Markups and Inequality*

Corina Boar† Virgiliu Midrigan‡

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Abstract

We study the aggregate and distributional impact of product market interventions and profit taxes using a model of firm dynamics, credit constraints and incomplete markets. A key ingredient of our model is that markups are endogenous so that the markup a producer charges depends on the amount of competition it faces. We show that size-dependent subsidies that remove the distortions due to markup dispersion lead to sizable welfare gains and reduce inequality, even though they increase firm concentration and long-run misallocation. In contrast, policies that reduce concentration lead to large output, TFP and welfare losses and increase inequality. A tax on profits greatly depresses the incentives to create new firms, reducing labor demand, after-tax wages and welfare.

Keywords: misallocation, inequality, markups, entrepreneurship, tax policy.

JEL classifications: D4, E2, L1.

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†New York University and NBER, corina.boar@nyu.edu.

‡New York University and NBER, virgiliu.midrigan@nyu.edu.

1 Introduction

The United States has experienced a sharp increase in both firm- and household-level inequality in recent decades. On one hand, the market share of the largest firms has increased considerably in most industries, a trend accompanied by a rise in profit shares and measured markups. On the other hand, household wealth and income inequality has increased as well. Since firm ownership is highly concentrated, these two trends may be interrelated: an increase in firm profits and the resulting decline in the labor share of income may have redistributed income from workers towards firm owners. Indeed, a number of economists (Stiglitz, 2012, Atkinson, 2015) and antitrust scholars (Baker and Salop, 2015, Khan and Vaheesan, 2017) made this point, leading to calls in favor of using product market policies in order to combat inequality.

Despite the growing concern in policy circles about the relationship between markups and inequality, existing work on markups, such as Atkeson and Burstein (2008), Bilbiie et al. (2012, 2018) and Edmond et al. (2018), assumes perfect consumption sharing across households and thus abstracts from distributional concerns. In such a setting markups only distort production by introducing two sources of inefficiency. First, the aggregate markup, a weighted average of individual firm markups, acts as a uniform tax on production and reduces overall output. Second, firms with higher market shares charge higher markups, which generates dispersion in the marginal product of labor and capital and reduces allocative efficiency and TFP. In this environment a policy that subsidizes firms, more so the larger their markups, restores efficiency. Even though this policy increases product market concentration and firm profits, it makes the representative consumer, who owns all firms, better off. This policy prescription ignores, however, potentially important distributional consequences that increased markups and firm concentration may have.

Our goal in this paper is to study the macroeconomic and welfare consequences of policies aimed at alleviating the production and distributional costs of markups. We do so using a dynamic general equilibrium model parameterized to reproduce salient facts about U.S. wealth and income inequality, as well as markups and product market concentration. The model features heterogeneous producers engaged in monopolistic competition with non-CES demand, as in Kimball (1995). Two types of producers co-exist: privately owned businesses operated by entrepreneurs and publicly owned corporate firms. Unlike corporate firms, private businesses face collateral constraints. More productive or wealthier producers are larger and face less elastic demand, so they charge higher markups compared to less productive or more financially constrained firms.

We use the model to study two sets of policies. First, we analyze the impact of product market interventions aimed at correcting the production-side inefficiencies induced by markups. Second, we study the impact of profit taxes which redistribute the rents from markups that accrue to firm owners.

We study a range of product market interventions but focus most of our analysis on the impact of size-dependent sales subsidies or taxes, which either increase or decrease the degree of product market concentration. We do so because these policies are relatively easy to implement and widespread in practice (Guner et al., 2008). We show that subsidies that increase with firm size and eliminate the dispersion in the marginal product of labor induced by markups increase the welfare of most households, especially the poor, despite the resulting increase in firm concentration and markups. Such policies also decrease inequality, by redistributing from entrepreneurs to workers. Conversely, policies that reduce concentration, either by directly taxing larger firms, or imposing restrictions on their market shares, lead to large welfare losses and increase inequality. Such policies disadvantage workers the most, and benefit a small fraction of entrepreneurs who gain from a reallocation of market share from larger firms.

We then show that profit taxes are too blunt of an instrument to redistribute income. Such taxes depress the incentives to create new firms, leading to a large drop in labor demand, allocative efficiency and after-tax wages. The median household loses from these policies. Nevertheless, the poorest workers do benefit from profit taxes due to an increase in the after-tax wage in the immediate aftermath of such a policy reform.

The economy we study consists of a large number of households who work and have the option to run a private business. Households face idiosyncratic shocks to both their labor market efficiency and their entrepreneurial ability. They can partially insure against these shocks by saving in a risk-free asset managed by a financial intermediary, which uses household savings to purchase capital, shares in corporate firms or government bonds. Households who run a private business are the monopoly supplier of a differentiated variety of a good and charge a markup over marginal cost.

We explicitly model entrepreneurial activity and financial constraints because these are important determinants of wealth and income inequality, as pointed out by Cagetti and De Nardi (2006) and Peter (2019). According to the 2013 Survey of Consumer Finances, though entrepreneurs represent only about 7% of all households, they hold 37% of all wealth and earn 28% of all income. Privately-owned businesses are also much more reliant on external finance than publicly-owned firms (Shourideh and Zeitlin-Jones, 2017). We follow Buera et al. (2011) in assuming that privately owned businesses face a collateral constraint that limits their stock of capital to a multiple of their wealth. Higher ability entrepreneurs have a larger optimal scale of operations and are more constrained, on average. Dispersion in entrepreneurial ability therefore gives rise to dispersion in the rates of return on savings and is an important determinant of wealth inequality. Collateral constraints imply that entrepreneurs are inefficiently small, which in turn reduces aggregate productivity and output.

Entrepreneurs in our model compete among themselves, as well as against firms in the corporate sector. Corporate firms operate an identical technology, but do not face borrowing constraints. There is free entry into the corporate sector. The assumptions we make on the demand system imply that the demand elasticity a producer faces decreases in its market share, and so larger producers charge higher markups. In this environment, more competition reduces markups. Our framework thus parsimoniously captures the trade-off between efficiency gains and markups that is at the heart of the debate about product market policies. On one hand, policies that disproportionately tax large firms reduce concentration and markups, but on the other hand they exacerbate production inefficiencies.

Given our focus on the distributional consequences of profit taxes and product market policies, it is imperative that our model reproduces well the distribution of wealth and income in the data. We calibrate the parameters of the model to match moments of the wealth and income distribution, several salient facts about entrepreneurs, the relative size and concentration of the corporate sector, as well as an aggregate markup of 15%. Our calibration implies that both markups and financial constraints are costly. Absent financial constraints, privately-owned firms would double in size and account for two thirds of the economy's sales, compared to approximately one third in our baseline model. Absent markups, wages would be 20% higher.

We begin by analyzing the impact of uniform sales subsidies which remove the aggregate markup distortion, reduce the prices faced by consumers and increase factor shares. As Edmond et al. (2018) show, such subsidies nearly restore production efficiency in a representative consumer economy provided they are financed with lump-sum taxes. In our setting, however, such subsidies must be financed by increasing distortionary personal income taxes. This leads to a decline in after-tax wages, which disadvantages the poor, and an increase in after-tax interest rates, which benefits the rich. Most households lose from such a policy, a result that stands in sharp contrast to the predictions of representative consumer models.

We next study a policy that subsidizes larger firms and removes the dispersion in the marginal product of labor across producers. Interestingly, this policy increases the TFP losses from misallocation in the long-run. More productive entrepreneurs, who would otherwise take advantage of the subsidy and expand, cannot do so because of credit constraints. Since in our model entrepreneurs are too small relative to the efficient allocation, a size-dependent subsidy decreases allocative efficiency in the long-run by amplifying the severity of credit constraints. The resulting decline in TFP is gradual, however. TFP increases on impact and only slowly falls to its lower steady state level because it takes a long time for entrepreneurs to dissave and lose market share to larger firms. This short-run increase in TFP increases after-tax wages initially and benefits most households.

A size-dependent subsidy also reduces inequality, by reducing the income and wealth shares of the relatively rich entrepreneurs who are disadvantaged by the subsidies received by larger corporate producers. Our results thus stand in sharp contrast to the often-invoked argument that an increase in firm concentration necessarily increases wealth inequality. Overall, size-dependent subsidies benefit 96% of all households, with the median household experiencing a welfare gain equivalent to a 1.7% permanent increase in consumption.

Conversely, policies that attempt to reduce concentration amplify the TFP losses from misallocation. Such policies reduce wages and disadvantage workers the most. They benefit a small fraction of medium-sized entrepreneurs who gain from depressed factor prices and reduced competition from larger corporate firms. Since medium-sized entrepreneurs are much wealthier than the average household, in both our model and in the data, policies that reduce concentration further increase inequality.

We also analyze two alternative product market interventions aimed at changing the degree of competition and concentration in the product market. The first policy is a cap on how much a firm can sell and therefore the markup it charges. This policy has similar implications as a size-dependent tax, and leads to large losses from misallocation. The second policy caps the price a firm can charge in an attempt to limit its markup directly. We show that even though such a policy decreases inequality, it reduces the median household's welfare by implicitly taxing credit-constrained entrepreneurs and greatly reducing output and TFP.

We then turn our attention to studying the impact of profit taxes. We consider two sets of interventions. First, we study the impact of a 25% tax on all profits. Second, we study a tax that only applies to profits above a cutoff. We set the cutoff equal to the profits of the largest 0.5% of all firms. Since firm profits are highly concentrated in our economy, as in the data, this latter policy affects a small fraction of mostly large corporate firms, but nevertheless subjects about half of all profits in the economy to a tax.

We find that taxing all profits leads to a sizable drop in steady-state wages of approximately 6%, owing to a nearly 30% drop in the mass of corporate firms and the resulting drop in the demand for labor and reallocation of production towards less efficient private businesses. Even though personal income taxes fall due to an increase in tax revenues, the after-tax wage falls in the long-run by approximately 4%. After-tax wages do increase in the short-run, since the government is able to extract profits from existing firms, but this increase is relatively transitory, so only the poorest one-third of workers benefits. Interestingly, a tax on only the largest firms' profits is even more costly. Such a tax redistributes resources towards the relatively rich private business owners, who benefit from the reduction in wages, and hurts 95% of all workers. We show that the free entry condition is critical for these results: if the stock of corporate firms were fixed, a tax on profits would generate an increase in the median household's welfare of approximately 2%.

The welfare implications of product market interventions are robust to a number of perturbations of the model, including relaxing the free entry condition, as well as separately eliminating the private business sector and the corporate sector. Even though the model's implications for inequality change in an environment without corporate firms in which all firm ownership is concentrated in the hands of a small number of households, the model's implications for factor prices and therefore welfare are largely unchanged.

One concern that is often voiced in discussions about firm concentration is that size differences across firms partly reflect political connections, monopsony power or other factors that lead some firms to inefficiently expand. We address this concern by studying a version of our model in which firms receive subsidies that are negatively correlated with their productivity. We show that, as long as the model matches the empirical evidence that the average revenue product of labor increases with firm size, size-dependent subsidies that remove the dispersion in markups improve efficiency and benefit consumers, despite increasing product market concentration.

A second concern about firm concentration is that it reflects horizontal mergers among firms that would otherwise compete among themselves. We illustrate the impact of mergers using a stylized model of oligopolistic competition among a small number of producers. Mergers in this environment indeed increase markups and allocative inefficiency, leading to large welfare losses. Nevertheless, a policy that subsidizes larger firms increases allocative efficiency and benefits consumers, even more so than in the absence of mergers. Such subsidies, however, do not come close to eliminating the losses brought about by mergers. This suggests an important role for anti-trust authority in preventing such outcomes. Since the costs and benefits of individual mergers vary greatly across industries depending on the nature of technology and competition, they must be evaluated on a case by case basis.

Related Work In addition to the literature on endogenous markups discussed above, our work builds on studies of wealth and income inequality, originating with Castaneda et al. (2003), Cagetti and De Nardi (2006) and more recently Benhabib et al. (2017) and Hubmer et al. (2018). This line of research typically assumes perfect competition in the product market or that markups are constant. Several notable exceptions are the work of Brun and Gonzalez (2017) and Colciago and Mechelli (2019) who study the effect of increasing markups in Bewley-Aiygari models with homogeneous firms. In contrast to their work, we explicitly model firm heterogeneity, entrepreneurial activity, and study the normative implications of policies aimed at changing product market concentration and markups. Our work is also related to Kaplow (2019) who studies optimal income taxation in a static economy with markups and Bhandari et al. (2018) who study optimal monetary policy responses to markup shocks in an economy with heterogeneous agents.

Our paper is also related to research that studies the taxation of private businesses (Hurst and Pugsley, 2017, Dyrda and Pugsley, 2018, Bhandari and McGrattan, 2018), and is motivated by work documenting facts about allocative efficiency (Hsieh and Klenow, 2009, Baqaee and Farhi, 2018), rise in inequality (Piketty and Goldhammer, 2014, Kuhn and Rios-Rull, 2016), increase in measured markups (Gutierrez and Philippon, 2017, De Loecker et al., 2018, Hall, 2018), and firm concentration (Autor et al., 2017, Hartman-Glaser et al., 2018).

The remainder of the paper proceeds as follows. Section 2 presents several facts on inequality and market concentration that motivate our work. Section 3 presents the model. Section 4 explains how we parameterize the model. Section 5 discusses the role of markups and borrowing constraints in shaping equilibrium outcomes. Section 6 studies the impact of product market policies aimed at changing markups and concentration. Section 7 studies the effect of taxing profits. Section 8 discusses a number of perturbations of our benchmark model. Section 9 concludes.

2 Motivating Evidence

We motivate our modeling choices below by summarizing several salient facts in the data on the rise in firm concentration, firm markups, wealth and income inequality. These facts are well-known from existing work by Autor et al. (2017), De Loecker et al. (2018), Cagetti and De Nardi (2006), Saez and Zucman (2016) and Kuhn and Rios-Rull (2016). Though our goal in this paper is not to explain these trends, we report them here in order to provide some context for our quantitative model. We also highlight the importance of entrepreneurial activity by reporting statistics on the wealth and income shares of entrepreneurs.

Inequality. We use the Survey of Consumer Finances (SCF) to compute moments of the wealth and income distribution, and to document several facts about entrepreneurs. As the top panels of Figure 1 show, both wealth and income inequality increased considerably over the past three decades. The share of wealth held by the wealthiest 1% increased from 0.29 in 1989 to 0.39 in 2016. The top 1% income share increased from 0.17 to 0.23 over this period.

Table 1 reports several statistics that describe the prevalence of entrepreneurs in the wealth and income distribution in the 2013 SCF survey, which we use to calibrate our model. We follow Cagetti and De Nardi (2006) in defining an entrepreneur as a self-employed business owner who actively manages a business. Entrepreneurs are wealthier and earn more on average: though they represent only 7% of all households, they hold 37% of all wealth and earn 29% of all income. Notice also that entrepreneurs represent a large fraction of households at the top of the wealth and income distribution. For example, entrepreneurs account for

58% of the wealthiest 1% of households and hold 62% of the wealth of this group.

Firm Concentration. The lower left panel of Figure 1 plots the evolution of the share of sales accounted for by the largest 5% of firms in Compustat. We calculate these shares within four-digit industries and report a sales-weighted average across industries. Figure 1 shows a clear upward trend. The share of sales accounted for by the largest 5% of firms in an industry rose from 0.30 in 1950 to 0.64 in 2014.

Firm Markups. The lower right panel of Figure 1 reproduces the evidence in Edmond et al. (2018) on the evolution of the cost-weighted average markup in Compustat. This aggregate markup rose from 1.16 in 1950 to 1.24 in 2014. The increase is especially prominent between 1980 and 2014, when the aggregate markup rose from 1.11 to 1.24.

3 Model

The economy is inhabited by a continuum of households who work and have the option to run a privately-owned business. There is also a continuum of perfectly diversified corporate firms, with mass pinned down by a free entry condition. We abstract from aggregate uncertainty, and study the steady state of the model and transition dynamics after policy reforms.

3.1 Households

Households seek to maximize life-time utility given by

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{c_t^{1-\theta}}{1-\theta} - \frac{h_t^{1+\gamma}}{1+\gamma} \right)$$

subject to the budget constraint

$$c_t + a_{t+1} = i_t - T\left(i_t\right) + a_t,$$

where a_{t+1} are savings, c_t is consumption, h_t are hours worked, i_t is pre-tax income, derived from work, return on asset holdings and profits from entrepreneurship, and $T(i_t)$ is the amount the household pays in taxes. Households save with perfectly competitive financial intermediaries at a risk-free rate r_t. Financial intermediaries use the resources obtained from households to purchase capital, shares in corporate firms and a risk-free government bond. We describe the problem of the financial intermediary below.

All households supply labor and earn wage income $W_t e_t h_t$, where e_t is the agent's idiosyncratic efficiency on the job and W_t is the wage rate. In addition, households may choose to operate a private business and supply a differentiated product variety.[1] Operating a business gives profits $\pi_t(a_t, z_t)$, which depend on the household's wealth a_t, due to a leverage constraint that we describe below, and entrepreneurial ability z_t. As we explain below, even though there are no fixed costs of operating a business, only the most productive households become entrepreneurs in equilibrium.

We assume that the logarithm of entrepreneurial and labor market efficiency, z_t and e_t, evolve according to independent AR(1) processes, with persistence ρ_z and ρ_e and volatility σ_z and σ_e. Specifically,

$$\log z_{t+1} = \rho_z \log z_t + \sigma_z \varepsilon_t^z,$$

and

$$\log e_{t+1} = \rho_e \log e_t + \sigma_e \varepsilon_t^e,$$

where ε_t^z and ε_t^e are independent standard normal random variables.

The income of the household is

$$i_t = r_{t-1} a_t + W_t e_t h_t + \pi_t(a_t, z_t), \tag{1}$$

where $\pi_t(a_t, z_t) = 0$ for households who choose not to run a business. We refer to households who run a business as *entrepreneurs.*

We assume that taxes are determined according to the function

$$T(i_t) = i_t - (1 - \tau) \frac{i_t^{1-\xi}}{1 - \xi}, \tag{2}$$

where τ governs the level and ξ the progressivity of the tax schedule. This specification has been shown to approximate well the US tax and transfer system (Heathcote et al., 2017).

Before we derive the profit function $\pi_t(a_t, z_t)$, we must describe the goods markets.

