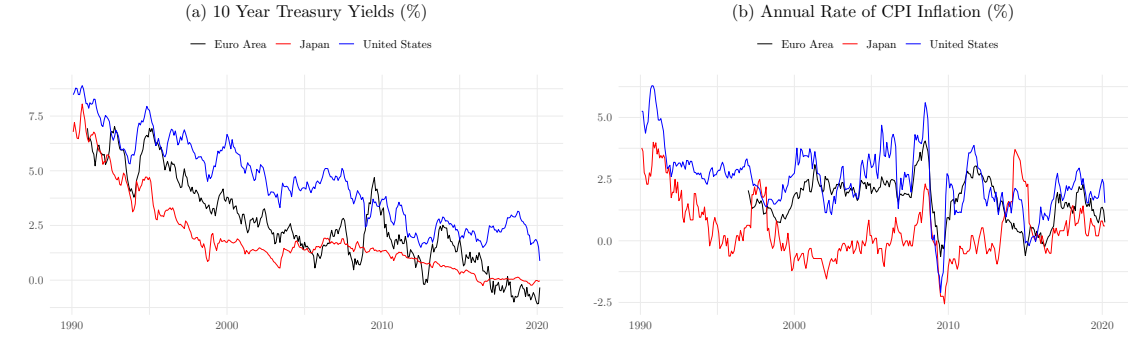
Figure 2: Corporate Balance Sheet Components in OECD Countries



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

The past three decades have 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 has averaged around around 1% 2015-2020 across the three economies, 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. However, there is mounting evidence the quantitative easing has exacerbated inequality and may be pushing down long-term real interest rates (e.g. Auclert and Rognlie 2018). Meanwhile, forward guidance does not appear to influence household behavior, although the financial channel may be indirect and difficult to observe (e.g. D'Acunto, Hoang, and Weber 2020).

Figure 3: Interest Rates and CPI



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

1.1.2 Increase in the Profit Share of Income

Low interest rates have reduced capital rental costs for firms. However, there has been no commensurate increase in investment and most of the cost saving has been been used by firms to pay down liabilities or retained as cash holdings. In the United States, the decline in costs is associated with rising corporate

profitability.

The gross operating surplus (GOS) is equal to total gross value added (GVA) less payments to labor, intermediate inputs, and taxes on production. The OECD National Accounts can be divided as follows[4]

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

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 has stagnated or dropped.[5] In Japan and the United States, distributed profits make up a greater part of the operating surplus. More generally, firms have shifted towards positive net lending. Total saving by firms (the sum of investment and net lending) is stable in the United States and Japan, while increasing in the Euro Area. For the Euro Area, the overall evolution of the operating surplus masks some heterogeneity between countries, but all major economies (France, Germany, Italy, Spain) follow the same trend of higher corporate saving.[6]

Incorporating information on the level of payments along with shares, three distinct regional trends become clear:

- In 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.
- In Europe, saving from lower net rents went into higher net lending by firms. Relative to Japan and the United States, dividends made up a large share of total payments to households. A relative decline in profitability post-2008 subsequently reduced both dividends and overall net payments to households.
- In Japan, lower net rents translated into higher net lending by firms. While net payments from firms declined substantially over the 1990s and 2000s, their composition shifted from rental payments to dividends. Dividends received by households remained relatively stable. Higher direct payments from corporates offset lower payments from the financial sector.

The supporting analysis of the flow of funds is included in 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.

[4]Note two components are missing: reinvested earnings on FDI and 'other' transfers. Both are small and relatively stable over time.

[5]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) respectively.

[6]Finland and Denmark show trends more consistent with the United States and Japan for example.

Table 1: Uses of the 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.

1.2 The Finances of US Households and Firms

Higher corporate profitability has influenced the structure of household income in the United States. Households at the top of the income distribution disproportionately benefited.

1.2.1 Exploring 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 a primary driver of rising income inequality over recent decades.[7]

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

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

Source: Congressional Budget Office (CBO).

[7]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."

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

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)
Financial Assets to Income	2.44	3.14	4.10	5.05
	(0.05)	(0.10)	(0.14)	(0.10)
Business Assets to Income	0.51	0.72	1.23	3.35
	(0.03)	(0.07)	(0.12)	(0.10)

Notes: Standard errors in parentheses.

Source: Survey of Consumer Finances.

1.2.2 Saving Behavior across the Income Distribution

As might be expected, business ownership is concentrated among top incomes (table 3).[9] Business ownership is much more frequent among top incomes. This is even more pronounced when looking at business assets, indicating that high income households own businesses that are larger or more valuable than other households. Financial assets are similarly concentrated among top incomes. A recent study by Fagereng et al. (2019) uses Norwegian administrative data, which includes information on both 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 shocks to income and wealth. Controlling for capital gains, Fagereng et al. still find the saving rate increases over the income distribution. At the 99th percentile, around 35% of net disposable income is saved, compared to a 5% for the median household.[10]

Milton Friedman's permanent income hypothesis—that households will not consume out of transitory income—is one explanation for why high income households may save more. 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 decile, compared to 60% for wage earners. Firm exit 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. Most risk appears transitory. A decomposition by the authors suggests the risk from

[8]The CBO does not publish standard errors for their tabulations, but the survey size is around 150,000 observations for the top 5% of incomes each year on average. The expected standard errors are very small given a sample of this size.

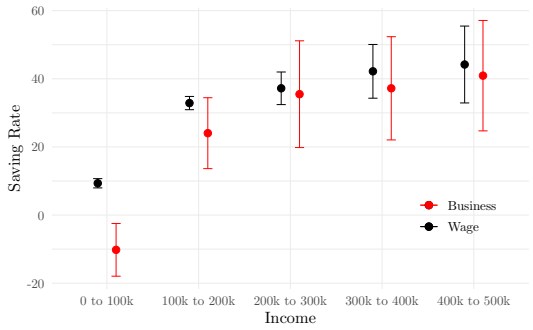
[9]The same tabulation indicates 70% of the top 1% of incomes are business owners.

[10]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) finds a saving rate around 25% of disposable income for the top 10% of the US income distribution, with an aggregate saving rate around 9 percent.

permanent changes to income accounts for just 20% of total income risk. These shares are similar across income source, but the overall level of risk is much higher for business income–suggesting both transitory and permanent income risk is much higher.

Saving rates across the income distribution are tabulated using the same approach as Fisher et al. (2022). Income source is categorized depending on whether a household received two-thirds of its total market income from wages or distributed profits (including dividends). The results indicate income level – as opposed to source – is the main determinant of saving rate. Average incomes over the 2004-16 sample period are $70k for majority wage earners compared to $150k for households with majority business income. Accordingly, households dependent on business income save more on average.

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



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

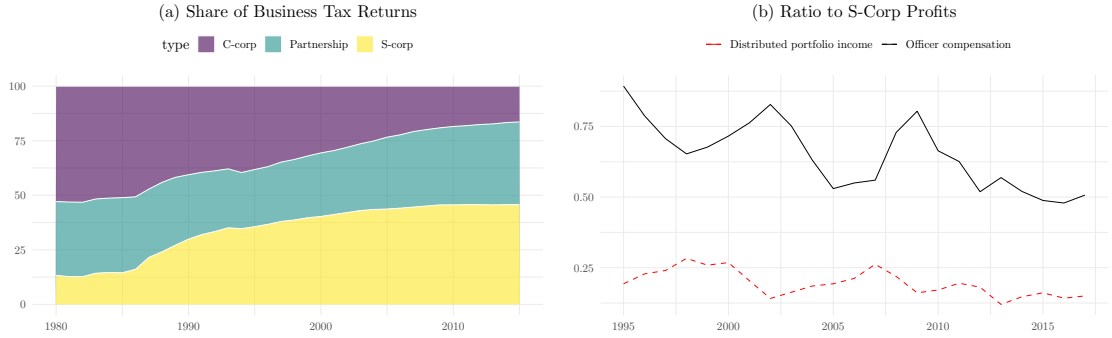
Figure 4 shows the saving rate increases in after-tax income. While households reliant on business income save less at lower income levels, there is no measurable difference in saving rates when household incomes are above $100k. The 95-99% income percentiles fall generally between $200k and $500k over the sample period.[11] The gap in the saving rates below $100k may arise due to higher expected permanent income for entrepreneur households. The apparent irrelevance of income source at the top of the distribution is surprising given business income is much more transitory than than wage income.