3.2 Final Goods Firms

We normalize the price of the final good to 1. The output of the final goods sector is used for consumption, investment and government spending, so the aggregate resource constraint is

$$Y_t = C_t + X_t + G,$$

where G is spending by the government and X_t is investment in physical capital and new corporate firms.

The final goods sector is competitive, with final goods firms purchasing differentiated intermediate varieties from both entrepreneurs and corporate firms. Each intermediate goods

[1] A household who operates a private business supplies $e_t h_t$ of own labor and can hire an additional $l_t - e_t h_t$ units, in order to operate with l_t units of labor. Since the two types of labor are perfect substitutes, we say that all households, including entrepreneurs, supply labor.

producer is the monopoly supplier of such a variety and thus has market power. The final goods sector operates a technology implicitly defined by the Kimball aggregator

$$\int_0^{\bar{N}_t} \Upsilon\Big(\frac{y_t(\omega)}{Y_t}\Big)\,\mathrm{d}\omega = 1,$$

where $y_t(\omega)$ is the quantity of variety ω purchased and $\bar{N}_t$ is the mass of all potentially available varieties. The function $\Upsilon(q)$ is strictly increasing and strictly concave. We follow Klenow and Willis (2016) in assuming an aggregator of the form

$$\Upsilon(q) = 1 + (\sigma - 1)\exp\left(\frac{1}{\varepsilon}\right)\varepsilon^{\frac{\sigma}{\varepsilon}-1}\left[\Gamma\left(\frac{\sigma}{\varepsilon}, \frac{1}{\varepsilon}\right) - \Gamma\left(\frac{\sigma}{\varepsilon}, \frac{q^{\varepsilon/\sigma}}{\varepsilon}\right)\right],$$

where $\Gamma(s, x)$ is the upper incomplete gamma function. This specification nests the CES aggregator as a special case ($\varepsilon = 0$). The Klenow-Willis functional form implies a variable demand elasticity

$$\theta(q) = -\frac{\Upsilon'(q)}{\Upsilon''(q)q} = \sigma q^{-\frac{\varepsilon}{\sigma}},$$

which falls with the producer's relative quantity $q = y/Y$, or equivalently market share. This in turn implies that the producer's optimal markup

$$m(q) = \frac{\theta(q)}{\theta(q) - 1} = \frac{\sigma}{\sigma - q^{\frac{\varepsilon}{\sigma}}}$$

is endogenous and increases with the firm's relative size q when $\varepsilon > 0$.

This specification of the demand system is widely used both in macroeconomics (Smets and Wouters, 2007) and international economics (Gopinath and Itskhoki, 2010). Importantly, explicitly modeling search frictions (Benabou, 1988, Levin and Yun, 2011) or oligopolistic competition in the product markets (Atkeson and Burstein, 2008) gives rise to a similar positive relationship between firm size and markups. In contrast to the CES benchmark, such demand systems allow one to model the effect more competition (a reduction in a producer's relative size or market share) has on markups.

Taking the prices $p_t(\omega)$ of the inputs as given, final good producers choose how much of each intermediate variety $y_t(\omega)$ to buy in order to maximize profits

$$Y_t - \int_{\Omega_t} p_t(\omega)\, y_t(\omega)\,\mathrm{d}\omega,$$

subject to the Kimball production function. Here Ω_t is the set of varieties that are produced in equilibrium in period t. The optimality condition for this problem gives rise to the demand for each intermediate producer's product

$$p_t(\omega) = \Upsilon'\Big(\frac{y_t(\omega)}{Y_t}\Big)\, D_t,$$

where

$$D_t = \left(\int_{\Omega_t} \Upsilon' \Big(\frac{y_t(\omega)}{Y_t} \Big) \frac{y_t(\omega)}{Y_t} \, \mathrm{d}\omega \right)^{-1}$$

is an endogenously determined demand index.

We implicitly assume here that private businesses compete alongside corporate firms in the product market. We show in the Appendix that the two types of firms coexist in every major industry in the U.S., though corporate firms are relatively more represented in manufacturing, and less so in retail.[2] Additionally, our robustness section shows that our results are similar in economies without either corporations or entrepreneurs.

3.3 Intermediate Goods Producers

Each variety $\omega \in \left[0,\ \bar{N}_t\right]$ is produced by a single producer. The technology with which a producer with efficiency z_t operates is

$$y_t = z_t k_t^{\alpha} l_t^{1-\alpha},$$

where l_t is the amount of efficiency units of labor it hires and k_t is the amount of capital it rents. Producers pay W_t per unit of labor and R_t per unit of capital. The producer's profits are therefore

$$p_t y_t - W_t l_t - R_t k_t.$$

In addition, privately-owned businesses are subject to a leverage constraint which limits the capital used in production to be below a multiple $\lambda \geq 1$ of one's wealth,

$$k_t \leq \lambda a_t. \tag{3}$$

As is well-known (see for example Moll, 2014), absent adjustment costs on capital this setup is isomorphic to one in which entrepreneurs own their capital and can borrow up to a fraction $1 - 1/\lambda$ of its capital.

An entrepreneur's optimal choices of capital and labor satisfy

$$R_t + \mu_t = \phi_t \alpha \frac{y_t}{k_t}, \tag{4}$$

and

$$W_t = \phi_t (1-\alpha) \frac{y_t}{l_t}, \tag{5}$$

where μ_t is the multiplier on the borrowing constraint (3), given by

$$\mu_t = \max \left[\frac{\alpha}{1-\alpha} W_t \left(\frac{y_t}{z_t \lambda a_t} \right)^{\frac{1}{1-\alpha}} - R_t, 0 \right]$$

[2]See also Smith et al. (2018) for an analysis at a more disaggregated level.

and ϕ_t is the marginal cost of production

$$\phi_t = \frac{1}{z_t}\left(\frac{R_t+\mu_t}{\alpha}\right)^{\alpha}\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}.$$

Constrained entrepreneurs, those with $\mu_t > 0$, effectively face upward sloping marginal cost curves. Such producers cannot increase their capital above the borrowing limit λa_t and increase production solely by hiring more labor, which is subject to decreasing returns.

The firm's optimal price is equal to a markup over the marginal cost,

$$p_t = \frac{\sigma}{\sigma - (y_t/Y_t)^{\frac{\varepsilon}{\sigma}}}\phi_t. \tag{6}$$

An unconstrained firm's profits do not depend on the owner's wealth. For constrained producers, an additional unit of wealth allows the producer to expand its capital by λ and increases the firm's profits by $\lambda\mu_t$ on the margin. This implies that the implicit pre-tax marginal return to wealth is equal to

$$r_{t-1} + \frac{\partial\pi\left(a_t, z_t\right)}{\partial a} = r_{t-1} + \lambda\mu_t\left(a_t, z_t\right).$$

This model therefore predicts dispersion in the implicit rates of return on savings, which Benhabib et al. (2017) argue is an important determinant of wealth inequality.

We finally explain why not all households choose to operate a business, despite the absence of fixed operating costs. Given our specification of the demand system, the price of a particular variety $p_t(q) = \Upsilon'(q)D_t$, evaluated at $q = 0$, is finite, and equal to $p_t(0) = \frac{\sigma-1}{\sigma}\exp\left(\frac{1}{\varepsilon}\right)D_t$. This implies that there is a *choke price* above which the demand for a firm's product is zero. Producers with marginal cost exceeding this cutoff choose not to operate. The productivity cutoff above which a household operates is

$$\bar{z}_t = \frac{\sigma}{\sigma-1}\exp\left(-\frac{1}{\varepsilon}\right)\frac{1}{D_t}\left(\frac{R_t}{\alpha}\right)^{\alpha}\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}, \tag{7}$$

provided $a > 0$.

Corporate firms solve the same problem as privately owned firms, but are not subject to a borrowing constraint. We assume that corporations face a linear tax τ_c on their profits. The dividends paid by a corporate firm are

$$\pi_t^c(z) = (1-\tau_c)\Big(p_t^c(z)y_t^c(z) - W_t l_t^c(z) - R_t k_t^c(z)\Big),$$

and are rebated each period to their owners.

Creating a new corporate firms requires paying a fixed cost F, denominated in units of final output. After paying the fixed cost, an entrant draws productivity z from a log-normal distribution, $\log z \sim \mathbb{N}\left(\bar{z}_c, \sigma_{z_c}\right)$. The expected dividends Π_t^c are given by

$$\Pi_t^c = \int \pi_t^c(z)\,\mathrm{d}n^c(z),$$

where n^c is the productivity distribution of corporate firms. We assume that corporate firms exit with constant probability δ_c.

3.4 Household Choices

A household's state variables are its assets a, entrepreneurial ability z and labor market efficiency e. The value function of the household is

$$V_t(a,z,e) = \max_{c,h,a'} u(c,h) + \beta \mathbb{E} V_{t+1}(a',z',e')$$

subject to

$$c + a' = a + \frac{1-\tau}{1-\xi} i_t(a,z,e)^{1-\xi}$$

and

$$a' \geq 0,$$

where the income of the household i_t is defined by (1).

The optimal labor supply satisfies

$$h_t(a,z,e)^{\gamma} = c_t(a,z,e)^{-\theta} (1 - \tilde{\tau}_t(a,z,e)) W_t e,$$

where $\tilde{\tau}_t(a,z,e)$ denotes the marginal income tax rate and is equal to

$$\tilde{\tau}_t(a,z,e) = 1 - (1-\tau) i_t(a,z,e)^{-\xi}.$$

The optimal choice of savings is dictated by the Euler equation

$$c_t(a,z,e)^{-\theta} = \beta \mathbb{E}_t (1 + \tilde{r}_{t+1}(a',z',e')) c_{t+1}(a',z',e')^{-\theta},$$

where $\tilde{r}_{t+1}$ is the agent's marginal after-tax return on savings:

$$\tilde{r}_{t+1}(a,z,e) = (1 - \tilde{\tau}_{t+1}(a,z,e)) (r_t + \lambda \mu_{t+1}(a,z)).$$

Figure 2 illustrates the entrepreneurs' production choices as a function of ability z for two levels of wealth. Output, employment and capital increase with both wealth and productivity, while the price decreases. The kinks in the graphs reflect the region in which the borrowing constraint starts binding. For a given level of wealth, more productive entrepreneurs are more constrained because they require a larger stock of capital. Because markups increase with firm size, more productive and wealthier producers charge higher markups.

Figure 3 illustrates the entrepreneurs' consumption, savings and hours choices. More productive entrepreneurs have a higher marginal after-tax return on savings, $\tilde{r}$, and find it optimal to consume less and supply more hours than the less productive entrepreneurs. More productive entrepreneurs therefore accumulate wealth at a faster rate in an effort to grow out of their borrowing constraints.

3.5 Financial Intermediaries

We assume that households deposit their savings with perfectly competitive financial intermediaries who use these resources to invest in capital, new corporate firms, shares in existing corporate firms or government bonds.

The budget constraint of the financial intermediary is

$$K_{t+1} + Q_t S_{t+1} + F N_{t+1}^e + B_{t+1} + (1 + r_{t-1}) A_t =$$
$$(R_t + 1 - \delta) K_t + (Q_t + \Pi_t^c) ((1 - \delta_c) S_t + N_t^e) + (1 + r_{t-1}) B_t + A_{t+1}$$

where K_t is the capital stock, S_t denotes the number of shares in existing corporate firms, Q_t is the price of such a share, Π_t^c is the total amount of after-tax dividends issued by corporate firms, N_t^e is the mass of corporate firms created in period $t-1$, B_t is the debt issued by the government in period $t-1$ and A_t denotes the assets of the households. Here we implicitly assume that a new firm created in period t starts operating with probability 1 in period $t+1$.

The right-hand-side of the budget constraint lists the intermediary's source of funds: the value of undepreciated capital $(R_t + 1 - \delta) K_t$, the cum-dividend market value of the corporate firms $(Q_t + \Pi_t^c) ((1 - \delta_c) S_t + N_t^e)$, the return on the government bond $(1 + r_{t-1}) B_t$, and deposits from households A_{t+1}. The intermediary uses these resources to pay interest on households' initial deposits $(1 + r_{t-1}) A_t$ and make new investments.

Since this is a closed economy, all of the investments made by the financial intermediaries must add up to the savings of the households

$$A_{t+1} = K_{t+1} + Q_t S_{t+1} + F N_{t+1}^e + B_{t+1}.$$

Absent aggregate uncertainty, no-arbitrage requires that the rate of return on all these investments is equal, which implies

$$R_{t+1} = r_t + \delta,$$
$$Q_t = \frac{1 - \delta_c}{1 + r_t} \left(Q_{t+1} + \Pi_{t+1}^c\right),$$

and

$$F \geq \frac{1}{1 + r_t} \left(Q_{t+1} + \Pi_{t+1}^c\right).$$

The last expression, the free entry condition, holds with equality if the mass of entrants in period t is positive.

3.6 Government

The government has an outstanding stock of debt B_t on which it pays the equilibrium interest rate r_{t-1}. It finances an exogenous amount of government spending G and collects taxes T_t from both households and corporate firms. The government budget constraint is

$$(1 + r_{t-1}) B_t + G = B_{t+1} + T_t.$$

3.7 Equilibrium

A competitive equilibrium consists of: *(i)* aggregate prices W_t, R_t, r_t, Q_t, *(ii)* consumption, saving and labor supply decisions for households $c_t(a,z,e)$, $a_{t+1}(a,z,e)$, $h_t(a,z,e)$, *(iii)* employment, capital, output and price choices of entrepreneurs $l_t(a,z)$, $k_t(a,z)$, $y_t(a,z)$, $p_t(a,z)$ and of corporations $l_t^c(z)$, $k_t^c(z)$, $y_t^c(z)$, $p_t^c(z)$, *(iv)* measures of households over their idiosyncratic states $n_t(a,z,e)$, and *(v)* mass of corporate firms N_t^c and new entrants N_t^e, such that

1. Given prices, households, entrepreneurs and corporations solve the optimization problems in Sections 3.3 and 3.4.

2. Total output satisfies the Kimball aggregator

$$\int \Upsilon\left(\frac{y_t(a,z)}{Y_t}\right) \mathrm{d}n_t(a,z,e) + N_t^c \int \Upsilon\left(\frac{y_t^c(z)}{Y_t}\right) \mathrm{d}n^c(z) = 1.$$

3. Markets clear period by period. The labor market clearing condition is

$$\int l_t(a,z)\,\mathrm{d}n_t(a,z,e) + N_t^c \int l_t^c(z)\,\mathrm{d}n^c(z) = \int e h_t(a,z,e)\,\mathrm{d}n_t(a,z,e).$$

   The asset market clearing condition is

$$\int a_{t+1}(a,z,e)\,\mathrm{d}n_t(a,z,e) = K_{t+1} + Q_t S_{t+1} + F N_{t+1}^e + B_{t+1}.$$

   The capital market clearing condition is

$$\int k_t(a,z)\,\mathrm{d}n_t(a,z,e) + N_t^c \int k_t^c(z)\,\mathrm{d}n^c(z) = K_t.$$

   The goods market clears by Walras' Law.

4. The budget constraints of the financial intermediary and of the government are satisfied period by period.

5. The law of motion for the measure $n_t(a,z,e)$ evolves according to an equilibrium mapping dictated by the households' optimal choice of assets and the stochastic process for entrepreneurial productivity and labor efficiency.

6. The mass of corporations evolves according to

$$N_{t+1}^c = (1-\delta_c)\,N_t^c + N_t^e,$$

   and the mass of new entrants N_t^e satisfies the free entry condition.

4 Quantifying the Model

In this section we outline our calibration strategy, and then evaluate the model's ability to account for a number of additional features of the data not targeted in our calibration. We assume the economy is in a steady-state in 2013, so we target statistics for this year.

4.1 Calibration Strategy

We next describe how we choose parameters for our quantitative analysis.

4.1.1 Assigned Parameters

We assume that a period is one year and set the depreciation rate of capital $\delta = 0.06$. We assume that the stock of government debt $\bar{B}$ is constant and choose it to ensure that the equilibrium risk-free rate r is equal to 2% in the steady state. We set the elasticity of capital in production $\alpha = \frac{1}{3}$, the relative risk aversion $\theta = 2$, and the inverse of the Frisch elasticity of labor supply to $\gamma = 1$. We set $\tau_c = 0.40$, roughly consistent with the combined profit and dividend tax on C-corporations (Bhandari and McGrattan, 2018). We set the exit rate of corporate firms $\delta_c = 0.035$, to match that exiting firms account for approximately 3.5% of employment.[3] The last parameter we assign is the ratio ε/σ. As equation (6) shows, this ratio determines how quickly markups increase with firm size. We set $\varepsilon/\sigma = 0.15$, consistent with the estimate of Edmond et al. (2018), as well as other estimates surveyed by Klenow and Willis (2016). We summarize these parameter choices in Panel B of Table 2.

4.1.2 Calibrated Parameters

We divide the remaining parameters into two groups. The first group includes parameters that are chosen to exactly match a specific target in the data. The second group includes parameters that are jointly chosen in order to minimize the weighted distance between a number of moments in the model and in the data.

Parameters in Group 1. The parameters included in the first group are those governing the average demand elasticity σ, the maximum leverage ratio λ, the income tax schedule τ and ξ, the mean and variance of productivity of corporate firms $\bar{z}_c$ and σ_{z_c}, and the fixed cost of creating a corporate firm F. We report the parameter values in Panel C of Table 2 and the moments we target with these parameters in Panel A of Table 2.

We set $\sigma = 31.8$ to match an aggregate markup of 1.15, corresponding to the midpoint of recent estimates in the literature.[4] We set $\lambda = 1.78$ to match a size-weighted average debt

[3] https://www.census.gov/data/tables/2013/econ/susb/2013-susb-employment.html

[4] See, for example, Barkai (2017), De Loecker et al. (2018), Hall (2018).

to capital ratio for entrepreneurs of 0.35, as reported by Zetlin-Jones and Shourideh (2017) for UK firms and Crouzet and Mehrotra (2017) for US firms.

The parameters $\bar{z}_c$, σ_{z_c} and F pin down the size of the corporate sector. We associate corporate firms in the model with C-corporations in the data and use the statistics reported by Dyrda and Pugsley (2018) for 2012. We choose F to match the fact that 4.9% of all firms are corporations. The calibrated value of F implies that the total amount spent on creating new corporate firms is equal to 3.5% of GDP in steady state. We set $\bar{z}_c = 1.10$ to match that corporations account for 63% of all sales. Finally, we set $\sigma_{z_c} = 0.38$ to match the observation in Figure 1 that the largest 5% of corporate firms account for 66% of corporate sales.

We set the tax parameters τ and ξ to match the overall average federal income tax rate (23%) as well as the average income tax rate of individuals between the 99.5^{th} and 99.9^{th} percentile of the income distribution (33%). These statistics were computed by Piketty and Saez (2007) for 2004. As Panel A of Table 2 shows, we also match well the average income tax rates of other top brackets. The resulting parameter values are $\tau = 0.273$ and $\xi = 0.079$, which imply a degree of progressivity in line with the estimates of Guner et al. (2014).

Parameters in Group 2. We have a total of 5 remaining parameters that we choose by minimizing the distance between a number of moments in the model and in the data. The moments describe the prevalence of entrepreneurs in the economy, as well as the wealth and income distributions. We report the parameter values in Panel C of Table 2. These parameters are the discount factor β, the persistence and the standard deviation of the process for entrepreneurial ability ρ_z and σ_z, and the persistence and the standard deviation of the process for labor market efficiency ρ_e and σ_e.

We choose these parameters to minimize the distance between 10 moments in the model and in the data. Panel A of Table 2 reports the values of the moments we target. Specifically, we target the share of entrepreneurs, the average wealth to average income ratio, the shares of aggregate wealth and aggregate income held by entrepreneurs, the Gini coefficients of the wealth and income distributions across all households, as well as across entrepreneurs and workers in isolation.

In minimizing the distance between the moments in the model and in the data, we assign a higher weight to the fraction of entrepreneurs and the average wealth to average income ratio, so that we match them exactly. In particular, 7.1% of households are entrepreneurs and the wealth to income ratio is 6.1 in both the model and the data. The model also reproduces well the other moments we have targeted. It matches well the Gini coefficient of the wealth distribution across all households (0.81 in both the data and the model) and across workers (0.78). It also accounts reasonably well for the Gini coefficient of the income distribution across all households (0.58 vs. 0.53), across entrepreneurs (0.69 vs. 0.75), and across workers

(0.53 vs. 0.48). Even though it matches the share of income held by entrepreneurs (0.21 vs. 0.18), it understates the share of wealth they hold (0.37 vs. 0.29). The one moment the model captures less well is the wealth Gini of entrepreneurs (0.76 vs. 0.88), owing to the fact that we effectively use only three parameters to target eight moments.

Panel C of Table 2 reports the values of the calibrated parameters. The discount factor, which is primarily pinned down by the average wealth to income ratio, is $\beta = 0.953$. The process for entrepreneurial ability has persistence $\rho_z = 0.992$ and standard deviation $\sigma_z = 0.061$. The process for labor market efficiency has persistence $\rho_e = 0.979$ and standard deviation $\sigma_e = 0.203$.

Intuition for Identification. We next provide some intuition for how the various moments we have targeted pin down parameters in the second group. For a given interest rate, the discount factor determines how much individual agents save, and therefore the wealth to income ratio. For a given level of unconditional dispersion in entrepreneurial productivity, $\sigma_z^2/(1-\rho_z^2)$, the persistence parameter ρ_z determines how much wealth entrepreneurs hold: the more persistent z is, the more time the entrepreneur has available to accumulate wealth and grow out of their borrowing constraint. Matching the relatively high wealth shares of entrepreneurs in the data thus requires a lot of persistence in the process for entrepreneurial ability. In turn, the unconditional dispersion of z pins down the fraction of entrepreneurs in the economy: when z is more dispersed, the very efficient producers dominate, bidding up factor prices and making it optimal for less efficient producers to shut down. Finally, the parameters governing the efficiency with which households provide labor, ρ_e and σ_e, are pinned down by the Gini coefficients for wealth and income. Though we do not use panel information to identify these parameters, we note that our estimates are comparable to those obtained in earlier work using panel data, for example, Krueger et al. (2017).

4.2 Additional Moments Not Targeted in Calibration

We next evaluate the ability of the model to account for a number of additional features of the data not targeted in our calibration.

Wealth and Income Distribution. In our calibration we have only targeted the Gini coefficients of the wealth and income distributions. Panels A and B of Table 3 show that the model reproduces these distributions more broadly. Though the model somewhat understates the top wealth and income shares, it does a reasonably good job of reproducing the observation that the wealthiest (richest) households account for a large share share of wealth (income). For example, households in the top 1% of the wealth distribution hold 36% of wealth in the data and 31% of wealth in the model. Similarly, households in the top 1% of the income distribution earn 20% of income in the data and 17% in the model.

The model also reproduces well the wealth and income shares at the bottom of the distribution. For example, households in the bottom half of the wealth distribution hold only 1% of the wealth both in the data and in the model, while households in the bottom half of the income distribution earn 14% of income in the data and 17% in the model.

Entrepreneurs in the Wealth and Income Distribution. Panels C and D of Table 3 report the fraction of households that are entrepreneurs in different parts of the wealth and income distribution. In the model, as in the data, entrepreneurs are much more prevalent at the top. For example, 58% of the households in the top 1% of the wealth distribution are entrepreneurs in the data and 36% in the model. Only 4% of the households in the bottom half of the wealth distribution are entrepreneurs in the data and 2% in the model.

Panels E and F of Table 3 report the fraction of wealth and income held by entrepreneurs in different parts of the wealth and income distribution. In the model, as in the data, entrepreneurs account for a large fraction of wealth and income at the top. For example, they hold 62% of the wealth of the top 1% wealthiest households in the data and 70% in the model. In contrast, entrepreneurs hold a much smaller share of wealth and income at the bottom, in both the model and in the data.

Relationship Between Labor Productivity and Firm Size. Finally, we assess the model's ability to reproduce the relationship between firm size and labor productivity. In the data, a regression of log labor productivity py/Wl on log sales py gives a slope coefficient of 0.039. We estimate this coefficient using data on total sales and total wage bill for firms in approximately 15 revenue-based size classes from the Small Business Administration, as in Edmond et al. (2018).[5] In the model, an identical regression gives a slope coefficient of 0.038. Since in the model labor productivity is proportional to markups, this suggests that the model reproduces the relationship between firm size and measured markups in the data.

In summary, our model does a good job at reproducing the high degree of inequality in wealth and income in the United States, including the very low wealth and income shares of the median household, the prevalence of entrepreneurs at the top of the distribution, and the relationship between firm size and labor productivity.

[5] https://www.sba.gov/advocacy/firm-size-data

5 Cost of Markups and Credit Constraints

We next discuss the impact markups and credit constraints have in shaping the equilibrium outcomes in our model economy. We do so by first reporting the size of the wedges in the first-order optimality conditions for capital and labor of individual firms and then aggregating these firm-level wedges into their aggregate counterparts. We then study the impact of removing the markup and credit distortions on the steady state outcomes of our model.

5.1 Labor and Capital Wedges

Consider first the distortion in the firm's choice of labor. Combining the first-order condition for employment (5) and the optimal price (6) implies that the labor share of firm i is inversely proportional to its markup, m_{it}:

$$\frac{W_t l_{it}}{p_{it} y_{it}} = \frac{1-\alpha}{m_{it}}. \tag{8}$$

Aggregating across firms implies that the aggregate labor share is equal to

$$\frac{W_t L_t}{Y_t} = \frac{1-\alpha}{M_t}, \tag{9}$$

where

$$M_t = \int m_{it} \frac{l_{it}}{L_t} \mathrm{d}i \tag{10}$$

is the *aggregate markup*, an employment-weighted average of individual firm markups.[6]

Consider next the distortion in the firm's choice of capital. Let

$$\nu_{it} = \frac{R_t + \mu_{it}}{R_t} \tag{11}$$

denote the wedge in the capital first-order condition implied by the credit constraint. Combining the first-order condition for capital (4) and the optimal price (6) implies that the capital share of firm i is inversely proportional to the product of the firm's markup and the wedge induced by the collateral constraint:

$$\frac{R_t k_{it}}{p_{it} y_{it}} = \frac{\alpha}{\lambda_{it}}, \tag{12}$$

where

$$\lambda_{it} = m_{it} \nu_{it}.$$

The aggregate capital share is then

$$\frac{R_t K_t}{Y_t} = \frac{1-\alpha}{\Lambda_t}, \tag{13}$$

[6] See, for example, Edmond et al. (2018), for a derivation.

where

$$\Lambda_t = \int \lambda_{it} \frac{k_{it}}{K_t} \mathrm{d}i$$

is a capital-weighted average of the individual firm wedges.

Panel A of Table 4 summarizes the distribution of the two wedges. We report percentiles of the distribution of each wedge, weighting each producer by its employment or capital share, respectively. As the table shows, the average labor wedge is equal to 1.15, implying a drop in the labor share from $1-\alpha = 2/3$ to 0.58. The labor wedge ranges from 1.08 at the lower end of the distribution to 1.22 at the top. The capital wedge is, in contrast, larger on average (1.28) and more dispersed, ranging from 1.10 to 1.59. The last columns of the table report these statistics separately for entrepreneurs and corporations. The markup of entrepreneurs is smaller on average than that of corporations (1.12 vs. 1.17) because entrepreneurs are smaller on average. In contrast, the average capital wedge of entrepreneurs is approximately 1.5, implying that their capital-output ratio is two-thirds of its unconstrained level.

5.2 Aggregate Productivity and Misallocation

We next explain how the distribution of capital and labor wedges affects aggregate productivity in this economy. Let

$$Y_t = Z_t K_t^{\alpha} L_t^{1-\alpha} \tag{14}$$

denote the aggregate production function, where Z_t is total factor productivity. As we show in the Appendix, Z_t is related to the efficiency of individual firms according to

$$Z_t = \left[\bar{N}_t \left(\int \nu_{it}^{\alpha} \frac{q_{it}}{z_{it}} \mathrm{d}i \right)^{1-\alpha} \left(\int \nu_{it}^{\alpha-1} \frac{q_{it}}{z_{it}} \mathrm{d}i \right)^{\alpha} \right]^{-1}, \tag{15}$$

where

$$q_{it} = \left[1 - \varepsilon \log \left(m_{it} \frac{\nu_{it}^{\alpha}}{z_{it}} \Omega_t \frac{\sigma}{\sigma - 1} \right) \right]^{\frac{\sigma}{\varepsilon}}, \tag{16}$$

and $\Omega_t = Z_t \Lambda_t^{-\alpha} M_t^{-(1-\alpha)} / D_t$. The capital and labor wedges distort the allocations of output q_{it} across firms and reduce aggregate productivity.

We quantify the impact of these distortions by solving the problem of a planner that uses the same amount of capital and labor, K_t and L_t as in the decentralized allocation, but can reallocate these factors in order to maximize aggregate output. Formally, the planner's problem is to:

$$\max_{k_{it}^*, l_{it}^*} Y_t^*,$$

subject to the final goods production function:

$$\bar{N}_t \int \Upsilon \left(\frac{z_{it} k_{it}^{*\alpha} l_{it}^{*1-\alpha}}{Y_t^*} \right) \mathrm{d}i = 1,$$

and the resources constraints for capital and labor,

$$\bar{N}_t \int k_{it}^* \mathrm{d}i = K_t$$

$$\bar{N}_t \int l_{it}^* \mathrm{d}i = L_t,$$

where recall that $\bar{N}_t$ is the mass of potential varieties. The solution to this problem gives

$$Z_t^* = \left(\bar{N}_t \int \frac{q_{it}^*}{z_{it}} \mathrm{d}i \right)^{-1},$$

where

$$q_{it}^* = \left[1 - \varepsilon \log \left(\frac{\Omega_t^*}{z_{it}} \frac{\sigma}{\sigma - 1} \right) \right]^{\frac{\sigma}{\varepsilon}}$$

and Ω_t^* is a function of the multipliers on the constraints faced by the planner. Clearly, the decentralized allocations coincide with those of the planner only in the absence of markup and credit distortions, that is, if $m_{it} = 1$ and $\nu_{it} = 1$.

Panel B of Table 4 shows that the aggregate productivity losses from misallocation, $\log Z^*/Z$, are equal to 6.1% in our baseline economy. We next decompose these losses into those due to each of the two wedges. We do so by eliminating the two distortions simultaneously or in isolation, by setting $m_{it} = 1$ and/or $\nu_{it} = 1$. We then use equations (15) and (16) to calculate the implied change in aggregate productivity.

Consider first the effect of removing both distortions. This entirely eliminates the losses from misallocation, leading to a 6.1% increase in TFP and a drop in the sales share of corporate firms from 0.63 to 0.38.

Consider next the effect of removing the markup distortion only. The losses from misallocation decline little, from 6.1% to 6.0%. Removing the markup distortion reallocates market share towards corporate firms who are not subject to collateral constraints and are inefficiently large to begin with. Removing only the markup distortion makes corporate firms even larger and amplifies the distortions due to credit frictions, offsetting the gains from removing the dispersion in markups.

Finally, we consider the effect of removing the credit distortion. This reduces the TFP losses from misallocation by a substantial amount, 5.2%, and reduces the sales share of corporate firms to 0.29. Clearly, credit frictions account for the bulk of the TFP losses from misallocation in our baseline model.

5.3 Aggregate Implications

Consider next the effect of markups and credit frictions on the model's aggregate implications. We can rewrite the aggregate production function (14) as

$$Y_t = Z_t^{\frac{1}{1-\alpha}} \left(\frac{K_t}{Y_t}\right)^{\frac{\alpha}{1-\alpha}} L_t$$

and using equation (13) we can express aggregate labor productivity as a function of TFP, Z_t, and the aggregate capital wedge, Λ_t:

$$\frac{Y_t}{L_t} = Z_t^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{\Lambda_t}\frac{1}{R_t}\right)^{\frac{\alpha}{1-\alpha}}.$$

Using equation (9) we can express the equilibrium wage as a function of the aggregate labor and capital wedge,

$$W_t = \frac{1-\alpha}{M_t}\frac{Y_t}{L_t} = \frac{1-\alpha}{M_t} Z_t^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{\Lambda_t}\frac{1}{R_t}\right)^{\frac{\alpha}{1-\alpha}}.$$

These wedges therefore reduce wages through three channels: i) directly by raising the aggregate markup, M_t, ii) by reducing aggregate productivity, Z_t, iii) by reducing the capital-output ratio.

These expressions allow us to conduct a simple accounting exercise aimed at quantifying the aggregate impact of markups and credit constraints. Consider first the effect of removing both distortions, that is, setting $\Lambda_t = M_t = 1$. As Table 4 shows, this has a sizable impact, increasing the capital to output ratio by 25%, aggregate labor productivity by 22% and the wage by 36%.

The last two columns of the table decompose these effects into those due to the markup and credit frictions. Removing the markup distortions increases the capital-output ratio by 16%, labor productivity by 8% and the wage rate by 22%. Removing the credit distortions raises the capital-output ratio by 13%, labor productivity by 14% and wages by 16%.

To conclude, both markup and credit distortions have a sizable impact on aggregate outcomes in our model. We next study the effect of product market policies aimed at alleviating the consequences of markup distortions. See Itskhoki and Moll (2019) for an analysis of policies aimed at alleviating the impact of credit constraints in an economy without markups.

6 Product Market Policies

We next evaluate the macroeconomic, distributional and welfare consequences of product market interventions. The goal of these interventions is to change firms' output and thus input choices in an effort to alleviate the production inefficiencies implied by markups.

We first consider uniform sales subsidies which remove the aggregate markup distortion. Financed with higher personal income taxes, they reduce the welfare of most households, especially the poor, by reducing after-tax wages. This result stands in sharp contrast to a representative agent economy in which uniform sales subsidies nearly restore efficiency (Edmond et al., 2018).

We next evaluate a size-dependent sales subsidy that removes the dispersion in the marginal product of labor across firms, but leaves the aggregate markup unchanged. This policy is revenue-neutral, in that we finance it with a a uniform sales tax levied on all firms. We show that this policy benefits most households, especially workers, by increasing wages and aggregate productivity, despite the resulting increase in product market concentration. This policy also reduces inequality, by lowering the profits of relatively rich mid-sized entrepreneurs who lose market share to larger corporate firms. Accounting for general equilibrium effects thus overturns the conventional wisdom that more concentration hurts the poor and raises inequality. Conversely, we show that policies that reduce firm concentration by disproportionately taxing larger firms are *regressive*, in that they increase wealth and income inequality and generate welfare loses for the vast majority of agents.

We focus most of our analysis on studying size-dependent subsidies and taxes because they are relatively easy to implement and often discussed in policy debates. For completeness, we also consider two alternative policies aimed at changing the degree of concentration: a quantity cap on individual firms and a cap on the price a firm can charge. We show that both policies reduce the welfare of the median household, even though they have different implications for concentration and inequality.

6.1 Uniform Sales Subsidies

We first analyze the impact of uniform sales subsidies. Let $s_t = p_t y_t$ denote a firm's sales. We assume that firms receive a uniform sales subsidy τ_s that changes their revenue to

$$\mathcal{R}(s_t) = (1 + \tau_s)\, s_t.$$

The firm's optimal price therefore falls to

$$p_t = \frac{m_t}{1 + \tau_s} \phi_t,$$

where recall that $m_t = \frac{\sigma}{\sigma - q_t^{\varepsilon/\sigma}}$ is the firm's markup and $\frac{\phi_t}{1+\tau_s}$ is its marginal cost inclusive of the subsidy. With the subsidy in place, the aggregate labor share increases to

$$\frac{W_t L_t}{Y_t} = \frac{1 - \alpha}{M_t} \left(1 + \tau_s\right),$$

so by setting $1 + \tau_s = M_t = 1.15$ we remove the aggregate distortion generated by markups.

Subsidizing firms requires that the government collects additional revenue, so we adjust the personal income tax parameter τ_t in each period to ensure that the policy is revenue neutral, both in steady state, as well as during each period of the transition.

Macroeconomic and Distributional Implications. We begin by analyzing the implications of the subsidy for steady-state macroeconomic aggregates and product market concentration. As Panel A of Table 5 shows, concentration, markups and efficiency are largely unchanged, since the policy affects all firms equally. As Panel B shows, the subsidy increases output by 1.8%, primarily due to an increase in capital and the mass of corporate firms. The wage rate increases by 19% and the interest rate by 0.8 percentage points. Since the subsidy is financed with higher personal income taxes, the median after tax wage actually falls by 1%, while the median after-tax interest rate increases only by 0.2 percentage points.