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

Rising business incomes do not necessarily stem from higher profits, but may reflect other factors. The traditional separation of wages and profits typical of C-corporations is less well defined for other businesses. Most growth in registered businesses has been from partnerships and S-corporations. For these entities, profits are passed through directly to owners, who report the income on their individual tax returns. This blurs the normal separation of wages and profits. There is no large tax advantage for either form of incorporation, at least for upper tax brackets. The 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) finds that the effective tax rate on partnerships and S-corporations is lower than C-corporations, which may explain their rapid growth. To ensure consistency over time, two adjustments are needed to ensure consistent measurement of profits over time.

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

Figure 5: Changes in the Structure of US Businesses



Source: IRS Statistics of Income.

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 in the tax code and a decline in the effective tax rate on corporate profits. One way to reduce ambiguity over officer pay is to add it to net income. This makes C- and S-corporations more comparable to partnerships and sole proprietorships, where owner-employees generally report income as profits.[12] 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 4e is therefore smaller than Table 4c, 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 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 and the resulting drop in profitability is equally large following the adjustment. Given data limitations, the ordinary income share of total net income has to be imputed for much of the 1980s assuming a constant share. However, the contribution of S-corporations and partnerships to overall receipts was very small in this period—less than 10%. Even if ordinary income was much higher than imputed, the observed change in profitability would be very similar to what is estimated in 4g.[13] Despite the adjustments, the 'within' component still explains most of the change in total income. The combined static and dynamic reallocation of income to pass-through entities has a small, albeit positive, net effect.

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

[13] The share of portfolio income in the total net income of S-corporations is relatively stable—around 20-25% over the sample period. This is less the case for partnerships, where the share varied between 30 and 70%. The average 1987-2016 was around 50% and this was also the approximate average in the first 5 years with data (1987-92).

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 (Upper Bound)

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 Compensation 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[b]	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 Compensation 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[b,c]	0.035	0.069	0.083	0.095
Partnership[a,d]	0.031	0.069	0.058	0.067
Sole proprietorship	0.152	0.209	0.213	0.228

(g) Shift-Share Decomposition (Lower Bound)

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

Notes: The methodology of the shift-share decomposition is included in the appendix. The decomposition compares the periods 1981-9 and 2010-16.
[a]Partnerships exclude capital gains and real estate and rental income from net income for all years.
[b]S-corporation officer compensation is assumed to be 90% of total net income before 1992. The total for the corporate sector 1981-91 is published and C-corporation officer compensation is imputed as a residual.
[c]S-corporation business income is assumed to be 75% of total net income before 1992.
[d]Partnership business income is assumed to be 50% of total net income before 1987.
Source: IRS Statistics of Income.

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.[14] 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.ˆ[The CBO data for households indicate a corresponding increase around 4.8 percentage points for business income (including

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

dividends) over the same period.] Gross net income for the pass-through sector is larger in the IRS data than what CBO reports as household business income (e.g. $1.64 trillion compared to $1.01 trillion in 2016).[15] There are several explanations for the discrepancy. First, there is a well-known mismatch between personal tax records and business income (Service 2016). Second, some share of net income reported to the IRS may go towards the net lending by firms. Finally, some share of profits may go to foreign nationals.

2 Related Literature

One concern addressed by this paper is that a markup shock acted to both lower capital demand and increase the saving supply with a large negative impact on interest rates. With a binding ZLB, there has been growing interest in using fiscal policy to raise interest rates. This paper will argue that a redistributive tax cannot offset a markup shock. The literature review is divided into four parts. First, there is an overview of the relevant literature on the ZLB, followed by an overview of capital taxation. The following section considers other structural factors behind declining real interest rates. These include higher bequests, widening income inequality, and the potential slowdown in global productivity growth. The final section looks at research on declining competition and rising markups in the United States and elsewhere.

2.1 Conducting Monetary Policy at the ZLB

Monetary policy is likely to be constrained by the zero lower bound (ZLB) in an economy with a low natural interest rate. Central banks are reluctant to set negative policy rates since a liquidity trap may form. Eggertsson and Woodford (2003) finds downturns are longer and more costly when the ZLB 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. In such a case, forward guidance can raise inflation expectations and generate higher demand. Tax policy may also be useful. Correia et al. (2013) demonstrates any nominal interest rate policy can be implemented through a combination of labor, consumption, and capital income taxes. Temporarily lowering consumption taxes generates higher demand and thereby CPI inflation. A simultaneous increase in labor taxes offsets lower marginal costs for firms and declines in producer prices (and so on). Eggertsson, Mehrotra, and Robbins (2019) presents an economy where the ZLB can permanently bind under certain conditions. Unlike short-term models where interest rate shocks are temporary, the model shows various demographic and structural factors can lead to permanently negative real interest rates. In such a case, various policies can crowd out excess saving. This includes a permanent increase in government debt or tax/redistribution policies that act on the lifetime consumption-savings decisions of households.

While sophisticated investors may react to forward guidance, households are much more responsive to price incentives. Using a difference-in-differences approach, D'Acunto, Hoang, and Weber (2020) shows sales tax changes affected household inflation expectations and spending to a much larger extent than forward guidance. The evidence on the effect of fiscal transfers on demand is mixed.[16] Coibion, Gorodnichenko, and Weber (2020) looks at how United States consumers spent one-time transfers during the initial Covid-19 outbreak, amounting to around $2 trillion in government funds. Only 15 percent of respondents reported spending most of the transfer payment and the majority either saved it (33 percent) or used it to pay down debt (52 percent). While this period was exceptional, an earlier survey by Sahm, Shapiro, and Slemrod

[15] Note that income from C-corporations is reported as dividends by the CBO.
[16] Most of the transfers studied were temporary.

(2012) reflects a similar pattern following the 2008 financial crisis. Over half of survey respondents said they saved government transfers. Theory suggests the marginal propensity to consume (MPC) from transitory income will either be near zero or one (Jappelli and Pistaferri 2010). Unconstrained households will increase consumption proportional to the change in annuitized lifetime income resulting from the one-time transfer, which will typically be near zero. By contrast, constrained hand-to-mouth consumers would have a MPC close to one. The literature also notes that 'hand-to-mouth' consumers are not necessarily poor households, but also wealthy ones with illiquid assets (Kaplan, Violante, and Weidner 2014).

2.2 An Overview of Capital Taxation

By the 1970s and 80s, there was a general consensus among economists that capital taxes were less efficient than taxing labor. This stemmed from two main observations: (i) that capital was accumulated and small distortions had large cumulative effects, and (ii) that labor income could be taxed 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. A tax on capital reduces the expected return on saving and thereby depresses investment in the economy, therefore eliminating capital taxes is optimal.[17] 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 some complementarity between capital and labor or pass-through of the tax burden from firm owners to employees. Suárez Serrato and Zidar (2016) uses variation in US state corporate tax rates to estimate how the tax burden is distributed among workers, firm owners, and landowners. Around 30-35% of tax increases are absorbed by labor. Other studies support this finding and produce similar (if not higher) estimates, supporting the view that corporate incomes 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 more debt since interest payments are deductible (e.g. Rajan and Zingales 1995). Heider and Ljungqvist (2012) exploits variation in corporate income tax rates across US states over time and finds tax differences are a major determinant of firms' capital structure. Djankov et al. (2010) uses 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.[18] A working paper by Matray and Boissel (2020) finds that firms increased investment following a large hike in the French dividend tax rate. With the tax increase, firms immediately cut dividend payments and used the extra liquidity to invest. 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

[17] Chamley notes a capital income tax is an efficient revenue source in the short run as the economy converges to the steady state.

[18] A study by Isakov, Pérignon, and Weisskopf (2021) arrives at a similar conclusion for Switzerland.

taxation affects capital costs and thereby investment decisions (as in Harberger 1962; Feldstein 1970). In the 'new view' it acts as a lump sum tax and is irrelevant for firms' investment decision (as in King et al. 1977; Auerbach 1979; Bradford 1981). A third strand in literature investigates dividends as a signaling mechanism that conveys positive future prospects for a firm, thereby raising share prices (as in Poterba and Summers 1984; Bernheim 1991). 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). The authors show a tax on capital income can increase saving if the income effect is sufficiently strong. Since the capital tax is effectively a transfer from the old generation to either the government or the young, it can used to improve intergenerational equity or as a means to boost saving/investment. Similarly, Erosa and Gervais (2002) uses 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 because consumption, leisure, and capital income all increase with age.

2.3 Income, Wealth, Productivity and r^*

Structural determinants of the equilibrium real interest rate (r^*) include income, wealth, and productivity. Platzer and Peruffo (2022) aims 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.

Straub (2019) argues the marginal propensity to consume decreases in permanent income.[19] Since the rich consume less of their permanent income, rising inequality has resulted in high saving and low aggregate demand, pushing down interest rates. The causes for inequality are particularly important in this context. Song et al. (2018) observes 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. However, Auclert and Rognlie (2018) finds the effects of inequality on saving/consumption are small if caused by individual fixed component but are large if caused by higher income risk. This does not entirely match the findings here, but the approaches are very different. In addition, economic conditions may favor particular age cohorts—creating income gaps between generation—or become more prevalent within certain generations. Hallaert et al. (2018) finds that income inequality has increased both within or 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) provides 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.[20] Brülhart, Dupertuis,

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

[20] In Europe, the share of inherited wealth when 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) if several assumptions are followed to impute missing data.

and Moreau (2018) shows a similar pattern for Switzerland, which indicates that wartime destruction is not the only driver for this trend. 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.

There is a general consensus productivity growth in both Europe and the United States has slowed since the mid-2000s, at least by standard measures. However, the underlying causes are manifold and there is not full agreement that the slowdown is structural, rather than a product of cyclical factors or measurement issues. Both Cerra and Saxena (2008) and Reinhart and Reinhart (2010) note output losses are persistent following financial crises, such as in 2008. A later study by Duval et al. (2020) provides more granularity, showing the link between TFP and firm balance sheets. The authors find (i) the decline in TFP was larger for firms that entered the 2008 financial crisis with weak balance sheets; (ii) firms located in countries with tighter credit conditions post-crisis experienced larger TFP declines; and (iii) financially weak firms cut investment in intangibles more than their peers. This connects to findings in Autor et al. (2017) and Decker et al. (2018) that productivity dispersion (within industry) in the United States has expanded in recent years despite slow growth in average productivity. Firms at the "productivity frontier" are still seeing strong gains, but employment has not reallocated from low productivity firms. Accordingly, dispersion in output per worker has also increased. The study by Duval et al. also indicates financial constraints are likely a driver of slow TFP growth. In this vein, Ikeda and Kurozumi (2019) develops a framework where a tighter financial constraint on firms reduces endogenous TFP growth since firms borrow to fund development costs. This results in a permanent decline in output from tighter financial constraints.

Along with the aftermath of 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. Gutiérrez and Philippon (2017) observes 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. Dell'Ariccia et al. (2020) observes banks have moved away from some corporate lending as a consequence, while firms with more intangible assets find private equity financing and M&A more attractive.[21]

2.4 Rising Markups, Profits, and Pass-Through Income

The earlier stylized facts suggested corporate profits are higher in the United States relative to 1980. Indeed, several papers find markups grew over this period (notably Autor et al. 2017; De Loecker and Eeckhout 2017). 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) finds consumers have become less sensitive to markups over time. Lower marginal costs allowed for a 25% increase in markups between 2006 and 2019—the corresponding savings were never passed on to consumers. Similarly, Sangani (2022) finds the price elasticity of consumers

[21] 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.

declines in income, with rising income inequality explaining 30% of the rise in markups. Eggertsson, Robbins, and Wold (2018) outlines the macroeconomic implications of a markup shock and demonstrates 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) finds the welfare costs of markups are large. Around two-thirds of the cost are due to the 'profit tax' on other factors of production and one-third due to misallocation since larger and relatively efficient firms face less competition.

The allocation of entrepreneurial income is a non-trivial question given its role in the rising capital share of income. The shift away from dividends to pass-through income explains higher aggregate profitability to some degree.[22] Additionally, the increase in business income is not necessarily explained by higher rents since the labor, capital, and 'entrepreneurial' components of income are increasingly mixed.[23] Smith et al. (2022) finds most growth in pass-through income reflects real economic growth, while around 30 percent reflects businesses reorganizing to pass-through forms. The profitability of pass-through firms appears mostly driven by 'human' capital rather than financial capital according to an earlier study by Smith et al. (2019). Still, whether this 'human' capital component represents returns to skills or rent seeking is an open question. In either case, firm owner's capture large and growing share of value added, accounting for at least 50% of the growth in entrepreneurial income.

3 Model Description

This model aims to explore the interconnection between higher monopoly power, taxation, and interest rates. Monopolistic competition is assumed and profits are paid to entrepreneurs, who are distinct from worker households dependent on wages. At first, this divide is treated as exogenous. In a later extension, each household receives a productivity draw that determines whether they select into entrepreneurship, similar to Levine and Rubinstein (2018). The interest rate is determined by the capital market clearing and saving supply of households. Households have overlapping generations and save for old age. The saving rates of households are exogenously specified at first. A final extension models the saving rate as a function of income. In this case, growing productivity dispersion can influence saving behavior along with the profit share.

3.1 Monopolistic Firms

Firms generate profits and monopolistic competition is assumed. Each firm is managed by a household and operates for one period.

3.1.1 Production

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

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

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

[23] This explains the declining labor share in part since profits are considered a form of capital income. See XXX

where k is capital, n is labor, and z is productivity. The parameter α represents the capital share in production. A final retailer combines the intermediate inputs into a 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. Each firm maximizes its profits by solving

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

so that its markup p is

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

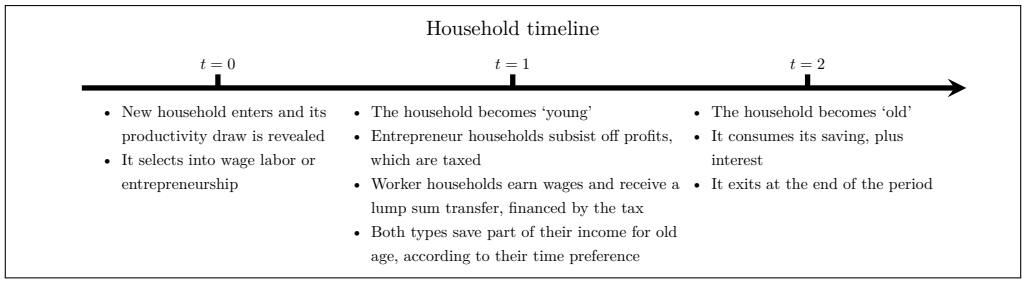
The firm's budget constraint takes the following form.

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

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

3.2 OLG Households

Households have overlapping generations that live for two periods. There is no population growth and each generation has size $i + j$. 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.



3.2.1 Workers

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

entrepreneurial income is a function of productivity.

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

subject to

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

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

Log utility is assumed.

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 $\zeta > \beta$.

$$\max_{\{c^y_{it};\, c^o_{it+1};\, d^e_{it};\, \Pi_{it}\}} \quad \mathbb{E}_t\left[\log\left(c^y_{it}\right) + \zeta \log\left(c^o_{it+1}\right)\right]$$

subject to

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

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

3.3 Market Clearing

Total consumption across household generations (workers and entrepreneurs) is given by

$$C_t = \int_i \left(c^y_{it} + c^o_{it}\right) di + \int_j \left(c^y_{jt} + c^o_{jt}\right) dj \tag{10}$$

Aggregate employment equals the total employment of individual firms. This must also equal total labor provided by 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 saving 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 are increasing in the interest rate, while capital demand from firms is decreasing.

Solving the firm budget constraint (eq. 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

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

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

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

Total profits are given by the remainder

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

Payments to each factor equal total output.

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 income that is saved

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

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

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 payments to households:

$$\frac{\partial r^*}{\partial \rho} = \Omega^{-1}\Bigg[\underbrace{(r^*+\delta)\left(\frac{\zeta}{1+\zeta}-\frac{\beta}{1+\beta}\right)(1-\tau)}_{\text{income redistribution}} + \underbrace{\alpha + (r^*+\delta)\,\frac{\alpha\beta}{1+\beta}}_{\text{income shares}}\Bigg] \quad \text{where} \quad \frac{\zeta}{1+\zeta} > \frac{\beta}{1+\beta} \tag{25}$$

Thus, r^* is decreasing as the profit share $1-\rho$ increases. The data for the United States plausibly indicate a decline in competition and a higher profit share. The change in r^* can be decomposed into two main channels: (i) an income transfer between households with different saving rates and (ii) the change in the capital income share and its interaction with the labor share. If the all income were transferred from entrepreneurs to worker households ($\tau = 1$) the first effect would disappear. Still, changes in the labor and capital shares cannot be offset by a redistributive tax. It is also useful to find the elasticity of the interest rate to changes in the corporate tax rate

$$\frac{\partial r^*}{\partial \tau} = \Omega^{-1}\left[(r^*+\delta)\left(\frac{\zeta}{1+\zeta}-\frac{\beta}{1+\beta}\right)(1-\rho_t)\right] \tag{26}$$

The result here shows that the tax only acts on the redistributive channel and is proportional to the size of markups. Given reasonable settings for ρ and τ of 0.92 and 0.15 respectively, the redistribution channel is much more sensitive to changes in the markup than changes in tax rates. A large tax increase is needed to offset a relatively small increase in markups.