To see why the after-tax interest rate increases while the after-tax wage falls, recall that factor prices are equal to $W = \frac{(1+\tau_s)(1-\alpha)Y}{ML}$ and $r+\delta = \frac{(1+\tau_s)\alpha Y}{MK}$. Because the subsidy increases the wage rate W and the rental rate of capital $r + \delta$ proportionally, the interest rate r must increase more than the wage rate as long as $\delta > 0$. The increase in the after-tax interest rate reduces wealth inequality, by allowing the poor to save more in the long-run. For example, the top 5% wealth share falls from 0.53 to 0.49.

Overall, the subsidy has a modest effect on macroeconomic variables, in sharp contrast to what Edmond et al. (2018) find in a representative agent economy. The key difference between the two environments is that we assume that markets are incomplete, which precludes us from using lump-sum taxes to finance firm subsidies. Since marginal income taxes increase in our economy, this effectively replaces the wedge between the marginal product of factors and their prices with another wedge between the marginal rates of substitution and prices, which distorts the labor supply and wealth accumulation of households.

Welfare. We next evaluate the welfare gains and losses from the uniform subsidy. To do so, we first calculate the transition dynamics resulting from this policy reform.

Figure 4 shows the dynamics of the key macroeconomic aggregates during the first two hundred years of the transition. Output increases by approximately 2% primarily because of an increase in the capital stock. Consumption falls and hours worked increase initially and then gradually converge to their new steady state values. Even though the wage rate jumps sharply, the median after-tax wage experiences a sharp initial drop of approximately 7%, before it converges to its new steady-state value.

We next describe how we calculate the welfare gains from this policy reform. Let

$$V_i = \mathbb{E} \sum_{t=0}^{\infty} \beta^t u(c_{it}, h_{it})$$

be the life-time value of household i in the initial steady state, and

$$\tilde{V}_i = \mathbb{E} \sum_{t=0}^{\infty} \beta^t u(\tilde{c}_{it}, \tilde{h}_{it})$$

be the value of the same household in the first period of the transition, immediately after the policy is implemented. We define the consumption-equivalent welfare change as the permanent increment in consumption Δ_i that leaves the household indifferent between the reform and the status-quo, implicitly defined as

$$\mathbb{E}\sum_{t=0}^{\infty}\beta^t u((1+\Delta_i)\,c_{it},h_{it})=\tilde{V}_i.$$

Panel D of Table 5 shows that only 29% of households gain from this policy and that the median household loses 1.4% of permanent consumption. Approximately 28% of workers benefit from the policy reform, with a median consumption-equivalent loss of 1.4%. Slightly less than half of entrepreneurs gain, with a median loss of 0.5%.

To understand who are the winners and losers from the reform, Figure 5 reports how the welfare gains vary across the wealth distribution. Households at the bottom of the wealth distribution experience a welfare loss of approximately 2%. Wages are the main source of income for these households, so they lose due to the large drop in after-tax wages during the transition. Households in the top wealth decile experience an average welfare gain of 4% because they take advantage of the higher after-tax interest rate. We also find that, conditional on wealth, one's entrepreneurial or labor market productivity are largely inconsequential for the welfare gains.

To summarize, uniform sales subsidies reduce most households' welfare, even though they lead to an increase in factor shares and output. Such policies reduce after-tax wages, which hurts the poor and increase after-tax interest rates, which benefits the rich.

6.2 Size-Dependent Sales Subsidies

We next analyze the impact of size-dependent sales subsidies aimed at removing the dispersion in the marginal product of labor. The subsidy we use is motivated by the work of Edmond et al. (2018), who show that a subsidy of the form

$$S(s_t)=\Upsilon\left(\frac{s_t}{p_t(s_t)Y_t}\right)D_tY_t-s_t \tag{17}$$

removes the markup wedge altogether by ensuring that firms produce up to a point where the marginal product of an individual variety is equal to its marginal cost. This subsidy implicitly has two components: a uniform subsidy that removes the aggregate markup distortion and a size-dependent subsidy that removes the dispersion in markups across firms. Since we would like to isolate the implications of removing each markup distortion in isolation, here we only consider a subsidy that removes the dispersion in markups, but leaves the aggregate markup wedge unchanged. The subsidy we use has the form

$$S(s_t)=\frac{1}{1+\tau_s}\left(\Upsilon\left(\frac{s_t}{p_t(s_t)Y_t}\right)-\Upsilon(0)\right)D_tY_t-s_t, \tag{18}$$

where $\tau_s > 0$ removes the uniform component of the subsidy in (17) and subtracting the term $\Upsilon(0)$ ensures that only firms that produce a positive amount receive a subsidy.[7]

This formulation implies that the marginal subsidy is proportional to the markup of the firm:

$$S'(s_t) = \frac{1}{1+\tau_s} \times \frac{\sigma}{\sigma - \left(\frac{s_t}{p_t(s_t)Y_t}\right)^{\varepsilon/\sigma}} - 1,$$

and ensures that the optimal price the firm charges is equal to a constant multiple of its marginal cost,

$$p_t = (1+\tau_s)\phi_t.$$

The policy thus removes all dispersion in the marginal product of labor, which is now equal to

$$\frac{p_t y_t}{W_t l_t} = \frac{1+\tau_s}{1-\alpha}.$$

We choose $\tau_s = 0.148$ to ensure that the subsidies on large firms are entirely paid for by taxes on small firms, so that the parameters of the personal income tax function are unchanged across steady states.[8] This choice of τ_s also implies that the aggregate labor share is unchanged. The left panel of Figure 6 illustrates how the marginal subsidy varies with firm sales. The majority of firms (99.6%) are taxed under this policy, with a small minority of very large firms benefiting from subsidies.

Concentration, Markups and Efficiency. Panel A of Table 5 illustrates the impact such a policy has on the steady state outcomes of our model. As the column labeled 'Size-dependent subsidy' shows, firm concentration increases. The number of active producers falls by 42%, primarily due to a 3 percentage points drop in the fraction of entrepreneurs. The policy disproportionately benefits the larger corporate firms and increases their sales share from 63 to 72%. The increase in the market share of the largest firms raises markups (the ratio of price to the marginal cost inclusive of the subsidy). For example, the 90^{th} percentile of markups increases from 1.22 to 1.25.

We also note that the TFP losses from misallocation increase in the new steady state, from 6.1 to 6.3%. Because the corporate sector is inefficiently large to begin with, owing to collateral constraints on entrepreneurs, the reallocation of capital and labor towards corporate firms exacerbates allocative inefficiency. Thus, even though this policy removes one source of misallocation – the dispersion of markups, it amplifies the impact of the second source of misallocation – credit frictions. As we show below, this reallocation process is gradual, since it takes a long time for entrepreneurs to dissave in response to the higher taxes they face.

[7] We found that subtracting $\Upsilon(0)$ has a negligible effect.

[8] We do allow the paramter τ_t governing the average level of taxes to vary during the transition.

Macroeconomic Implications. Consider next the implications of size-dependent subsidies for steady-state macroeconomic aggregates. As Panel B of Table 5 shows, this policy reduces consumption by 1.4% and output by 0.9%, owing to a decline in the stock of capital and hours worked. Wages are unchanged, while the interest rate increases by 0.2 percentage points. Intuitively, the crowding out of smaller, privately-owned firms discourages wealth accumulation by entrepreneurs and must be met by an increase in the interest rate.

Inequality. Consider next the implications of size-dependent subsidies for steady-state wealth and income inequality. As Panel C of Table 5 shows, inequality decreases in the new steady state. The wealth Gini falls from 0.81 to 0.79, reflecting a decline in the top 1% wealth share from 0.31 to 0.27 and in the top 5% wealth share from 0.53 to 0.49. Income inequality falls as well, but by a smaller amount. This decrease in inequality is primarily driven by a reallocation of income and wealth away from entrepreneurs and towards workers. The wealth share of entrepreneurs falls from 29% in our baseline economy to 20% in the presence of size-dependent subsidies, while their income share falls from 18 to 13%. Intuitively, most entrepreneurs operate relatively small businesses and are taxed by the policy. Since entrepreneurs account for a substantial fraction of top wealth and income shares, the resulting redistribution away from entrepreneurs reduces inequality.

Welfare. We next evaluate the welfare gains and losses from size-dependent subsidies. To do so, we first calculate the transition dynamics following this reform. Figure 7 shows that output, consumption, TFP and wages increase initially, owing to the immediate removal of the dispersion in the marginal product of labor and the resulting increase in allocative efficiency. Though these macroeconomic aggregates eventually converge to values below those in the initial steady state, due to the decline in entrepreneurs' wealth and the resulting tightening of credit constraints, these transition dynamics are long-lived: it takes approximately one hundred years for TFP and wages to fall below their initial levels.

Panel D of Table 5 shows that 96.3% of households gain from this policy. The median household experiences a permanent consumption-equivalent gain of 1.7%. All workers and approximately one-half of the entrepreneurs benefit. To understand which agents gain and lose from the reform, we next report how the welfare gains vary with entrepreneurial ability, z. To interpret the units in which we measure ability, notice in Figure 8 that the cutoff level of productivity above which households operate a private business is approximately equal to $\ln(z) = 1$. The figure shows that all agents with productivity below this cutoff, that is, workers, gain from the policy. A second group of agents, those with intermediate levels of entrepreneurial ability, lose from the reform, with some experiencing losses as large as 18%. These agents operate relatively small businesses and face an increase in sales taxes. Finally, extremely productive entrepreneurs, those who operate very large firms, benefit from the subsidies brought about by the reform, with the most productive ones experiencing a welfare gain of approximately 10%.

We also studied a policy reform in which $\tau_s = 0$, which removes both the aggregate markup wedge and the dispersion of markups. We found that most agents gain little from such a reform, with the median household experiencing a 0.1% welfare gain. Intuitively, setting $\tau_s = 0$ implicitly adds a 15% uniform subsidy to the sales-dependent policy considered above. Since the median agent experiences a 1.4% welfare loss from the uniform subsidy and a 1.7% welfare gain from the policy that removes markup dispersion, the two combined policies effectively cancel out.

To summarize, we find that size-dependent subsidies aimed at reducing the dispersion in the marginal product of labor are *progressive*, even though they increase firm profits, markups and concentration. Because of general equilibrium effects, such policies redistribute income and wealth from richer entrepreneurs towards workers and benefit most households.

6.3 Size-Dependent Sales Taxes

We next analyze the impact of size-dependent taxes aimed at reducing concentration. We consider a policy under which firms are subject to a sales tax that changes their after-tax revenue to

$$\mathcal{R}(s_t) = \frac{1+\tau_s}{\xi_s}\left[1 - \exp(-\xi_s s_t)\right],$$

where $\xi_s \geq 0$ governs the degree of tax progressivity and τ_s the average tax rate. The tax bill of the firm is equal to $s_t - \mathcal{R}(s_t)$, implying that the marginal tax is equal to

$$\tau_s(s_t) = 1 - (1+\tau_s)\exp(-\xi_s s_t)$$

and increases with firm size, more so the larger is ξ_s. We choose ξ_s so that the reform reduces the market shares of the largest 0.1% of firms in half. As before, we choose τ_s to ensure that the parameters of the personal income tax function are unchanged across steady states. The right panel of Figure 6 illustrates the shape of the function we assume and shows that only the largest 1% of firms are taxed.

Since the firm maximizes $\mathcal{R}(p_t y_t) - W_t l_t - R_t k_t$, its optimal price is given by

$$p_t = \frac{m_t}{1 - \tau_s(p_t y_t)}\phi_t,$$

where recall that $m_t = \frac{\sigma}{\sigma - q_t^{\varepsilon/\sigma}}$ is the firm's markup and ϕ_t is its marginal cost. Even though the policy reduces the markup of large firms by forcing them to contract, it does so by further amplifying the wedge between the firm's price and marginal cost, a wedge that now includes the marginal taxes faced by large producers.

Concentration, Markups and Efficiency. The steady state implications of policies that reduce concentration are largely the opposite of the size-dependent subsidy above. As the column labeled 'Size-dependent tax' of Panel A of Table 5 shows, concentration and markups now fall. The number of producers increases by 43%, reflecting an increase in the entrepreneurship rate from 7.1 to 10.4%. The corporate sales share falls from 63 to 44%, as do markups. For example, the 90^{th} percentile of markups falls from 1.22 to 1.16.

Policies that reduce concentration have a large efficiency cost. Size-dependent taxes reallocate production towards smaller producers, who are less efficient on average, and thus reduce allocative efficiency. As the table shows, the TFP losses from misallocation increase from 6.1 to 10.7%. Our framework thus parsimoniously captures the trade-off between markups and efficiency that is at the heart of competition policy.

Macroeconomic Implications. Consider next the implications of size-dependent taxes for steady-state macroeconomic aggregates. As Panel B of Table 5 shows, such policies reduce output and consumption by 4% and increase hours worked by 6%. Wages fall sharply, with the median household experiencing a decline in after-tax wages of 10%. The interest rate falls as well, by 0.5 percentage points, due to the decline in the demand for capital.

Inequality. As Panel C of Table 5 shows, inequality increases substantially in an economy with size-dependent taxes. The wealth Gini increases from 0.81 to 0.86, reflecting an increase in the top 1% wealth share from 0.31 to 0.41. Income inequality increases as well, but by a smaller amount: the top 1% income share increases from 0.17 to 0.21. This increase in inequality is primarily driven by a reallocation of income and wealth towards entrepreneurs. The wealth share of entrepreneurs increases from 29% in our baseline economy to 44%, while their income share increases from 18 to 26%. Intuitively, many entrepreneurs benefit from a reduction in concentration because of the subsidies they now receive, the lower wages induced by the policy, and the reduced competition from corporate producers.

Welfare. We finally calculate the welfare gains and losses from size-dependent taxes. Figure 9 shows that after-tax wages immediately fall by 10% due to the reduction in the demand for labor by larger firms, while output, consumption and TFP fall by 6%.

Panel D of Table 5 shows that only 1.9% of households gain from a policy that reduces concentration. The median welfare losses are sizable, 10.5%. As Figure 10 shows, agents with very low or very high entrepreneurial ability lose from the reform. The former group includes workers, who experience sharp declines in after-tax wages, while the latter includes owners of very large firms, who experience an increase in sales taxes. Mid-sized entrepreneurs benefit from this policy, since they are now subsidized and face lower factor prices.

To summarize, we find that policies aimed at reducing concentration are *regressive*. Because of general equilibrium effects, such policies redistribute income and wealth from most workers to a handful of medium-sized private business owners who take advantage of the decline in competition from the larger firms. In addition, size-dependent policies decrease allocative efficiency and welfare.

6.4 Quantity Cap

We briefly discuss two alternative product market policies aimed at changing the degree of competition and concentration in the product market. The first policy is a cap on how much a firm can sell and therefore the optimal markup it charges. We use this policy to illustrate that our conclusions are not driven by the assumption that size-dependent policies take the form of explicit sales taxes, as opposed to other restrictions on firm size.

Specifically, we impose an upper bound on firms' quantity (which equivalently implies a cap on their market share) equal to $\bar{q}$ which implicitly solves

$$\frac{\sigma}{\sigma - (\bar{q})^{\frac{\varepsilon}{\sigma}}} = 1.15.$$

That is, we choose the quantity cap to ensure that the largest firms in our economy do not charge a markup greater than 15%. Given this quantity cap, the firm's optimal price is now equal to

$$p_t = \frac{\sigma}{\sigma - q_t^{\frac{\varepsilon}{\sigma}}} \frac{\phi_t}{1 - \chi(q_t)},$$

where $\chi(q_t) \geq 0$ is the multiplier on the quantity cap and ϕ_t is the firm's marginal cost.

Clearly, this policy acts much like a size-dependent tax, in that it reduces firm markups and concentration, but amplifies the wedge between price and marginal cost for firms with a binding quantity cap. Table 6 shows that such a policy reduces steady state output by 5%, after-tax wages by 13%, and doubles the TFP losses from misallocation. The policy also increases wealth inequality, by disproportionately benefiting entrepreneurs who gain at the expense of larger corporate firms. Overall, only 1% of households benefit from such a policy, with the median welfare loss equal to 13%.

6.5 Price Cap

We finally consider a policy that caps the price a firm can charge in an attempt to limit its markup directly. Since firms that charge high markups also have low prices owing to their high productivity, an unconditional price cap would only bind for unproductive, high marginal cost firms, but have no impact on high-markup producers. We therefore allow the price cap to depend on the firm's productivity. Since productivity is notoriously difficult to measure, such a policy is more difficult to implement than a corresponding sales subsidy. Nevertheless, we illustrate the consequence such a price cap has for completeness.

Let

$$\bar{\phi}_t(z_t) = \frac{1}{z_t}\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}\left(\frac{R_t}{\alpha}\right)^{\alpha}$$

denote the marginal cost of an unconstrained producer. We consider a policy that limits a firm's price to at most a multiple $\bar{m}$ of this marginal cost, where we set $\bar{m} = 1.15$ to ensure that unconstrained firms can charge a markup of at most 15%.

Unconstrained producers' marginal cost $\bar{\phi}_t(z)$ is independent of the amount they produce. As long as $\bar{m} > 1$, they find it optimal to meet all demand at the price cap,

$$\bar{p}_t(z) = \bar{m}\bar{\phi}_t(z_t).$$

Such producers thus expand production above their privately optimal level and lose profits, so this policy resembles the size-dependent subsidy we considered earlier, in that it reduces the price faced by consumers and the wedge between price and marginal cost. The difference between the price cap and the size-dependent subsidy is that the high-markup producer itself bears the cost of increasing production.

A price cap has, however, dire consequences for credit-constrained entrepreneurs. Credit constraints manifest themselves in higher and upward-sloping marginal cost curves. Poorer entrepreneurs may therefore choose to not meet all demand at the price cap and instead reduce their quantities to the point at which their marginal cost is equal to the price cap:

$$\bar{p}_t(z) = \phi_t(y_t, a_t, z_t).$$

Table 6 shows that this price cap leads to a 9% drop in output and a 13% drop in after-tax wages in the new steady state. These declines are largely driven by a sharp increase in misallocation because of the collapse of the private business sector. Though inequality declines sharply, with the top 1% wealth share falling from 31 to 11%, mostly due to a three-fold drop in the wealth share of entrepreneurs, only 21% of the households benefit from such a policy change. The winners from this reform are mostly the wealthy workers who benefit from the increase in interest rates. Since after-tax wages increase initially before reaching their lower steady-state levels, the median household experiences fairly mild losses from this policy, approximately 0.6%. Entrepreneurs bear the brunt of these losses with the most productive ones experiencing welfare losses as large as 40%.