4 Baseline Results

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% 2004-16. Households reliant on wage income saved around 24%. Solving for the saving share given by ζ and β in the model gives 42.5% and and 25.5% respectively. In the replication files, the flat tax on profits corresponds to an 8% observed gap in tax rates between households, but is adjusted upwards to 15% when accounting for corporate income taxes.[24] 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 the 'consumption of fixed capital' share of GDP as reported by the BEA.

The results reported in Figure 6 are directly comparable to the changes reported in Table 1 for the United States. For an increase in the profit share of 5 percentage points, there is a decline in the equilibrium interest

[24] Households with majority business income generally fall into higher tax brackets. Their tax burden is usually lower than equivalent households with wage income, but income level appears much more important than source overall. The average effective tax rate on corporate income was around 25% over the sample period.

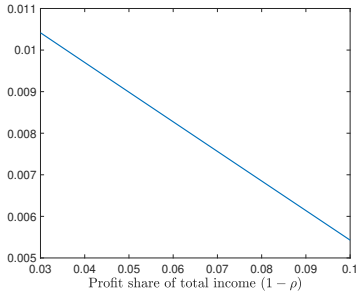
Table 5: Parameter Values

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

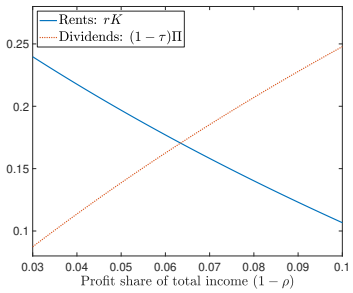
rate around 35 basis points. The decline can be equally attributed to weaker capital demand and the increase in the saving supply. While the increase in dividend payments is mechanical, the decline in net rents and the investment share of the operating surplus are consistent with observed outcomes. The main inconsistency produced by the model is a predicted 1 percentage point increase in investment to output, which does not appear in the data.[25]

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

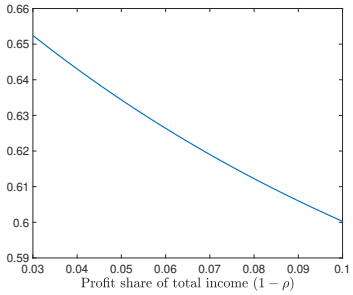
(a) Real Interest Rate



(b) Share of Operating Surplus



(c) Investment to Operating Surplus



While effective tax rates dropped over the past several decades, the following section shows tax dynamics cannot explain observed outcomes. Alternative policies answers to the markup shock are compared in terms of their macroeconomic effects and final allocations. Since the impact of the markup shock on government revenue is large—even when tax rates are declining—it is possible to think of it as a fiscal shock as well.

4.1 Fiscal Policy

Three different fiscal policies are considered. Redistribution is specified in the baseline model. Profits are taxed and given to households as a lump-sum transfer. In the second case, capital and labor subsidies are used to shift the economy back to its competitive allocation. Finally, government debt is added to the model. While the channels are different, the main outcomes are consistent with the baseline. Furthermore, the extension shows that the markup shock can finance a large increase in government debt.

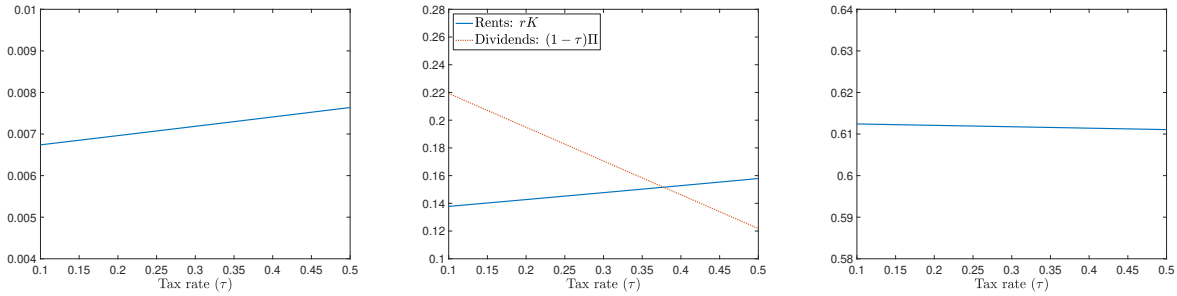
[25] Investment to GDP shows no long term trend in the data.

4.1.1 Redistribution

The results in Figure 7a indicate redistributive taxation cannot be used to raise interest rates given a shock to markups, as implied by equation 25. While redistribution lowers inequality, there are negative economic externalities. Income is diverted to households with low rates of saving, resulting in lower capital and effective output.[26]

Figure 7: The Effect of a Redistribution Tax on Interest Rates and Payments by Firms ($1 - \rho = 0.08$)

(a) Real Interest Rate (b) Share of Operating Surplus (c) Investment to Operating Surplus



4.1.2 Capital and Labor Subsidies

Rather than redistribution, the tax can be used to subsidize labor and capital.[27] The firm budget constraint from eq. 5 is modified so that

$$\pi_{it} = p_{it}y_{it} - (1 - s_t)\, w_t n_{it} - (1 - s_t)\,(r_t + \delta)\, k_{it} \tag{27}$$

The revenue constraint for the subsidy is

$$(1 - s_t)\, w_t N_t + (1 - s_t)\,(r_t + \delta)\, K_t = \tau \Pi_t \quad \Longrightarrow \quad s_t = 1 - \frac{\tau_t}{\sigma_t - 1} \tag{28}$$

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

$$K_t = \frac{\alpha \rho_t}{(1 - s_t)(r_t + \delta)} Y_t \qquad\qquad w_t N_t = \frac{\rho_t (1 - \alpha)}{1 - s_t} Y_t \tag{29}$$

In this case, total saving is given by $D = \Gamma_t Y_t$ where

$$\Gamma_t = \frac{\beta}{1 + \beta} \frac{\rho_t (1 - \alpha)}{1 - s_t} + \frac{\zeta}{1 + \zeta} (1 - \tau_t)(1 - \rho_t) \tag{30}$$

[26] The transfer contracts the saving supply and thereby raises interest rates. The capital to output ratio declines. The labor supply may increase to compensate, with more hours worked per household, but effective output is lower as a result.

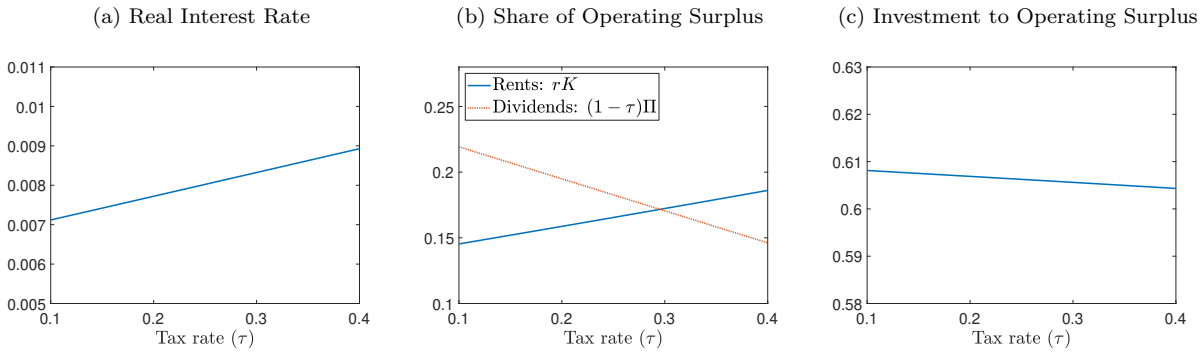
[27] The lump-sum transfer $\mathcal{T} = 0$ in this case as well as section 4.1.3. Also, the subsidy could be specified as a tax deduction, which is more common in practice, but results would not differ.

The equilibrium interest rate is given by

$$r^* = \frac{\alpha\rho}{(1-s_t)\Gamma} - \delta \tag{31}$$

The subsidy raises labor and capital demand in line with their income shares and shifts the economy back to its competitive allocation. Γ gives the change in household saving from the subsidy. If only one factor was subsidized, this would raise aggregate output but is not necessarily efficient. For example, an excessive capital subsidy would act as an implicit tax on labor if it brings capital above its competitive allocation.