To conclude, a price cap can have undesired consequences in our economy. Size-dependent subsidies are therefore a more efficient and practical tool to remove the dispersion in the marginal product of labor across producers.

7 Profit Taxes

We next evaluate the implications of policies aimed at directly alleviating the distributional consequences of markups. Specifically, we impose a tax on producer profits. We consider two scenarios. In the first one we subject all firms, regardless of their size or incorporation status, to this profit tax. In the second we tax only profits above a given cutoff, and thus implicitly tax only the largest, most profitable firms. We use the receipts collected from this new tax to reduce the personal income tax rates, as determined by τ_t. This parameter is chosen period by period to ensure that the government budget constraint is satisfied both in the new steady state, as well as during the transition.

The tax we consider is a 25% tax on firm profits, large enough so that its macroeconomic and distributional implications are apparent. We have also experimented with smaller tax rates: the results we report below scale linearly with the size of the tax. Since the profit share of GDP in our economy is approximately equal to 16%, largely reflecting markups, but also the credit constraints, the additional tax revenue in the first scenario would be equal to approximately 4% of GDP in the absence of general equilibrium effects. By contrast, overall tax receipts amount to approximately 21% of GDP in our baseline economy.

The cutoff we impose in the second scenario is equal to the profits of the firm at the 99.5^{th} percentile of the sales distribution. Letting $\bar{\pi}$ denote this cutoff, the tax bill of a firm which earns profits π_{it} is equal to

$$0.25 \times \max\left(\pi_{it} - \bar{\pi}, 0\right),$$

so that only profits earned in excess of the cutoff are taxed, a policy that qualitatively mimics a proposal made by Senator Elizabeth Warren during the 2020 Presidential campaign.[9] Even though this policy affects a minority of (mostly corporate) producers, the high concentration of profits in our economy implies that approximately one-half of all profits, or 8% of GDP, are subject to a tax.

Tax on All Profits. We first evaluate the implications of taxing all profits. We start by discussing the steady-state consequences of the tax, reported in Panel A of Table 7. We note that the tax increases the number of active producers by 18%, primarily reflecting an increase in the fraction of households who run a private business from 7.1 to 8.6%. The mass of corporate producers falls considerably, by 28.1%, owing to a reduction in after-tax profits which depresses the incentives to create new firms. The drop in the number of corporate firms, as well as the resulting reallocation of production towards less efficient and credit constrained entrepreneurs, leads to a 3.6% drop in TFP. The aggregate markup does not

[9] https://medium.com/@teamwarren/im-proposing-a-big-new-idea-the-real-corporate-profits-tax-29dde7c960d

change, while inequality falls slightly, with the top 1% income share declining from 17% to 15%.

Overall, the drop in TFP and tightening of credit constraints leads to a sharp drop in demand for labor and capital, which reduces the wage rate by 6.4% and the interest rate by 0.2 percentage points. Even though the policy reduces personal income taxes, the decline in wages is so large that after-tax wages fall in the new state state, by approximately 4%.

Figure 11 reports the transition dynamics following this policy reform. Output, productivity and wages fall gradually because the mass of corporate firms is a slow-moving stock variable. The increase in tax revenue leads to a sizable initial increase of nearly 5% in the median household's after-tax wage. This increase is short-lived, however. The median after-tax wage falls below its initial value 20 years after the reform. Interest rates, in contrast, fall immediately, owing to the sharp decline in the demand for capital, and gradually return to their long-run level.

Panel B of Table 7 shows that only 29.4% of all households gain from the introduction of a profit tax. The median household experiences a welfare loss equivalent to a 0.5% permanent drop in consumption. Not surprisingly, entrepreneurs lose more, with the median entrepreneur experiencing a welfare loss of 1.4%.

Figure 12 shows how the welfare gains from the profit tax are distributed across households with different levels of entrepreneurial (left panel) and labor market (right panel) ability. Clearly, households with greater entrepreneurial ability lose the most from the higher taxes on an important source of their income, with the most productive experiencing losses in excess of 10%. Households with very low levels of labor market efficiency benefit from the reform, and experience a welfare gain of 1% of life-time consumption. Agents with a high labor market efficiency lose more than 3% of life-time consumption. Intuitively, these agents are wealthier on average, and derive much of their income from the asset market and thus stand to lose from the sharp decline in interest rates.

Tax on Profits Above Cutoff. Consider next the implications of only taxing profits in excess of the cutoff. As the last column of Table 7 shows, the qualitative implications of this policy are similar to those of a tax on all profits: the tax reduces the mass of corporate firms by 19.7% and reallocates production towards entrepreneurs, raising allocative inefficiency and reducing TFP. The drop in output, wages and interest rates is smaller now, reflecting the reduction in the base subject to the tax. For example, the wage rate falls by 2.9% now and the median after-tax wage falls by 1.8%.

Figure 13 reports the transition dynamics: all aggregate variables follow a pattern that is qualitatively similar to that resulting from a tax on all profits. The median after-tax wage increases by only 2% on impact, reflecting the smaller increase in government revenues.

Interestingly, Panel B of Table 7 shows that even fewer households benefit from this policy reform compared to the tax on all profits: the fraction of households that are better off is only 5%, with the median household experiencing a welfare loss of 0.6%. Workers thus disproportionately lose from the tax on larger firms' profits. Intuitively, as the left Panel of Figure 14 shows, the tax on large firms benefits mid-sized entrepreneurs, who can expand production due to the drop in factor prices and decreased competition from corporate firms. The policy therefore has a redistributive component, transferring resources from workers to privately-held business owners, a third of whom benefit from the reform.

To summarize, a tax on profits greatly reduces labor demand and after-tax wages, even though it lowers personal income taxes. Most workers lose from such a reform, especially if taxes are only applied to the larger, corporate firm profits. As we show below, the free entry condition is responsible for the negative welfare consequences of profit taxes. Because firm entry is highly elastic in the long-run, taxing profits is too blunt of a tool to achieve redistribution. Indeed, we found that a subsidy on profits delivers welfare gains for the majority of households, but the resulting gains are relatively small (61% of households benefit from a 25% subsidy on profits above the cutoff, with the median household gaining 0.2%), suggesting that the status quo is approximately optimal.

8 Alternative Model Variants

We showed above that policies that eliminate the dispersion in the marginal product of labor across firms benefit most households, despite the resulting rise in firm concentration. Conversely, policies that reduce firm concentration disproportionately hurt poorer workers and increase inequality, through their general equilibrium effects on wages. Finally, we demonstrated that most agents in our economy lose from a tax on profits because such a tax depresses firm entry and reduces the demand for labor.

We next study several perturbations of our model in an attempt to isolate the role of the various assumptions we have made in driving these results. We study variations of the model without a free entry condition, as well as economies without entrepreneurs and without corporate firms. We show that the welfare consequences of various product market interventions are robust across these models, even though they have different implications for inequality. We then show that the free entry condition is responsible for the welfare losses from profit taxes documented above: in its absence a tax on profits greatly benefits the median household.

We then study a simplified version of our model in which firms are subject to additional random subsidies that are negatively correlated with their productivity. Even though some firms in this economy are inefficiently large due to the subsidies they receive, a size-dependent subsidy that removes the markup dispersion generates welfare gains because it improves allocative efficiency. Finally, we show that our findings carry through to a stylized model of oligopolistic competition, which allows us discuss the impact of mergers and collusion.

8.1 No Free Entry

Here we shut down the free entry condition, by assuming that the number of corporate firms is constant. The stock market value of firms is no longer pinned down by the cost of creating new varieties, but rather responds to the policy change. The model and the parameterization are otherwise the same as in our benchmark economy.

Product Market Policies. Panel A of Table 8 reports the effect of product market interventions. A uniform subsidy benefits, as before, only a quarter of households. The welfare losses from this policy are much smaller, with the median household experiencing a 0.2% permanent consumption drop, as opposed to 1.4% in our benchmark model with free entry. The reason welfare losses are smaller now is because the personal income tax rate increases by less, implying a smaller drop in after-tax wages. The model's implications for macroeconomic aggregates, concentration and inequality are similar to those in our benchmark economy.

Policies that change the degree of product market concentration have very similar implications as in the economy with free entry. A size-dependent subsidy that removes the dispersion in markups reduces output, but increases after-tax wages, especially during the transition. This leads to sizable welfare gains for most households, with the median household experiencing a 1.8% gain. Size-dependent taxes that reduce concentration further increase misallocation and lead to large output losses and an increase in inequality. The median household experiences a welfare loss of 11.2% from a policy that halves the market share of the largest 0.1%of firms.

Profit Taxes. Panel A of Table 9 shows that a tax on all profits now leads to a 1.8% welfare gain for the median household, while a tax on profits above the cutoff leads to a 0.9% welfare gain. Output and total factor productivity fall much less now that the mass of corporate firms is constant, implying a much smaller drop in wages and an increase in the steady state median after-tax wage. The welfare implications of profit taxes are thus critically determined by the incentives to create new firms in our benchmark model.

8.2 No Entrepreneurs

We next assume that households cannot run a private business, so all firms are publicly owned. We re-calibrate the model to match the same set of relevant targets as in Panel A of

Table 2. Absent entrepreneurs, the model can no longer match the top wealth and income shares as well as our benchmark model does. For example, the share of wealth held by the richest 1% of households is now only 0.19, compared to 0.31 in our benchmark model.

Product Market Policies. As Panel B of Table 8 shows, a uniform subsidy leads to a 1.6% welfare loss for the median household, similar to that in our benchmark model. Size-dependent subsidies once again improve allocative efficiency, even in the new steady state, since publicly-owned firms are not subject to credit constraints. The median household experiences a welfare gain of 0.7%. These gains are half of those in our benchmark model because size-dependent subsidies no longer redistribute from entrepreneurs to workers. Size-dependent taxes that halve the market share of the largest firms once again have large efficiency costs, leading to welfare losses of approximately 8% for the median household.

We therefore conclude that our benchmark model's welfare implications are not driven by our assumption that a large fraction of firms in the economy is privately owned. Though this version of the model predicts that inequality does not respond to changes in product market policies, the model once again implies that policies that remove the dispersion in markups benefit most households, despite the fact that they lead to an increase in firm concentration.

Profit Taxes. Panel B of Table 9 shows that a profit tax is costly even in an environment with no privately-held businesses. The median household experiences a welfare loss of 0.8% from a 25% tax on all profits and 0.1% from a 25% tax on profits above the cutoff.

8.3 No Corporations

One concern about our benchmark model is that we assume that corporate firms are perfectly diversified, whereas in reality many corporate firms are to a large extent owned by a few individuals. In addition, in our model the households' portfolio composition is indeterminate, while in the data richer households disproportionately hold stocks.

To address these concerns, here we study an economy in which all firms are privately owned. We assume that there are no corporations, so that all business wealth is concentrated in the hands of private business owners. As earlier, we calibrate the model to match the same set of relevant targets in Panel A of Table 2. Absent a publicly-held firm sector, ownership of firms and therefore wealth is highly concentrated, with the top 1% of the households holding 50% of the economy's wealth, compared to 36% in the data.

Product Market Policies. Panel C of Table 8 shows that the welfare implications of product market interventions are very similar to those in our benchmark model. A uniform subsidy leads to a 1.8% welfare loss for the median household, a size-dependent subsidy that removes the dispersion in markups leads to a 1.6% welfare gain, while a size-dependent tax that halves the market share of the largest firms leads to a 10% welfare loss. Though these different policies have different implications for inequality compared to our benchmark model, owing to a lack of reallocation between publicly and privately-owned firms, what ultimately matters for welfare is the response of after-tax wages and interest rates and these respond in a similar way as in our benchmark model.

Profit Taxes. Panel C of Table 9 shows that a profit tax is approximately welfare-neutral for the median household in the absence of the corporate sector. Though profit taxes depress wealth accumulation by entrepreneurs, the increase in after-tax wages during the initial stages of the transition offsets the losses from the decline in after-tax wages in the long-run, so that the median household is indifferent between the profit tax and the status quo.

8.4 Random Subsidies

One concern that is often voiced in discussions about product market concentration is that size differences across firms reflect not only fundamental differences in productivity, quality or demand[10], but also other factors that lead some firms to inefficiently expand at the expense of others. For example, some firms may have better political connections and receive implicit or explicit subsidies, benefit from monopsony power or government policies that insulate them from competition. The concern is that if large firms are large precisely because of such distortions, further subsidizing them may reduce allocative efficiency even more.

We address this concern by studying a simplified static version of our model in which producers differ both in their productivity, z, as well as an input subsidy, s, financed by levying taxes on consumers. The two random variables are jointly log-normal and assumed to have a mean of zero so that some firms are taxed and others are subsidized. The firm's problem is to maximize

$$py - \frac{W}{sz}y,$$

where we implicitly assume that labor is the only factor of production, so $y = zl$. Labor is supplied by a representative consumer. This consumer derives income solely from work and has the same utility function as in our benchmark model. For simplicity, we assume that all firms are owned by a second class of agents and that the social welfare function places zero weight on the welfare of agents in this second group.

[10] Our model's implications are very similar if we assume that the size distribution of firms is accounted for by differences in the quality or demand for different varieties, as opposed to differences in productivity. Though with a Kimball aggregator quality or taste differences are not isomorphic to productivity differences, quantitatively the distinction is small when the super-elasticity of demand is low, as in our calibration.

The firm's optimal price in this economy is

$$p = \frac{\sigma}{\sigma - q^{\varepsilon/\sigma}} \frac{W}{sz}$$

and its average (and marginal) revenue product of labor is

$$\frac{py}{Wl} = \frac{m}{s}.$$

The model thus features two sources of dispersion in the marginal product of labor: markups and subsidies.

To calibrate the parameters of this model, we note first that if firm productivity and the subsidy were uncorrelated, larger producers would have a lower average product of labor since the subsidy makes it optimal for a firm to hire too much labor. A salient feature of the data, however, is that the average product of labor is positively correlated with firm size. Recall that a regression of log labor productivity on log sales in the data yields a coefficient of 0.039, which our benchmark model reproduces well. Matching this elasticity in the presence of random subsidies requires that subsidies are negatively correlated with firm productivity, so that more productive and therefore larger firms are taxed more on average and have a higher average product of labor.

We illustrate the role played by random subsidies using the following numerical example. We first study an economy without random subsidies in which we set the dispersion of productivity across firms to match a 66% sales share of the largest 5% of firms, the demand elasticity σ to match an aggregate markup of 15%, and a super-elasticity of demand $\varepsilon/\sigma = 0.25$ to match an elasticity of the average product of labor to sales of 0.039. We then introduce random subsidies. We choose the variance of the log-normal distribution of these subsidies to generate a TFP loss from misallocation of 25%, and set the correlation of productivity and the subsidy to reproduce the 0.039 elasticity of labor productivity to firm sales, leaving all other parameters unchanged.

Table 10 reports the results of these experiments. Panel A contrasts the outcomes in the baseline model without random subsidies with the allocations chosen by a planner who only places weight on the utility of consumers and does not value the welfare of the owners of firms. Under the planner's allocations consumption increases by 11% and the welfare of the consumer increases by 17%, reflecting redistribution from the owners of the firms to consumers and the removal of the production distortions induced by markups. We next introduce the size-dependent subsidy in (18), choosing τ_s to ensure that the policy is revenue-neutral. This policy leads to a 2% welfare gain for the consumer, owing to the 1.2% increase in TFP that results from the equalization of the marginal product of labor and an increase in the market share of the largest 5% firms from 0.66 to 0.81.

Panel B of Table 10 reports results for the economy with random subsidies. The welfare gains from implementing the efficient allocations are now substantially larger, 50%, reflecting the severe misallocation of factors of production caused by the random subsidies. Nevertheless, the size-dependent subsidy has similar implications as in Panel A. Removing the dispersion in the marginal product of labor caused by markup heterogeneity leads to a 1.3% increase in TFP and 2.2% welfare gain for the consumer. Of course, since markup dispersion is a small source of variation in the marginal product of labor across firms in this environment, these gains are nowhere near as large as those from removing the random subsidies. Nevertheless, a size-dependent subsidy does benefit consumers, by removing the variation in the marginal product of labor that covaries systematically with firm size. Once again, size-dependent subsidies benefit consumers despite increased concentration.

This experiment makes it clear that concentration is not costly in and of itself. Rather, what is costly is dispersion in the marginal product of labor across producers. If the marginal product of labor increases with firm size, as in the data, a policy that subsidizes larger firms and reduces this source of variation benefits the consumer, despite the increase in product market concentration it induces.

8.5 Oligopolistic Competition

We next argue that our results are robust to assuming oligopolistic competition among a small numbers of intermediate goods producers. We study a stylized static economy as in Section 8.4, but now assume that there is a continuum of identical sectors, each populated by three firms that differ in their productivity. The elasticity of substitution across sectors, ϑ, is relatively low, while the elasticity of substitution between firms in a given sector, ρ, is relatively high. This implies that firms that are larger in their own sector face a lower demand elasticity because they mostly compete with firms in other sectors.

As is well known, with Bertrand competition, the optimal markup of a firm in such a setting is given by $\varepsilon/(\varepsilon-1)$, where the demand elasticity is given by

$$\varepsilon = \rho\,(1-\omega) + \vartheta\omega,$$

and ω is the firm's market share in its sector.[11]

We set $\vartheta = 3$ which implies that a monopoly supplier in a given sector would charge a 50% markup and $\rho = 13.8$, which implies a 15% aggregate markup. We assume that productivity is equally spaced on the grid $\{z_1, z_2, z_3\}$, and set the gap $\log z_i/z_{i-1}$ equal to 0.14 to ensure that the largest firm has a 0.67 market share in its sector.

Panel A of Table 11 shows that under the planner's allocations consumption increases by 10% and the welfare of the consumer increases by 16%. This reflects redistribution from

[11] See Atkeson and Burstein (2008).

the owners of the firms to consumers and the removal of the production distortions induced by markups. Once again, the planner chooses allocations that imply a greater degree of product market concentration: it increases the largest firms' market share from 0.67 to 0.83 and reduces the smallest firms' market share from 0.06 to 0.03. This allows the planner to increase TFP by 0.7%.