Figure 8: The Effect of a Subsidy on Interest Rates and Payments by Firms ($1-\rho = 0.08$)



4.1.3 Government Debt

The markup shock can also increase government revenue as it pushes a subset of households into higher tax brackets. To capture this effect, the asset market clearing can be modified so that

$$D_t = K_{t+1} + B_t \tag{32}$$

where B_t is government debt. Instead of redistribution, the corporate tax finances debt and the depreciation of public infrastructure $G_t = B_{t-1}$

$$\tau_t \Pi_t + B_t + (1-\delta_g)G_{t-1} = (1+r_t)B_{t-1} + G_t \tag{33}$$

Assuming that $\delta_g = \delta$ in the steady state

$$B = \frac{\tau\Pi}{r+\delta} \tag{34}$$

Solving for the equilbrium interest rate gives

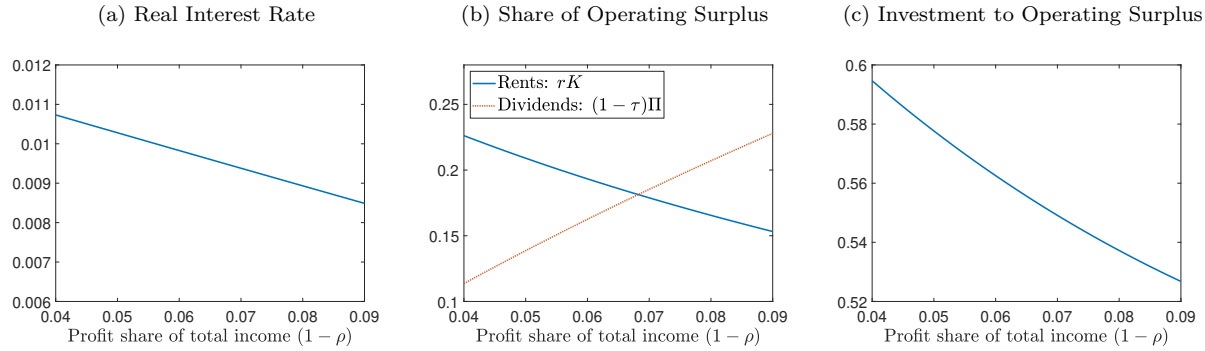
$$r^* = \frac{\alpha\rho + \tau(1-\rho)}{\Theta} - \delta \quad \text{where} \quad \Theta_t = \frac{\beta}{1+\beta}\rho_t(1-\alpha) + \frac{\zeta}{1+\zeta}(1-\tau_t)(1-\rho_t)$$

Figure 9 shows the main results assuming the tax partially finances depreciation on government assets.[28] The

[28]The case where $\delta_g = 0$ is included in the appendix. In this scenario, the markup shock can finance a large amount of government debt and the crowding-out effect on capital is strong than what is observed in the data.

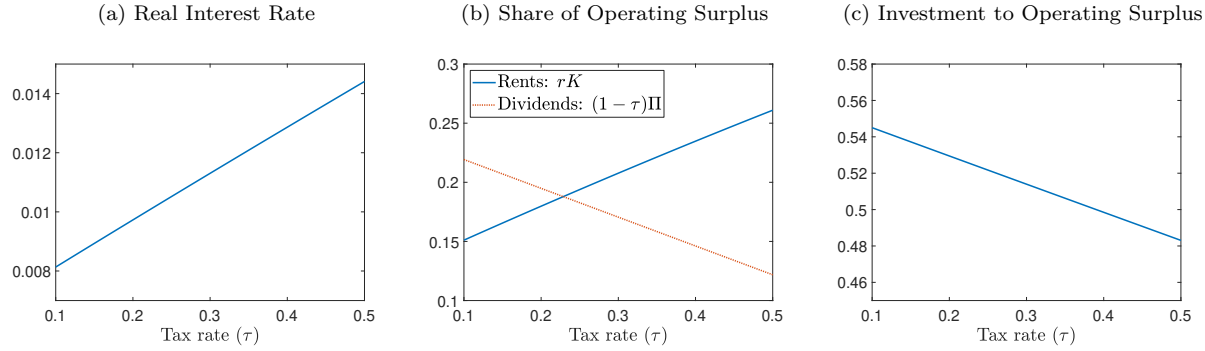
markup shock still reduces in the interest rate despite direct government intervention on the asset market. There is a notable increase in government debt as the profit share increases—from around 20% of output to 50% as the profit share goes from 4% to 9%. Along with the increase in debt, changes within the gross operating surplus still match observed dynamics fairly closely.

Figure 9: Higher Markups as a Government Revenue Shock ($\delta_g = \delta$; $\tau = 0.15$)



As might be expected, increasing taxes allows the government to finance a substantially higher debt level. Given a profit share around 8%, raising the tax rate to 50% can sustain debt equal to 80% of output.[29] This can substantially raise the equilibrium interest rate, but also crowds-out capital and lowers aggregate output.

Figure 10: The Effect of Debt Financing on Interest Rates and Payments by Firms ($\delta_g = 0$; $\rho = 0.08$)



4.2 Solving for the Marginal Entrepreneur and Equilibrium Wages

Until now, the share of entrepreneur and worker households has been treated as exogenous. However, if households are free to choose their type, then changes in the profit tax and the profit share of income should influence their allocation. Furthermore, the movement of households between activities will affect the equilibrium wage. One way to conceptualize this choice is to assume that households have different ability levels as entrepreneurs and know the level of profitability associated with their draw. Households will then choose entrepreneurship if the resulting profits greater than the average wage.

[29] Debt is less than 30% of output under baseline tax, given a total increase of 50 percentage points.

Solving the firm's problem for optimal capital gives

$$\frac{k_{it}}{Y_t} = z_{it}\kappa_t \quad \text{where} \quad \kappa_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{\rho_t(1-\alpha)} \left(\frac{\alpha}{r_t+\delta}\right)^{1-\rho_t(1-\alpha)}\right]^{\sigma_t} \tag{35}$$

Similarly, for labor

$$\frac{n_{it}}{Y_t} = z_{it}\varphi_t \quad \text{where} \quad \varphi_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{1-\rho_t\alpha} \left(\frac{\alpha}{r_t+\delta}\right)^{\rho_t\alpha}\right]^{\sigma_t} \tag{36}$$

For intermediate output

$$\frac{p_{it}y_{it}}{Y_t} = z_{it}\Upsilon_t \quad \text{where} \quad \Upsilon_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{1-\alpha} \left(\frac{\alpha}{r_t+\delta}\right)^{\alpha}\right]^{\sigma_t-1} \tag{37}$$

Thus profits are given by a constant markup adjusted by firm-specific productivity

$$\pi_{it} = z_{it}\psi_t Y_t \quad \text{where} \quad \psi_t = (\Upsilon_t - w_t\varphi_t - (r_t+\delta)\kappa_t) \tag{38}$$

There are a total of $i+j$ active households, where each has a productivity draw. Generally, 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

$$\int_i z_{it}di = \frac{1}{\Upsilon(w_t, r_t^*)} \tag{39}$$

This follows from aggregating eq. 37. The equilibrium interest rate r^* can be solved using the income shares. The average number of hours worked $\bar{n}_t$ is function of the equilibrium wages and the number of worker households

$$w_t\bar{n}_t = \frac{\rho_t(1-\alpha)Y_t}{j} \tag{40}$$

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. The case where

$$w_t\bar{n}_t + \mathcal{T}_t = (1-\tau_t)\pi_t \quad \implies \quad z_t^* = \frac{\rho_t(1-\alpha) + \tau_t(1-\rho_t)}{j \times (1-\tau_t)\psi(w_t, r_t^*)} \quad \text{(using eq. 40)} \tag{41}$$

The system contains three equations (39, 40, and 41) 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 output (eq. 37) by labor (eq. 35) and aggregating effective output

$$\frac{Y_t}{N_t} = \frac{\Upsilon_t(w_t^*, r_t^*)}{\varphi_t(w_t^*, r_t^*)} \quad \text{where} \quad N_t = j \times \bar{n} \tag{42}$$

This can also be used to solve average output and wages by household.

4.3 Tax Distortion to Entrepreneurship

The baseline case with a redistributive tax is considered. The results here are largely similar to those from Jaimovich and Rebelo (2017), but focus on the impact of the profit share. The flat tax on corporate profits has a negative effect on output as it dislocates the marginal entrepreneur from her optimal position and there are fewer firms than otherwise. At the same time, the tax redistributes income to workers. Since most households are worker households, the median voter would therefore choose to tax profits. Low productivity entrepreneurs exit first and initial losses from the tax are small. However, the flat tax has a non-linear effect as a consequence of the productivity distribution. With a higher profit share, the optimal tax for workers also generates larger output losses. Accordingly, a social planner might choose a different set of policies than the median household. The model implies a progressive dividend tax would avoid output losses. As long as entrepreneurial income remains above the average wage, households will not change type.[30] Many countries retain a flat tax on profits/dividends, although progressive taxation is more common.

In the results below, productivity follows a log-normal PDF.

$$z_t \sim lognormal(\mu_z, \sigma_z^2)$$

Productivity is calibrated to reflect the highly skewed nature of the firm size distribution.