We next introduce subsidies on the larger producers, financed by taxes on the smaller producers, a policy that is once again revenue-neutral. This policy leads to a 4.1% welfare gain for the consumer. The welfare gain is high here because the policy reduces firm profits by increasing wages, effectively redistributing income towards consumers. If instead we finance the subsidy on larger firms with an 18% income tax levied on consumers to ensure that firm profits remain unchanged, the resulting welfare gains are still positive, and equal to 0.7%, the amount by which TFP increases. Thus, regardless of how the subsidies on large producers are financed, the representative consumer is better off from a policy that increases the market share of the larger firms which are more productive on the margin.

8.6 Mergers

One important concern about the rise in concentration is that it reflects horizontal mergers among firms that would otherwise compete in the product market. Here we illustrate the impact of mergers using the stylized model of oligopolistic competition above. We assume that the two most productive firms in a given sector merge (or equivalently collude) and set prices that maximize the joint entity's profits. The joint entity now sets a common markup that depends on combined market share of the firms that merge.[12]

As Panel B of Table 11 shows, the merger generates large welfare losses. The consumer loses 17% of consumption and experiences a welfare loss of 27% relative to the planners' allocations. These losses reflect a further increase in the income share of firm owners and more severe production distortions. To see these distortions, notice that the aggregate markup increases from 1.15 to 1.24 in the presence of mergers, while the TFP losses from misallocation double, from 0.7% to 1.4%.

Once again, however, a key source of inefficiency is that the joint entity produces too little relative to what the planner would choose: its market share is equal to 0.84 compared to 0.97 under the efficient allocations. The last column of Panel B of Table 11 evaluates the impact of size-dependent subsidies in this economy with mergers. The subsidies increase TFP and the consumers' welfare, by bringing the market shares of all firms closer to the efficient ones. Since the economy with mergers is even more distorted, the subsidies benefit the consumer even more than they do in the absence of mergers.

[12] See, for example, Brooks et al. (2016).

As this stylized example makes it clear, though size-dependent subsidies benefit consumers by increasing allocative efficiency, they do not come close to eliminating the efficiency and distributional losses from the higher markups induced by mergers. This suggests an important role for policy in preventing such outcomes. The key question is whether the efficiency gains from a given merger outweigh the losses from higher markups. In the example above, we assumed no efficiency gains from mergers. However, in the presence of increasing returns to scale, say due to fixed overhead costs of operating a firm, a merger may benefit consumers if the resulting efficiency gains outweigh the loss from markups. Since the costs and benefits of individual mergers vary greatly across industries depending on the nature of technology and competition, antitrust authorities have an important role in evaluating the impact of individual mergers on a case by case basis.

9 Conclusions

We study the implications of product market interventions using a model of firm dynamics and incomplete markets in which markups are endogenously determined by the amount of competition firms face. We calibrate the model to match salient facts about wealth and income inequality, entrepreneurial activity, firm concentration and markups in the United States. We show that most households benefit from size-dependent subsidies that remove the distortion due to markup dispersion. Even though such a policy leads to higher markups and concentration, it reduces inequality by benefiting workers at the expense of the relatively rich entrepreneurs. In contrast, policies that reduce firm concentration lead to large output and TFP losses and increase inequality. A tax on profits greatly depresses the incentives to create new firms, reducing labor demand, after-tax wages and the welfare of the median household.

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Table 1: Entrepreneurs in the Wealth and Income Distribution

	Wealth distribution		Income distribution	
	Fraction of entrepreneurs	Share held by entrepreneurs	Fraction of entrepreneurs	Share held by entrepreneurs
All	0.07	0.37	0.07	0.21
Top 1%	0.58	0.62	0.46	0.55
Top 5%	0.40	0.52	0.34	0.46
Top 10%	0.29	0.46	0.23	0.38
Bottom 50%	0.02	0.03	0.04	0.04

Notes: The numbers in the table are based on the 2013 SCF survey. Entrepreneurs are defined as self-employed business owners who are actively engaged in managing the business.

Table 2: Parameterization

A. Moments Used in Calibration

Moments Group 1	Data	Model	Moments Group 2	Data	Model
Aggregate markup	1.15	1.15	Percentage entrepreneurs	7.1	7.1
Average debt to capital ratio	0.35	0.35	Wealth to income ratio	6.1	6.1
Percentage of corporate firms	4.9	4.9	Wealth share of entrepreneurs	0.37	0.29
Sales share of corporate firms	0.63	0.63	Income share of entrepreneurs	0.21	0.18
Top 5% sales concentration, corp.	0.66	0.66	Gini wealth, all hhs	0.81	0.81
Average income tax rate	0.23	0.23	Gini income, all hhs	0.58	0.53
Average income tax rate p95-99	0.27	0.27	Gini wealth, entrepr.	0.76	0.88
Average income tax rate p99-99.5	0.30	0.31	Gini income, entrepr.	0.69	0.75
Average income tax rate p99.5-99.9	0.33	0.33	Gini wealth, workers	0.78	0.78
			Gini income, workers	0.53	0.48

B. Assigned Parameter Values

θ	2	CRRA
γ	1	inverse Frisch elasticity
α	1/3	capital elasticity
δ	0.06	depreciation rate
ε/σ	0.15	super-elasticity
τ_c	0.40	dividends tax schedule
δ_c	0.035	exit rate, corporations

C. Calibrated Parameter Values

Group 1			Group 2		
σ	31.78	demand elasticity	β	0.953	discount factor
λ	1.783	leverage constraint	ρ_z	0.992	AR(1) z
F	0.035	entry cost, corp., rel. Y	σ_z	0.061	std. dev. z shocks
$\bar{z}_c$	1.101	average $\log z$ corp. firms	ρ_e	0.979	AR(1) e
σ_{z_c}	0.379	std. dev. $\log z$ corp. firms	σ_e	0.203	std. dev. e shocks
τ	0.273	income tax schedule			
ξ	0.079	income tax schedule			

Table 3: Non-targeted Moments

	Data	Model		Data	Model
A. Wealth Distribution			**B. Income Distribution**		
Share top 1%	0.36	0.31	Share top 1%	0.20	0.17
Share top 2%	0.47	0.39	Share top 2%	0.26	0.22
Share top 5%	0.63	0.53	Share top 5%	0.36	0.32
Share top 10%	0.75	0.68	Share top 10%	0.47	0.43
Share bottom 75%	0.09	0.11	Share bottom 75%	0.33	0.36
Share bottom 50%	0.01	0.01	Share bottom 50%	0.14	0.17
Share bottom 25%	0.00	0.00	Share bottom 25%	0.04	0.06
C. Fraction Entrep in Wealth Distribution			**D. Fraction Entrep in Income Distribution**		
Top 1%	0.58	0.36	Top 1%	0.46	0.30
Top 2%	0.51	0.25	Top 2%	0.45	0.21
Top 5%	0.40	0.17	Top 5%	0.34	0.15
Top 10%	0.29	0.13	Top 10%	0.23	0.12
Bottom 75%	0.03	0.06	Bottom 75%	0.05	0.06
Bottom 50%	0.02	0.04	Bottom 50%	0.04	0.06
Bottom 25%	0.02	0.01	Bottom 25%	0.03	0.05
E. Wealth by Entrep in Wealth Distribution			**F. Income by Entrep in Income Distribution**		
Share in top 1%	0.62	0.70	Share in top 1%	0.55	0.67
Share in top 2%	0.58	0.59	Share in top 2%	0.53	0.54
Share in top 5%	0.52	0.46	Share in top 5%	0.46	0.41
Share in top 10%	0.46	0.38	Share in top 10%	0.38	0.32
Share in bottom 75%	0.06	0.09	Share in bottom 75%	0.06	0.07
Share in bottom 50%	0.03	0.09	Share in bottom 50%	0.04	0.06
Share in bottom 25%	0.03	0.06	Share in bottom 25%	0.03	0.05

Notes: The data moments are calculated from the 2013 SCF survey. In the data, entrepreneurs are defined as self-employed business owners who are actively engaged in managing the business.

Table 4: Effect of Markups and Borrowing Constraints

A. Distribution of Labor and Capital Wedges

	All firms		Entrepreneurs		Corporations
	Labor wedge	Capital wedge	Labor wedge	Capital wedge	Both wedges
Average	1.15	1.28	1.12	1.54	1.17
p10	1.08	1.10	1.06	1.09	1.11
p25	1.11	1.13	1.09	1.14	1.13
p50	1.15	1.17	1.12	1.34	1.16
p75	1.18	1.23	1.15	1.75	1.20
p90	1.22	1.59	1.18	2.26	1.23

B. Macroeconomic Implications

	Baseline	No distortions	No markup distortions	No credit distortions
Losses from misallocation, ×100	6.1	0	6.0	0.9
Aggregate labor wedge, M	1.15	1	1	1.13
Aggregate capital wedge, Λ	1.28	1	1.09	1.13
Labor share, WL/Y	0.58	0.67	0.67	0.59
Sales share of corporate firms	0.63	0.38	0.70	0.29
$\Delta \log TFP$, ×100		6.1	0.1	5.2
$\Delta \log K/Y$, ×100		24.8	16.3	12.9
$\Delta \log Y/L$, ×100		21.5	8.2	14.2
$\Delta \log W$, ×100		35.5	22.2	16.3

Table 5: Effect of Product Market Policies

	Baseline	Uniform	Size-dependent subsidy	Size-dependent tax
A. Steady-State Concentration, Markups and Efficiency				
sales share top 0.01%	0.08	0.08	0.08	0.02
sales share top 0.1%	0.30	0.31	0.31	0.15
sales share top 1%	0.74	0.75	0.75	0.59
number active producers	1	1.01	0.58	1.43
percentage entrepreneurs	7.1	7.2	4.0	10.4
corporate sales share	0.63	0.67	0.72	0.44
10 pct markup	1.08	1.08	1.10	1.07
50 pct markup	1.15	1.15	1.17	1.12
90 pct markup	1.22	1.22	1.25	1.16
tfp loss misallocation, %	6.1	6.2	6.3	10.7
B. Macroeconomic Implications				
Δ output, %	–	1.8	-0.9	-3.6
Δ consumption, %	–	0.3	-1.4	-3.9
Δ hours, %	–	-1.9	-0.9	5.7
Δ capital, %	–	7.4	-1.0	-4.5
Δ mass corp. firms, %	–	8.7	2.1	-14.2
Δ tfp, %	–	0.3	-0.1	-5.3
labor share	0.58	0.67	0.58	0.56
capital share	0.26	0.30	0.27	0.24
Δ wage, %	–	18.6	0	-10.8
Δ median after-tax wage, %	–	-1.0	0	-10.3
interest rate, %	2.0	2.8	2.2	1.5
median after-tax interest rate, %	1.6	1.8	1.7	1.1

Notes: output, consumption, hours, capital, wage rate and mass of corporate producers are all reported as % deviations across steady states.

Table 5: Effect of Product Market Policies

	Baseline	Uniform	Size-dependent subsidy	Size-dependent tax
		C. Steady-State Inequality		
Gini wealth	0.81	0.79	0.79	0.86
top 1% wealth share	0.31	0.28	0.27	0.41
top 5% wealth share	0.53	0.49	0.49	0.63
Gini income	0.53	0.53	0.52	0.55
top 1% income share	0.17	0.16	0.15	0.21
top 5% income share	0.32	0.31	0.30	0.35
wealth share entrepreneurs	0.29	0.26	0.20	0.44
income share entrepreneurs	0.18	0.17	0.13	0.26
average tax, bot 25%	0.09	0.24	0.09	0.09
average tax, bot 50%	0.13	0.27	0.13	0.12
average tax, top 5%	0.34	0.45	0.33	0.35
average tax, top 1%	0.40	0.49	0.39	0.40
		D. Welfare Gains, Consumption Equivalent		
social welfare gains, %		-1.3	1.7	-10.0
all households				
percent better off		28.9	96.3	1.9
p10 gains, %		-2.3	1.4	-10.9
p25 gains, %		-2.0	1.6	-10.7
p50 gains, %		-1.4	1.7	-10.5
p75 gains, %		0.3	1.7	-10.0
p90 gains, %		2.4	2.0	-9.2
workers				
percent better off		27.9	100	0
p50 gains, %		-1.4	1.7	-10.6
entrepreneurs				
percent better off		42.5	48.1	26.8
p50 gains, %		-0.5	-0.1	-6.0

Table 6: Alternative Product Market Policies

	Baseline	Quantity Cap	Price Cap
Δ output, %	–	-5.3	-8.9
Δ median after-tax wage, %	–	-13.4	-12.9
Δ median after-tax i-rate, pp.	–	-0.3	0.5
aggregate markup	1.15	1.12	1.17
TFP loss misallocation, %	6.1	12.5	12.1
top 0.1% firm share, %	30.3	9.3	47.4
top 1% wealth share	0.31	0.39	0.11
wealth share entrepreneurs	0.29	0.41	0.12
percent better off	–	1.1	20.6
median welfare gains, %	–	-13.0	-0.6

Table 7: Effect of Profit Taxes

	Baseline	25% tax all profits	25% tax above cutoff
A. Steady-State Implications			
number active producers	1	1.18	1.17
percentage entrepreneurs	7.1	8.6	8.5
corporate sales share	0.63	0.60	0.59
top 1% wealth share	0.31	0.30	0.33
top 1% income share	0.17	0.15	0.17
aggregate markup	1.15	1.15	1.15
tfp loss misallocation, %	6.1	8.1	6.9
Δ output, %	–	-4.6	-1.8
Δ mass corp. firms, %	–	-28.1	-19.7
Δ tfp, %	–	-3.6	-2.0
Δ wage, %	–	-6.4	-2.9
Δ median after-tax wage, %	–	-4.0	-1.8
interest rate, %	2.0	1.8	1.8
median after-tax interest rate, %	1.6	1.5	1.4
B. Welfare Gains, Consumption Equivalent			
all households			
percent better off		29.4	5.0
p25 gains, %		-1.6	-1.3
p50 gains, %		-0.5	-0.6
p75 gains, %		0.0	-0.2
workers			
percent better off		31.1	2.6
p50 gains, %		-0.5	-0.6
entrepreneurs			
percent better off		7.6	36.4
p50 gains, %		-1.4	-0.2

Table 8: Effect of Product Market Policies. Alternative Model Variants

	Baseline	Uniform	Size-dependent subsidy	Size-dependent tax
A. No Free Entry				
Δ output, %	–	2.1	-0.7	-3.3
Δ median after-tax wage, %	–	-0.3	0.4	-10.1
Δ median after-tax i-rate, pp.	–	0.1	0.1	-0.3
aggregate markup	1.15	1.15	1.17	1.12
misallocation, %	6.1	6.6	6.4	10.4
top 0.1% firm share, %	30.3	30.7	30.7	15.1
top 1% wealth share	0.31	0.30	0.28	0.38
wealth share entrepreneurs	0.29	0.26	0.20	0.41
percent better off	–	25.0	96.2	2.0
median welfare gains	–	-0.2	1.8	-11.2
B. No Entrepreneurs				
Δ output, %	–	2.4	0	-4.1
Δ median after-tax wage, %	–	-3.4	0.6	-6.7
Δ median after-tax i-rate, pp.	–	0.2	0.0	0.1
aggregate markup	1.15	1.15	1.17	1.12
misallocation, %	0.5	0.5	0	5.1
top 1% firm share, %	31.5	31.9	35.7	15.7
top 1% wealth share	0.19	0.18	0.19	0.19
percent better off	–	28.3	87.9	0
median welfare gains	–	-1.6	0.7	-7.6
C. No Corporate Firms				
Δ output, %	–	0.5	-1.5	-3.2
Δ median after-tax wage, %	–	-1.8	-0.6	-10.9
Δ median after-tax i-rate, pp.	–	0.1	0.0	0.2
aggregate markup	1.15	1.15	1.17	1.12
misallocation, %	16.9	18.0	17.0	21.2
top 0.1% firm share, %	30.5	32.5	34.8	15.2
top 1% wealth share	0.50	0.49	0.51	0.45
wealth share entrepreneurs	0.43	0.44	0.41	0.43
percent better off	–	16.7	81.2	3.5
median welfare gains	–	-1.8	1.6	-10.0

Table 9: Effect of Profit Taxes. Alternative Model Variants

	25% tax all profits	25% tax above cutoff
A. No Free Entry		
Δ output, %	-1.4	0
Δ tfp, %	-1.0	-0.2
Δ mass corp. firms, %	0	0
Δ median after-tax wage, %	1.1	1.3
Δ median after-tax i-rate, pp.	0	0
percent better off	71.8	70.0
median welfare gains	1.8	0.9
B. No Entrepreneurs		
Δ output, %	-2.4	-0.3
Δ tfp, %	-3.5	-0.4
Δ mass corp. firms, %	-22.3	-3.0
Δ median after-tax wage, %	-1.1	-0.1
Δ median after-tax i-rate, pp.	-0.1	0
percent better off	9.2	19.5
median welfare gains	-0.8	-0.1
C. No Corporate Firms		
Δ output, %	-8.3	-3.5
Δ tfp, %	-1.3	-0.2
Δ median after-tax wage, %	-9.1	-3.7
Δ median after-tax i-rate, pp.	0.5	0.2
percent better off	50.1	51.6
median welfare gains	0.0	0.2

Table 10: Economy with Random Subsidies

	Baseline	Planner	Size-dependent subsidy
A. Without Random Subsidies			
Δ output, %	–	-4.8	0.5
Δ tfp, %	–	1.2	1.2
aggregate markup	1.15	–	1.18
Δ consumption, %	–	10.7	1.3
Δ hours, %	–	-4.9	-0.7
sales share largest 5%	0.66	0.81	0.81
welfare gains, %	–	16.9	2.0
B. With Random Subsidies			
Δ output, %	–	11.8	0.5
Δ tfp, %	–	26.9	1.3
aggregate markup	1.15	–	1.19
Δ consumption, %	–	28.7	1.5
Δ hours, %	–	-11.8	-0.7
sales share largest 5%	0.66	0.87	0.81
welfare gains, %	–	50.2	2.2

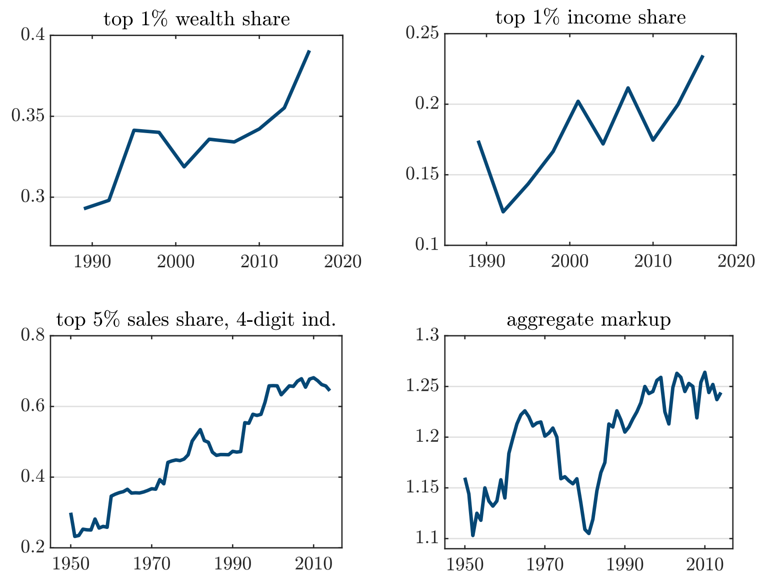
Notes: output, tfp, consumption, hours and welfare gains are expressed relative to the baseline economy (without random subsidies in Panel A and with random subsidies in Panel B).

Table 11: Economy with Oligopolistic Competition

	Baseline	Planner	Size-dependent subsidy
	A. Without Mergers		
Δ output, %	–	-4.1	-0.7
Δ tfp, %	–	0.7	0.7
aggregate markup	1.15	–	1.22
Δ consumption, %	–	10.3	2.7
Δ hours, %	–	-4.8	-1.3
sales share firm 1	0.06	0.03	0.02
sales share firm 2	0.27	0.14	0.12
sales share firm 3	0.67	0.83	0.86
welfare gains, %	–	16.3	4.1
	B. With Mergers		
Δ output, %	–	-6.0	-1.0
Δ tfp, %	–	1.4	1.4
aggregate markup	1.24	–	1.42
Δ consumption, %	–	16.5	5.0
Δ hours, %	–	-7.3	-2.4
sales share firm 1	0.16	0.03	0.03
sales share firm 2 & 3	0.84	0.97	0.97
welfare gains, %	–	26.9	7.7

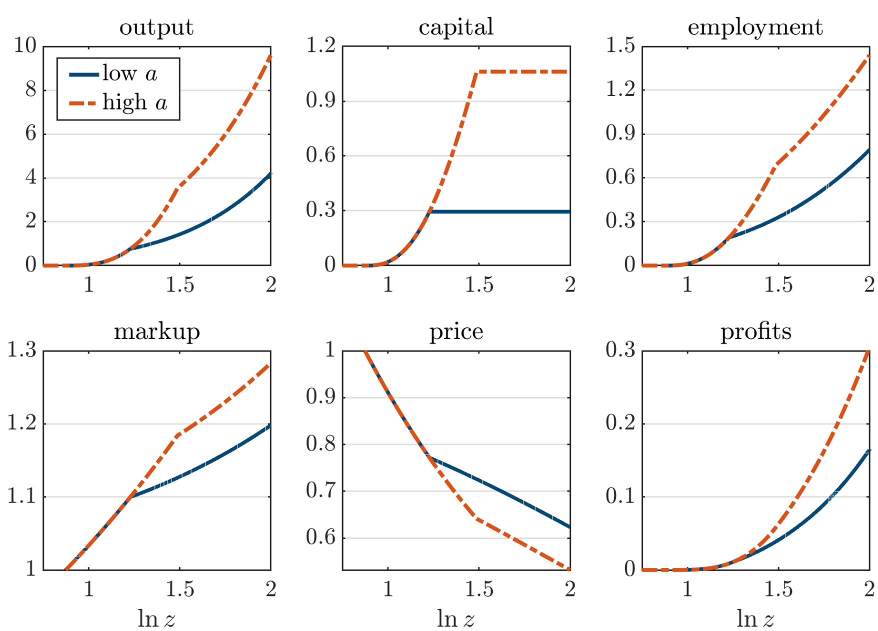
Notes: output, tfp, consumption, hours and welfare gains are expressed relative to the baseline economy (without mergers in Panel A and with mergers in Panel B).

Figure 1: Trends in U.S. Data



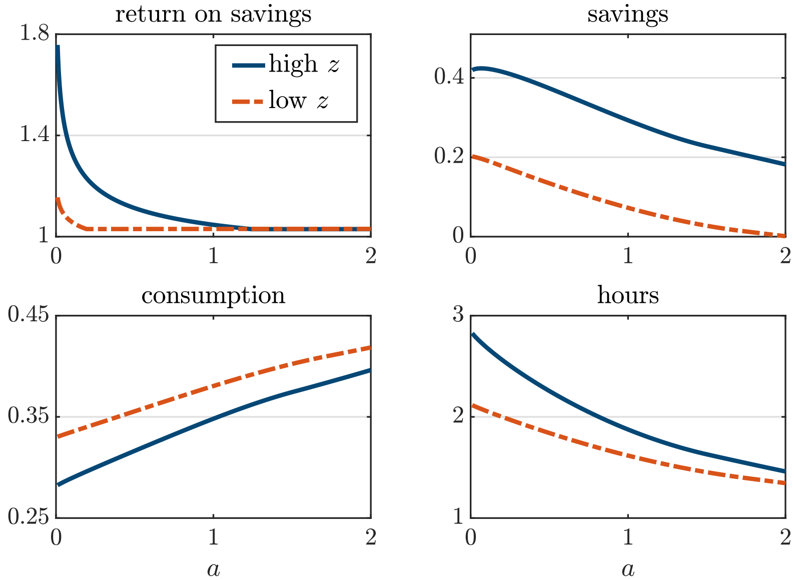
Notes: The upper-left panel shows the wealth share held by the wealthiest 1% of households in the SCF. The upper-right panel shows the income share of the top 1% earners in the SCF. The lower-left panel plots the average sales share of the top 5% largest firms in each 4-digit industry in Compustat. The lower-right panel depicts the cost-weighted average of firm markups in Compustat from Edmond et al. (2018).

Figure 2: Decision Rules: Production



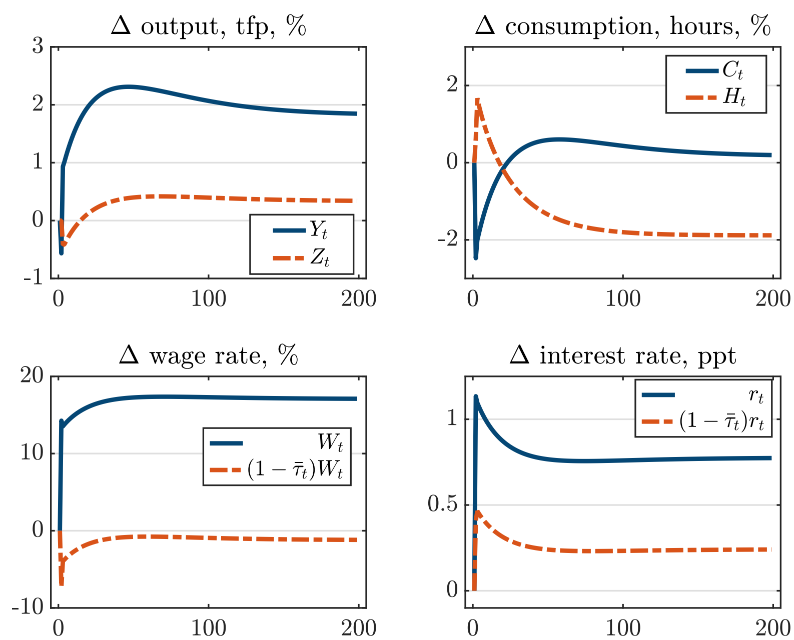
Notes: The solid blue lines show the decision rules of a low a agent against productivity. The dashed red lines show the decision rules of a high a agent.

Figure 3: Decision Rules: Savings and Hours



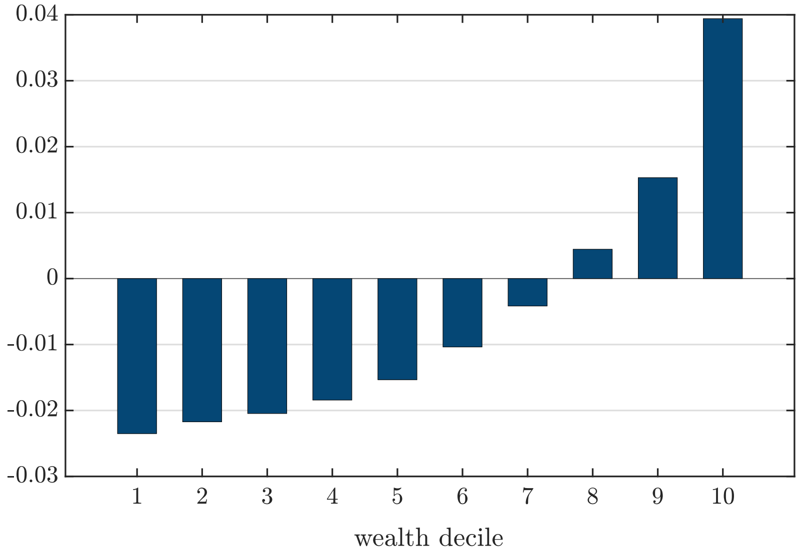
Notes: The solid (dashed) lines show the decision rules of a high (low) z agent against wealth.

Figure 4: Transition Dynamics: Uniform Subsidy



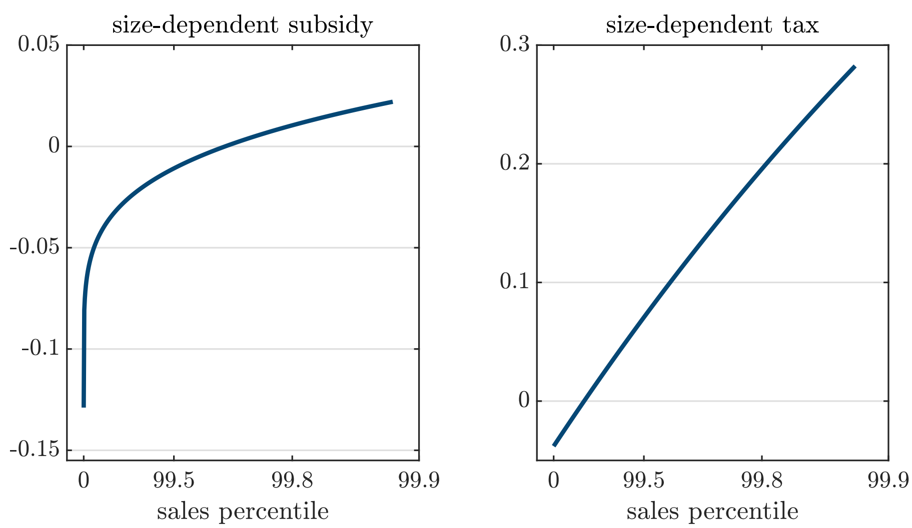
Notes: The figure shows the transition dynamics after the introduction of a 15% sales subsidy. With the exception of interest rates, all graphs report % deviations from the initial steady state. The x-axis shows years after the policy reform.

Figure 5: Welfare Gains from Uniform Subsidy



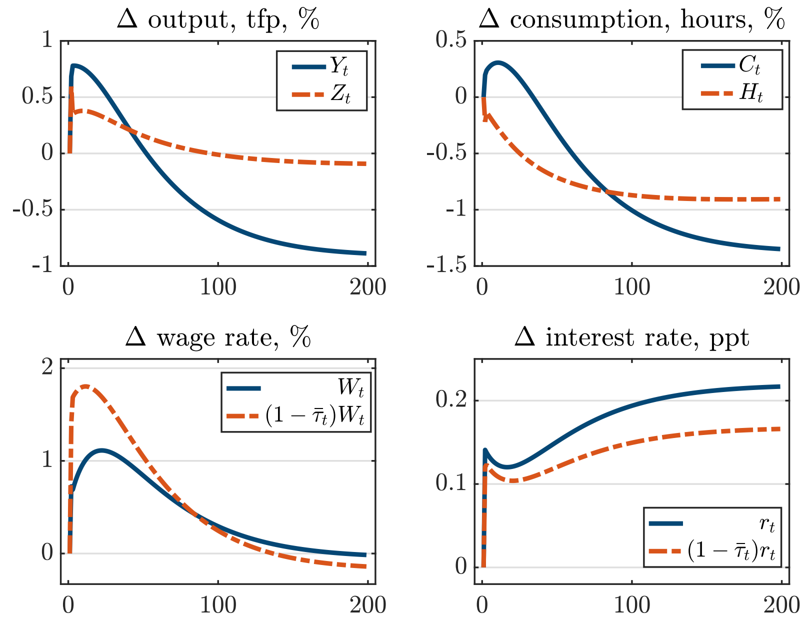
Notes: The figure reports the mean consumption-equivalent welfare gains by wealth decile.

Figure 6: Size-Dependent Policies



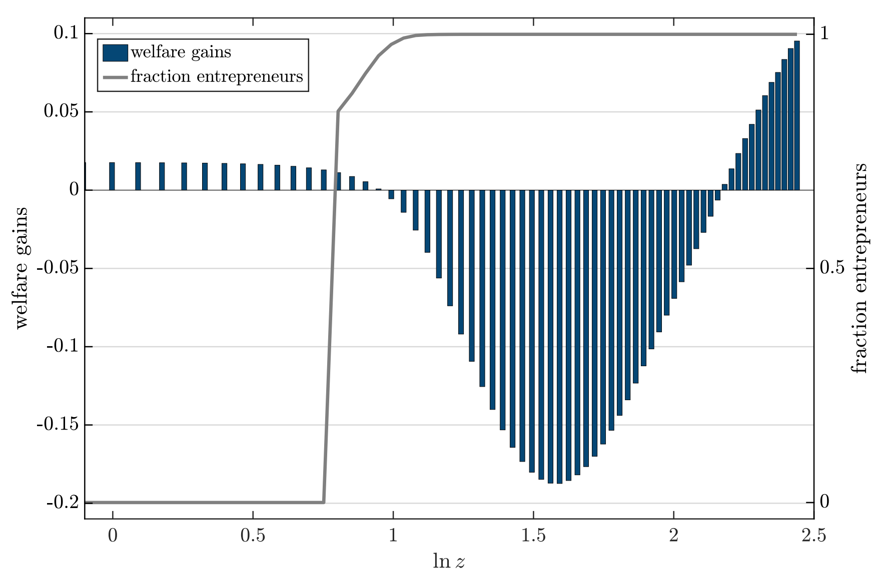
Notes: The left panel shows the marginal subsidy used in the experiment with size-dependent subsidies. The right panel shows the marginal tax used in the experiment with size-dependent taxes.

Figure 7: Transition Dynamics: Size-Dependent Subsidy



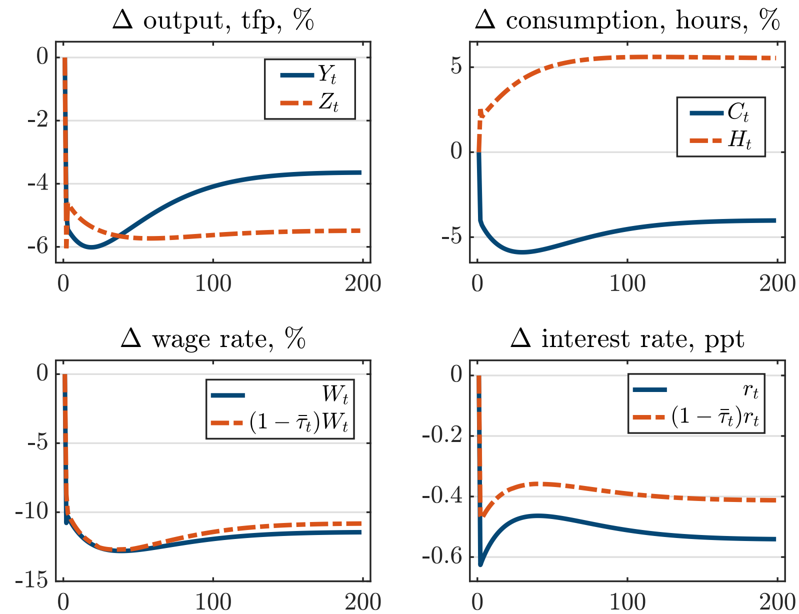
Notes: The figure shows the transition dynamics after the introduction of a size-dependent subsidy. With the exception of interest rates, all graphs report % deviations from the initial steady state. $\bar{\tau}_t$ is the median marginal personal income tax rate. The x-axis shows years after the policy reform.

Figure 8: Welfare Gains from Size-Dependent Subsidy



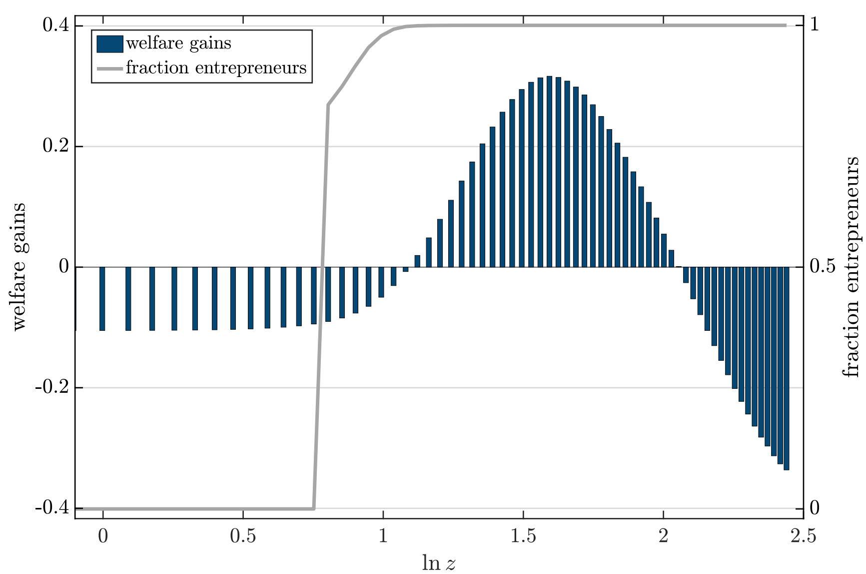
Notes: The figure reports the mean consumption-equivalent welfare gains as a function of z.