Table 6: Additional Parameter Values

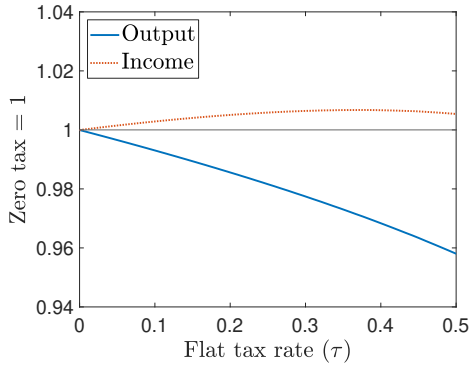
Parameter	Value	Description
μ_z	0	Median productivity $= \exp(\mu_z)$
σ_z^2	3	Productivity dispersion

In a zero-tax economy, the allocation of workers and entrepreneurs is solely determined by the profit share. Because the tax reduces entrepreneurial income and raises the income of worker households, low-productivity entrepreneurs exit and become workers. Total output declines due to the misallocation of resources. The average firm becomes larger and more productive, but the average wage is reduced. For worker households, the output loss is compensated by the transfer. However, the baseline model assumes that firm-exit has no impact on competition dynamics and that firm-owners cannot pass some of the tax burden onto workers or consumers. Relaxing this assumption even slightly shows that increasing the tax on profits can have a negative effect on welfare. Results are similar whether tax revenue are used for redistribution or for a subsidy on capital and labor payments.

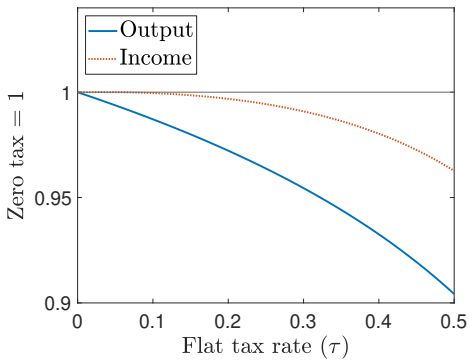
[30] However, including the wage distribution can change this dynamic.

Figure 11: Effective Income (Post-Redistribution) and Output

(a) No Change in Markups



(b) 20% of Tax Burden Shifted



Figures 11a and 11b show the change in effective income ($wN + \mathcal{T}$) and output (Y/N) relative to the zero-tax baseline. In the first case, workers gain additional income through redistribution and this exceeds output losses. In the second case, firm owners pass 20% of the tax increase onto workers through higher markups. This could be due to firm exit weakening the labor market or reducing competition for example. In the exercise, the profit share of income goes from 8% to 9% given a 50 percentage point increase in the tax rate. This leads to higher output losses and erases gains from redistribution.

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. Thus, one consequence of higher income inequality (i.e. dispersion) is higher saving. In the household utility function, this can be captured by changing the specification for old age for both household types, so that

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

with the same specification for worker (j-type) households.[31] Next, it is possible to define $\eta(c_i, c_0) = \upsilon'(c_i, c_0)\, c_i$ where c_0 is a household's consumption target, as done by Mian, Straub, and Sufi (2021a). In this case, the standard Euler equation for the young generation can be written as

$$\frac{c^o_{it+1}}{c^y_{it}} = \beta(1 + r_t)\, \eta(c^o_{it+1}, c_0) \tag{43}$$

Setting $\eta = 1$ is equivalent to specifying log utility for old age. If η is increasing in consumption, then households will save relatively more as their income increases. An 'activation' function can be specified as

$$\eta(c_i, c_0) = 1 + \frac{1}{\lambda_2} \log\left(1 + e^{\lambda_1 (c_i - c_0)}\right) \tag{44}$$

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 the observed saving distribution. Figure 12 shows that

[31] Note that wage earners are identical in the setup here, but some distribution could be specified.

an increase in productivity dispersion can further depress interest rates in this case, since entrepreneurial income is directly linked to firm productivity in the model. This extension only has a numerical solution.[32]

Figure 12: Response of Interest Rates to Productivity Dispersion ($\tau = 0.15$)

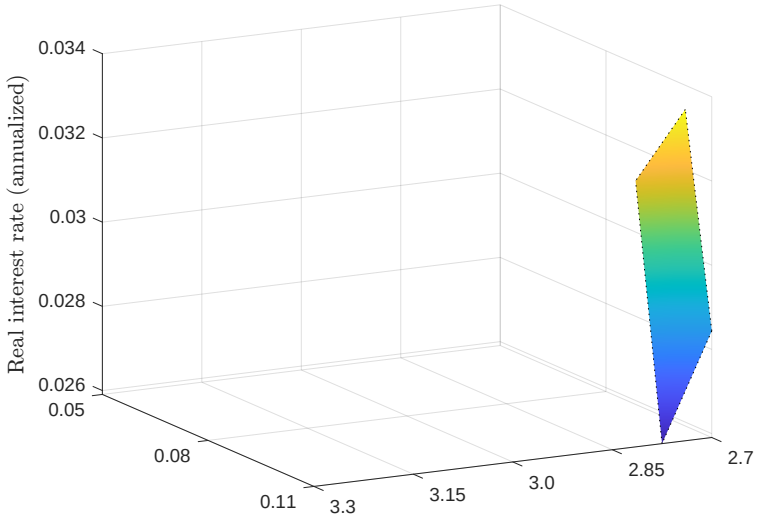


Table 7: The Effect of Higher Productivity Dispersion and Profit Share on r^*

		σ_z^2		
		3.3	3	2.7
	0.05	0.030	0.031	0.032
$1-\rho$	0.08	0.027	0.028	0.029
	0.11	0.023	0.025	0.027

The results indicate that the increase in the profit share of US income, along with a 20% increase in productivity dispersion (as documented in Cunningham et al. 2022) may have accelerated the decline in interest rates seen over the 1990s and 2000s.[33] Table 7 gives the numerical values from this exercise and indicates a decline of up to 70 basis points in the real interest rate can be explained by a combined increase in productivity dispersion and an increase in the profit share. While this paper has not done much to link the two components (an area for future research) there is evidence they are correlated and driven by changes at the productivity frontier.

5 Conclusion

This paper shows changes in the US flow of funds are consistent with a markup shock. It then shows the resulting profits were distributed to top incomes. There is strong evidence households with high incomes generally save more than others. A modeling exercise accounting for heterogeneity in indicates a larger drop in interest rates compared to the case where only capital demand is considered. Furthermore, combining the

[32]Note that the calibration matches saving rates across the income distribution closely. However, income shares are not closely aligned since only a flat wage distribution is modeled.

[33]Increasing wage dispersion is also well documented (e.g. Scanlon 2020). Preliminary tabulations of the SCF suggest a similar, if not stronger trend for business income over the 2000s.

observed increase in profit share of 5 percentage points with a 20% increase in income dispersion gives a real interest rate impact around -0.7 percentage point. A comparative statics exercise demonstrates very high levels of redistributive taxation are needed to move the interest rate. With endogenous entrepreneurship households may choose a positive tax, but if markups rise as firms exit or owners pass the tax burden to workers, welfare losses may be substantial. While a progressive tax on profits is not considered, such a tax may still discourage entrepreneurs if the alternative wage is high and/or the tax is overly progressive. This is an area for future research and a section in the appendix considers trade-off between a flat and progressive profit tax when the wage distribution is modeled. Since the markup accrues to top tax brackets, it acts as a revenue shock that allows the government to increase debt—although this is not always beneficial. Government can substantially raise interest rates, but also crowds out the asset market and lowers capital.

In conclusion, a markup shock is problematic in the context of low interest rates and a near-binding ZLB. Fiscal policies are not particularly effective at combating the shock and entail painful economic trade offs. If the goal is to move back to a competitive allocation, a tax on profits must be accompanied by subsidies on labor and capital costs to avoid distortions. The obvious alternative would be stronger competition policy. Still, the latter option depends heavily on the ultimate source of the shock. A shock coming from changes in consumer behavior is harder to address. In such a case, a tax/subsidy scheme can restore the economy its competitive allocation—raising interest rates and lowering inequality—while minimizing other trade offs.

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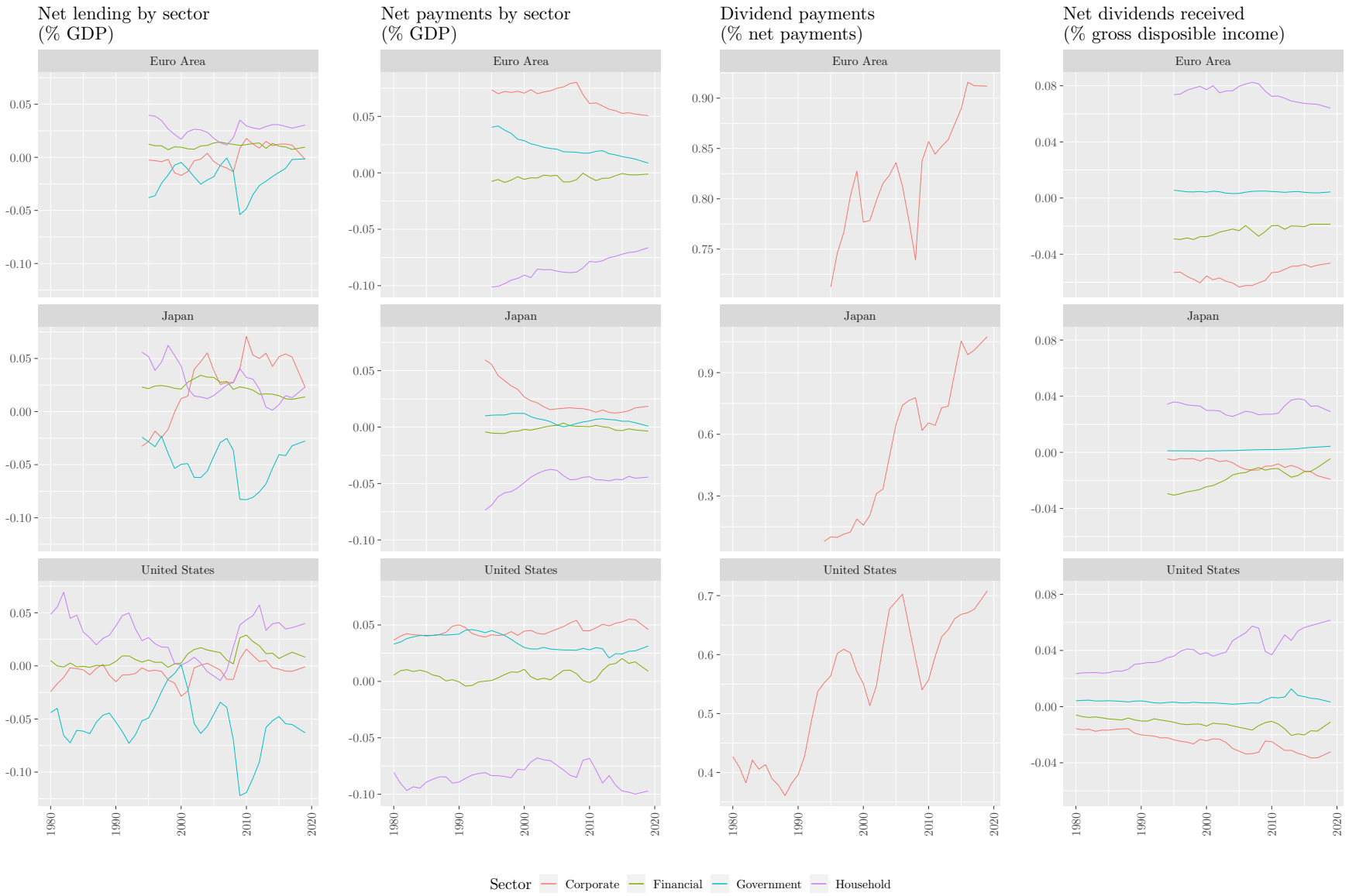
A Appendix

A.1 Evolution of Sector Balances

Figure 13: Flow of Funds Between Sectors (OECD National Accounts)



A.2 Shift-Share Decomposition

Shift-share decomposition:

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

$$\Delta X_t = \sum_i \Delta X_{it} \quad X_{it} = \text{profits to receipts for type } i \quad \omega_{it} = \text{share}$$

Figure 13 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 saving.[34] Meanwhile, corporate saving has absorbed deficits in Japan. 'Net payments' combines income from interest, rents, and dividends and 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 increase 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 goes directly to households and some was intermediated through the financial sector, which also distributes profits to households. ## Worker Household Optimization

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

$$\mathcal{L} = \log\left(c^y_{jt}\right) + \beta \log\left(c^o_{jt+1}\right) - \Lambda_{1,t}\left(c^y_{jt} + d^w_{jt} - w_t n_{jt} - \mathcal{T}_t\right) - \Lambda_{2,t+1}\left(c^o_{jt+1} - (1 + r_{t+1}) d^w_{jt}\right)$$

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

$$\frac{\partial \mathcal{L}}{\partial c^y_{jt}} = 0 \implies c^y_{jt} = \frac{1}{\Lambda_{1,t}} \tag{45}$$

$$\frac{\partial \mathcal{L}}{\partial c^o_{jt+1}} = 0 \implies c^o_{jt} = \frac{\beta}{\Lambda_{2,t}} \tag{46}$$

$$\frac{\partial \mathcal{L}}{\partial d^w_{jt}} = 0 \implies \Lambda_{1,t} = \Lambda_{2,t+1}(1 + r_{t+1}) \tag{47}$$

Combining elements in the system

$$\frac{c^o_{jt+1}}{c^y_{jt}} = \beta(1 + r_{t+1}) \tag{48}$$

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

$$\frac{c^o_{jt+1}}{1 + r_{t+1}} = w_t \bar{n} + \mathcal{T}_t - c^y_{jt} \tag{49}$$

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

Using the Euler equation

$$\beta c_t^y = w_t n_{jt} - c_{jt}^y \quad \Longrightarrow \quad c_{jt}^y = \frac{1}{1+\beta}(w_t n_{jt} + \mathcal{T}) \tag{50}$$

For deposits, the young household budget constraint imples

$$d_{jt}^w = \frac{\beta}{1+\beta}(w_t n_{jt} + \mathcal{T}_t) \tag{51}$$

A.3 Firm Owner Optimization

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

$$\frac{\partial \mathcal{L}}{\partial c_{it}^y} = 0 \implies c_{it}^y = \frac{1}{\Lambda_{1,t}} \tag{52}$$

$$\frac{\partial \mathcal{L}}{\partial c_{it+1}^o} = 0 \implies c_{it}^o = \frac{\zeta}{\Lambda_{1,t}} \tag{53}$$

$$\frac{\partial \mathcal{L}}{\partial d_{it}^e} = 0 \implies \Lambda_{1,t} = \Lambda_{2,t+1}(1+r_{t+1}) \tag{54}$$

$$\frac{\partial \mathcal{L}}{\partial n_{it}} = 0 \implies \Lambda_{1,t}\frac{\partial \Pi_{it}}{\partial n_{it}} = 0 \tag{55}$$

$$\frac{\partial \mathcal{L}}{\partial k_{it}} = 0 \implies \Lambda_{1,t}\frac{\partial \Pi_{it}}{\partial k_{it}} = 0 \tag{56}$$

Combining terms

$$\frac{c_{it+1}^o}{c_{it}^y} = \zeta(1+r_{t+1}) \tag{57}$$

As with households

$$d_{it}^e = \frac{\zeta}{1+\zeta}\left(\Pi_{it} + \mathcal{T}_t\right) \tag{58}$$

For individual firms, the optimality condition for labor is

$$n_{it} = \left(\rho_t(1-\alpha)(z_{it}Y_t)^{\frac{1}{\sigma_t}} k_{it}^{\rho_t\alpha} w_t^{-1}\right)^{\frac{1}{1-\rho_t(1-\alpha)}} \tag{59}$$

For capital,

$$k_{it} = \left(\rho_t\alpha(z_{it}Y_t)^{\frac{1}{\sigma_t}} n_{it}^{\rho_t(1-\alpha)}(r_t+\delta)^{-1}\right)^{\frac{1}{1-\rho_t\alpha}} \tag{60}$$

Putting the expressions together and solving for capital gives

$$\frac{k_{it}}{Y_t} = z_{it}\kappa_t \quad \text{where} \quad \kappa_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{\rho_t(1-\alpha)} \left(\frac{\alpha}{r_t+\delta}\right)^{1-\rho_t(1-\alpha)}\right]^{\sigma_t} \tag{61}$$

Similarly, for labor

$$\frac{n_{it}}{Y_t} = z_{it}\varphi_t \quad \text{where} \quad \varphi_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{1-\rho_t\alpha} \left(\frac{\alpha}{r_t+\delta}\right)^{\rho_t\alpha}\right]^{\sigma_t} \tag{62}$$

For intermediate output

$$\frac{p_{it}y_{it}}{Y_t} = z_{it}\Upsilon_t \quad \text{where} \quad \Upsilon_t = \left[\rho_t \left(\frac{1-\alpha}{w_t}\right)^{1-\alpha} \left(\frac{\alpha}{r_t+\delta}\right)^{\alpha}\right]^{\sigma_t-1} \tag{63}$$

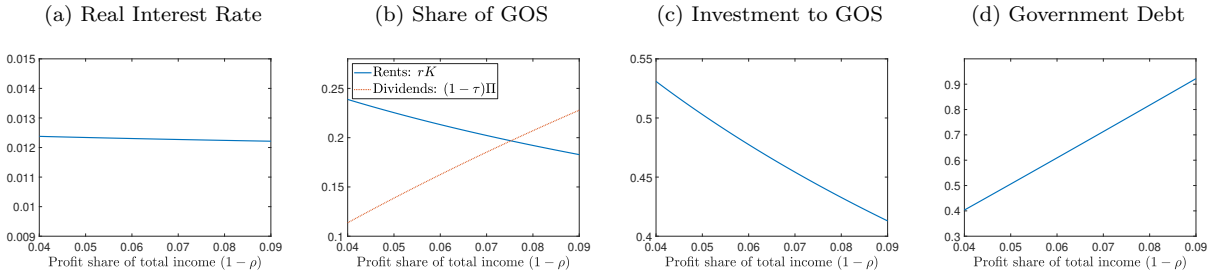
Thus profits are given by

$$\frac{\Pi_{it}}{Y_t} = z_{it}\left(\Upsilon_t - w_t\varphi_t - (r_t+\delta)\kappa_t\right) \tag{64}$$

A.4 Government Debt

If the tax only finances payments on debt and government depreciation is ignored ($\delta_g = 0$), the interest rate is stable. However, government debt crowds out capital and the decline in investment to the operating suplus is larger than what is observed in the data. The level of government debt to GDP increases by 60 percentage points in this scenario.[35]

Figure 14: The Effect of Government Debt on Interest Rates and Payments by Firms ($\delta_g = 0$; $\tau = 0.15$)



A.5 Entrepreneur and Worker Shares

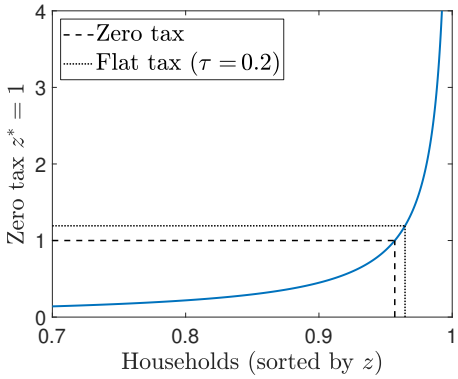
In the observed U.S income distribution, the top 1% earn about 4x from business income as the median household, as reflected in Panel 15c. While the model predicts that a greater profit share will lead more households to enter into entrepreneurship, this is not necessarily the case if productivity dispersion 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.

[35] This matches the observed increase in debt 1980-2016.

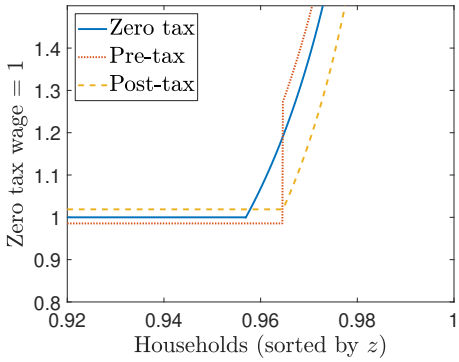
Figure 15: The Effects of a Flat Tax ($\tau = 0.20$)

High Markup Economy ($1 - \rho = 0.10$)

(a) Change in Worker Income

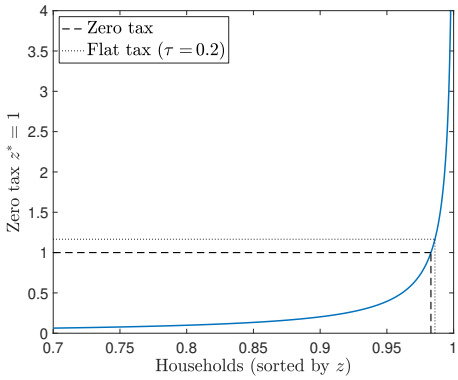


(b) Marginal Entrepreneur

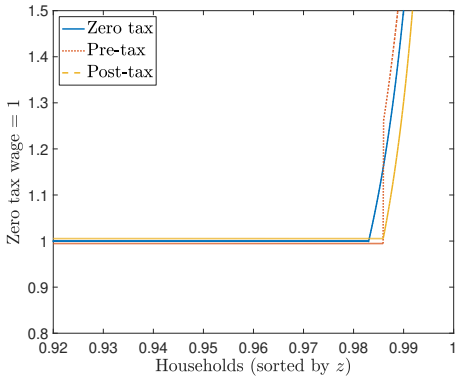


Low Markup Economy ($1 - \rho = 0.03$)

(e) Change in Worker Income



(f) Marginal Entrepreneur



A.6 Income Shares Using CES Production

Following Karabarbounis and Neiman (2013), the production function is specified using a more flexible CES specification

$$y_{it} = \left(\alpha k_{it}^{\frac{\omega-1}{\omega}} + (1-\alpha) n_{it}^{\frac{\omega-1}{\omega}}\right)^{\frac{\omega}{\omega-1}} \tag{65}$$

Solving the competitive equilibrium gives

$$K_t = \left(\frac{\alpha \rho_t}{r_t + \delta}\right)^{\omega} Y_t \quad \Longrightarrow \quad (r_t + \delta) K_t = (\alpha \rho_t)^{\omega} (r_t + \delta)^{1-\omega} Y_t \tag{66}$$

$$N_t = \left(\frac{\rho_t (1-\alpha)}{w_t}\right)^{\omega} Y_t \quad \Longrightarrow \quad w_t N_t = [\rho_t (1-\alpha)]^{\omega} w_t^{1-\omega} Y_t \tag{67}$$

Factor shares in the model can be specified as

$$s_t^K = \frac{(r_t+\delta)K_t}{Y_t} = \rho_t \frac{(r_t+\delta)K_t}{w_t N_t + (r_t+\delta)K_t} \tag{68}$$

$$s_t^L = \frac{w_t N_t}{Y_t} = \rho_t \frac{w_t N_t}{w_t N_t + (r_t+\delta)K_t} \tag{69}$$

$$s_t^\Pi = \frac{\Pi_t}{Y_t} = 1-\rho_t \tag{70}$$

Using the solutions from before

$$s_t^K = (\alpha\rho_t)^\omega (r_t+\delta)^{1-\omega} \tag{71}$$

$$s_t^L = [\rho_t(1-\alpha)]^\omega w_t^{1-\omega} \tag{72}$$

$$s_t^\Pi = 1 - s_K - s_L \tag{73}$$

This implies that

$$s_t^L = \rho_t - s_t^K \tag{74}$$

Therefore, the asset market clearing gives

$$\left(\frac{\alpha\rho_t}{r_t+\delta}\right)^\omega = \frac{\beta}{1+\beta}\left(\rho_t - s_t^K + \tau_t(1-\rho_t)\right) + \frac{\zeta}{1+\zeta}\left(1-\tau_t\right)\left(1-\rho_t\right) \tag{75}$$

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.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 eq. 6 becomes

$$c_{jt}^y + d_{jt} = w_{jt} n_{jt} + \mathcal{T}_{jt} \tag{76}$$

Aggregate wages are given by

$$w_t \bar{n}_t \int_j f(z_{jt})dj = \rho_t(1-\alpha)Y_t \quad \text{where} \quad \int_j f(z_{jt})dj = j \tag{77}$$

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 $f(z_t^*)w_t\bar{n}_t + \mathcal{T}_t = (1-\tau_t)\pi_t^*$

$$z_t^* = \frac{f(z_t^*)\rho_t(1-\alpha) + \tau_t(1-\rho_t)}{j \times (1-\tau_t)\psi_t} \tag{78}$$

If the wage distribution is modeled, is also assumed that

$$\frac{\partial \pi(z_t)}{\partial z_t} > \frac{\partial f(z_t)}{\partial z_t} \quad \text{whenever} \quad z_t > z_t^* \tag{79}$$

While a suitably progressive tax has no effect on the entrepreneurship decision in the baseline results, this is not the case when the alternative wage for entrepreneurs is close to their business income. While the flat tax only discourages low-productivity entrepreneurs, an excessively progressive tax could cause high-productivity entrepreneurs to exit. Unfortunately, this is difficult to observe, but can be tested for different wage distributions. Depending on the setup, either the flat or progressive tax may be optimal.

A.8 Composition of Saving across the Income Distribution

Table 8 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 8: 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)

Note: Standard errors in parentheses.

Source: US Federal Reserve Survey of Consumer Finances.