Figure 9: Transition Dynamics: Size-Dependent Tax



Notes: The figure shows the transition dynamics after the introduction of a size-dependent tax that halves the top 0.1% firms' market share. With the exception of interest rates, all graphs report % deviations from the initial steady state. $\bar{\tau}_t$ is the median marginal personal income tax rate. The x-axis shows years after the policy reform.

Figure 10: Welfare Gains from Size-Dependent Tax



Notes: The figure reports the mean consumption-equivalent welfare gains as a function of z.

Figure 11: Transition Dynamics: 25% Tax on All Profits

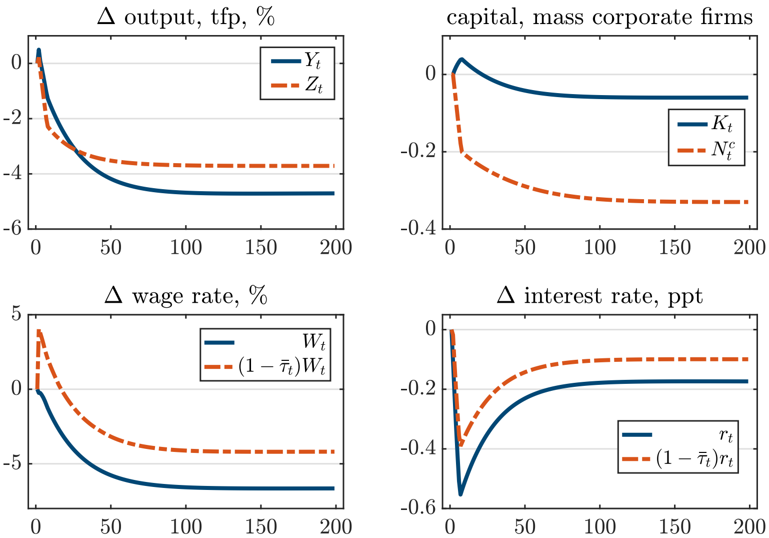


Figure 12: Welfare Gains: 25% Tax on All Profits

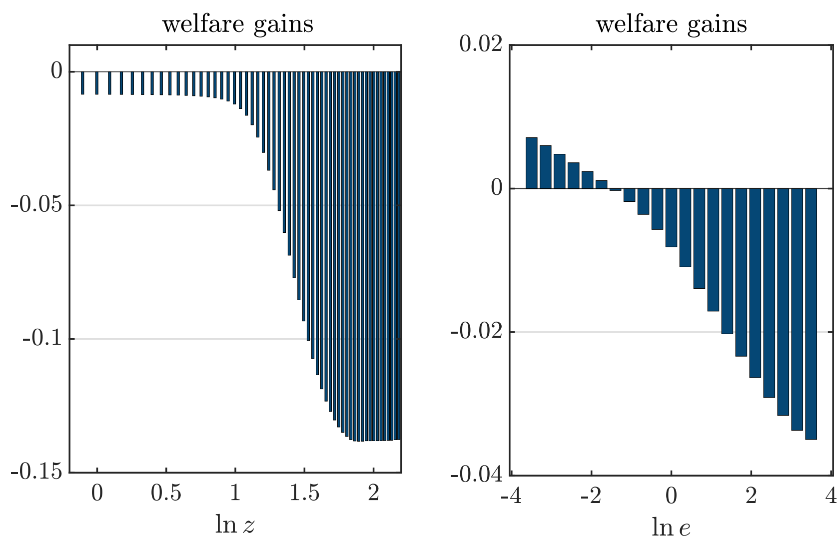


Figure 13: Transition Dynamics: 25% Tax on Profits Above Cutoff

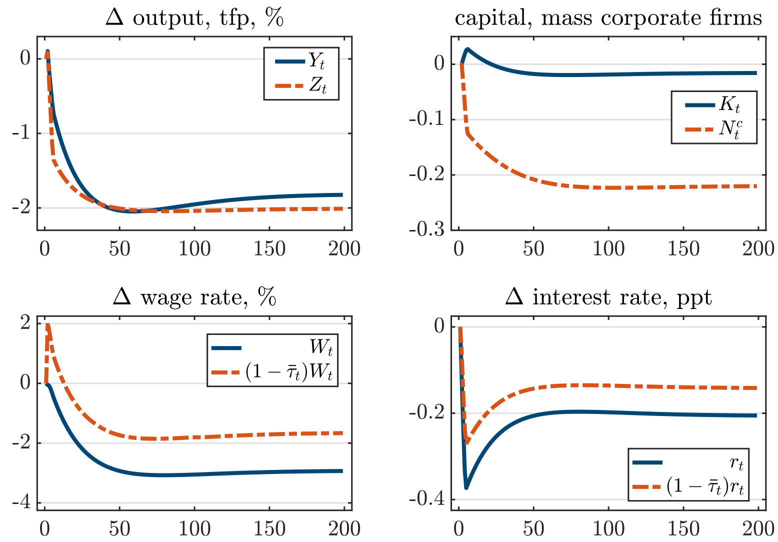
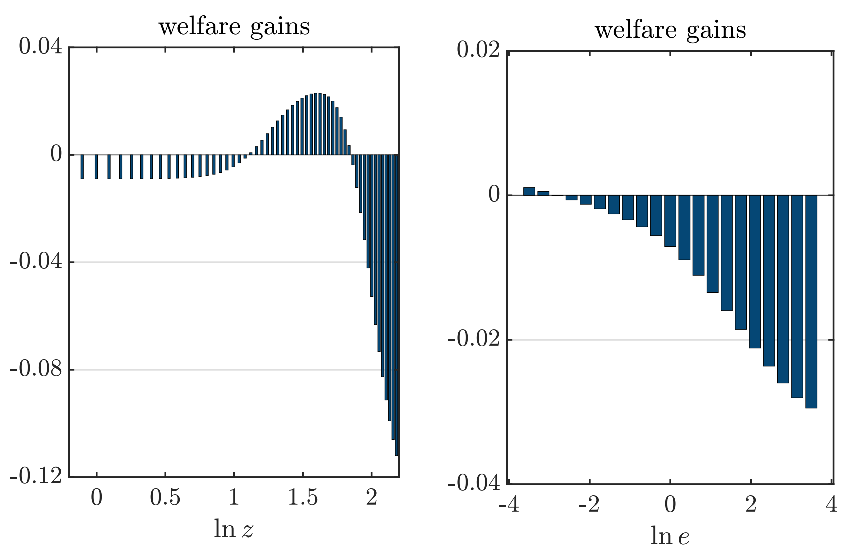


Figure 14: Welfare Gains: 25% Tax on Profits Above Cutoff



Appendices

A Additional Derivations

Let

$$Y_t = Z_t K_t^\alpha L_t^{1-\alpha}$$

denote the aggregate production function, where Z_t is total factor productivity. Using the first order conditions for capital and labor, (4) and (5), and the expression for the marginal cost ϕ_t

$$\phi_t = \frac{1}{z_t}\left(\frac{R_t+\mu_t}{\alpha}\right)^\alpha\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha},$$

we can write aggregate labor L_t

$$L_t = \bar{N}_t \int \left(\frac{\frac{R_t+\mu_t}{\alpha}}{\frac{W_t}{1-\alpha}}\right)^\alpha \frac{q_t}{z_t} Y_t$$

and aggregate capital K_t

$$K_t = \bar{N}_t \int \left(\frac{\frac{R_t+\mu_t}{\alpha}}{\frac{W_t}{1-\alpha}}\right)^{\alpha-1} \frac{q_t}{z_t} Y_t,$$

where $q_t = \frac{y_t}{Y_t}$.

Let $\nu_t = \frac{R_t+\mu_t}{R_t}$. We can then write

$$L_t = \left(\frac{\frac{R_t}{\alpha}}{\frac{W_t}{1-\alpha}}\right)^\alpha \bar{N}_t \int \nu_t^\alpha \frac{q_t}{z_t} Y_t$$

and

$$K_t = \left(\frac{\frac{R_t}{\alpha}}{\frac{W_t}{1-\alpha}}\right)^{\alpha-1} \bar{N}_t \int \nu_t^{\alpha-1} \frac{q_t}{z_t} Y_t$$

Raising both to the respective elasticities gives

$$L_t^{1-\alpha} K_t^\alpha = \left(\bar{N}_t \int \nu_t^\alpha \frac{q_t}{z_t}\right)^{1-\alpha} \left(\bar{N}_t \int \nu_t^{\alpha-1} \frac{q_t}{z_t}\right)^\alpha Y_t,$$

which implies

$$Z_t = \left[\left(\bar{N}_t \int \nu_t^\alpha \frac{q_t}{z_t}\right)^{1-\alpha} \left(\bar{N}_t \int \nu_t^{\alpha-1} \frac{q_t}{z_t}\right)^\alpha\right]^{-1}.$$

Using the firm's first order condition we can write

$$p_{it} = \Upsilon'(q_{it}) D_t = m_{it}\phi_t = m_{it}\frac{\nu_{it}^\alpha}{z_{it}}\left(\frac{R_t}{\alpha}\right)^\alpha\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}.$$

Using equations (9) and (13), as well as the aggregate production function, we can write

$$\left(\frac{R_t}{\alpha}\right)^{\alpha}\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}=Z_t\Lambda_t^{-\alpha}M_t^{-(1-\alpha)}$$

Next, using that

$$\Upsilon'\left(q_{it}\right)=\frac{\sigma-1}{\sigma}\exp\left(\frac{1-q_{it}^{\varepsilon/\sigma}}{\varepsilon}\right)$$

we can thus write

$$\frac{\sigma-1}{\sigma}\exp\left(\frac{1-q_{it}^{\varepsilon/\sigma}}{\varepsilon}\right)=m_{it}\frac{\nu_{it}^{\alpha}}{z_{it}}\Omega_t,$$

where $\Omega_t=\frac{Z_t\Lambda_t^{-\alpha}M_t^{-(1-\alpha)}}{D_t}$. Solving for q_{it} we obtain

$$\frac{1-q_{it}^{\varepsilon/\sigma}}{\varepsilon}=\log\left(m_{it}\frac{\nu_{it}^{\alpha}}{z_{it}}\Omega_t\frac{\sigma}{\sigma-1}\right)$$

or, equivalently

$$q_{it}=\left[1-\varepsilon\log\left(m_{it}\frac{\nu_{it}^{\alpha}}{z_{it}}\Omega_t\frac{\sigma}{\sigma-1}\right)\right]^{\frac{\sigma}{\varepsilon}}.$$

B Data Appendix

Here we describe the datasets we used in our empirical work and document a number of features of the data.

B.1 Survey of Consumer Finances

The Survey of Consumer Finances (SCF) is a survey conducted by the National Opinion Research Center at the University of Chicago. This survey is well suited for characterizing the earnings, income, and wealth concentration at the top because it oversamples rich households.

The unit of observation we use is the household. Each wave of the survey samples more than 6,000 households and is representative of the US economy.

Sample Selection. As is standard in the literature, we exclude households with negative income. In addition, we focus on a sample of households in which the household head is between 22 and 79 years old.

Wealth. Our measure of household wealth is the variable constructed by the Federal Reserve for its Bulletin article which accompanies each wave of the SCF. Wealth is defined as total net worth, which equals assets minus debt. Assets includes both financial and non-financial assets. Financial assets include checking and savings accounts, stocks, bonds, etc. Non-financial assets, among others, include the value of houses and other real state, the value of farm and private businesses owned by the household.[13] Debt include both housing debt (e.g. mortgages), debt from lines of credit or credit cards, installment loans, etc. Table B.1 presents descriptive statistics for wealth and its components.

Income. Our measure of income includes all sources of income excluding government transfers (e.g. social security and unemployment benefits) and excluding other (non classified) sources of income. Thus, we include wage income, income from businesses, income from interests and dividends, from capital gains, rent income and income from pensions and annuities. Table B.2 presents descriptive statistics for income and its components.

Entrepreneurs. We following Cagetti and De Nardi (2006) in identifying entrepreneurs as households in which the household head (1) owns a business, (2) is actively engaged in managing the business and (3) is self-employed.[14] As a robustness check, in Table B.3 we report the results presented in Table 1 of the paper about entrepreneurs in the wealth and income distributions for alternative definitions of what constitutes an entrepreneur. Finally, in Tables B.4 and B.5 we report the descriptive statistics for wealth and income, and its major components, for our sample of entrepreneurs.

[13] The value of houses, real state and businesses is self-reported. E.g. with respect to housing the survey asks: "What is the current value of this (home and land/apartment/property)?". For businesses the survey asks: "What is the net worth of (your share of) this business?"

[14] The exact questions in the survey are: (1) (does the household head) "own privately-held businesses?", (2) (were the household head) "ever involved in the active management of the business??", (3) (does the household head) "work for someone else, (is he or she) self-employed, or something else?".

B.2 Comparison With Other Sources of Data

Here we compare the numbers in the SCF data with those from alternative data sources. For household wealth we consider data from the Flow of Funds Accounts (FF). One disadvantage of this latter dataset is that it reports balance sheet information for households and nonprofit organizations combined. For household income we use data from the National Income and Product Accounts (NIPA). Both the FF and NIPA data report aggregate variables. To make these alternative data sources comparable with the SCF, which is at the household level, we divide the aggregate variables by the total number of households obtained from the St. Louis Fed Federal Reserve Economic Data (FRED). In this way we obtain per household variables which are comparable to the household level averages we obtain from the SCF.

B.2.1 Wealth in the Flow of Funds Accounts

Figure B.1 compare the time series of household average wealth in the SCF vs. per household wealth in the FF. As expected, because wealth in the FF includes both household and nonprofit organizations wealth, the numbers in the FF are slightly larger than the ones for household average wealth in the SCF. Nonetheless, the trend in these variables is very similar.

B.2.2 Income in the National Income and Product Accounts

We next analyze income in the SCF vs. different income variables in the NIPA. Specifically, from NIPA, we consider the Gross Domestic Product (GDP), Gross National Product (GNP), National Income (NI), and National Income minus Personal current transfer receipts (NI-T).[15] This last variable is the most comparable to our total income measure in the SCF as we exclude income from government transfers. Recall the following national income identities:[16]

$$\begin{aligned} \text{GNP} &= \text{GDP} \pm \text{payments to the rest of the world} \\ \text{NI} &= \text{GNP} - \text{consumption of fixed capital} \\ \text{NI-T} &= \text{NI} - \text{personal current transfer receipts} \end{aligned}$$

Figure B.2 presents the time series for the per household NIPA variables vs our total income measure in the SCF. For all years NI-T is above total income in the SCF by around 10k per year. To understand what explains this difference, Figure B.3 presents time series for different components of income in NIPA's NI-T that are comparable to the components of income we consider in our measure of total income in the SCF.[17] This figure shows that most of the difference between the income variable in NIPA and the one in the SCF is Interest and Dividends and Capital gains. Both wage, business and rent income exhibit similar levels and trends in both sources of data.

[15] Personal current transfer receipts includes: Government social benefits to persons (e.g. Social security, Medicare and Medicaid, Unemployment Insurance) and Other current transfer receipts.

[16] For details about national accounts and its components see NIPA's handbook: https://www.bea.gov/sites/default/files/methodologies/nipa-handbook-all-chapters.pdf#page=6.

[17] Specifically, for wage income we consider Compensation of employees; for business income we use Proprietors' income with inventory valuation and capital consumption adjustments; for interest and dividends plus Capital gains income we consider Personal income receipts on assets; finally for Rent income we consider Rental income of persons with capital consumption adjustment.

B.3 Entrepreneurial and Corporate Firms Across Industries

This section analyzes the distribution of entrepreneurial and corporate firms across production sectors in the US. We use data from the Public Use Microdata Sample (PUMS) of the Survey of Business Owners (SBO), which is available for the year 2007. The PUMS version of the SBO is representative of all nonfarm private businesses in the US.[18] We use the SBO data to represent all private firms and the Compustat data to represent corporate firms.

To analyze the relative importance of entrepreneurial and corporate firms we merge the variables for employment and sales in the SBO and Compustat datasets.[19] As an initial check, we compare the aggregate figures we obtain against other sources of data. Specifically, we compare the share of the corporate and private sectors in the aggregate economy, as measured by employment and sales, implied by the SBO-PUMS and Compustat datasets and the ones reported in the aggregate statistics of the SBO.[20] Table B.6 shows that the relative sizes of private and corporate firms align relatively with the aggregate numbers.[21]

Figure B.4 presents the employment and sale shares of entrepreneurial and corporate firms in different industries.[22] Even though corporate firms are disproportionately more prevalent in Manufacturing and less prevalent in Other Services, both types of firms co-exist in each sector of the economy, with relatively homogenous weights across sectors.

[18]The SBO covers all nonfarm businesses filling IRS tax forms as individual proprietorships, partnerships, or any type of corporation with receipts of $1,000 or more. However, businesses classified in the SBO as publicly owned are not included in the PUMS version.

[19]To compute sector and aggregate level variables in the SBO we use the sample weights reported in the PUMS.

[20]Importantly, the aggregate data of the SBO includes all firms, including the private firms, reported in the SBO-PUMS dataset, and corporate firms.

[21]A potential explanation for the discrepancy in the shares is that Compustat only reports data for publicly listed corporations. Thus, our analysis misses all the non-publicly listed corporations.

[22]To ease exposition we collapse the 2-digit NAICS codes reported in both the SBO and Compustat datasets into 6 categories.

Table B.1: Wealth and its Components, Descriptive Statistics

	Fr.=0	Mean	25th	50th	75th	90th	95th	99th
Wealth	0.01	544.7	8.9	80.7	329.4	981.5	1,946.2	8,127.6
Assets (+)	0.02	644.9	26.8	179.2	454.1	1,168.7	2,169.7	8,632.2
Financial Assets	0.06	261.4	1.3	18.8	129.1	496.0	967.3	4,057.4
Ch. and sav. acc.	0.07	33.2	0.5	3.4	16.5	56.5	107.8	470.2
Bonds	0.99	8.2	0.0	0.0	0.0	0.0	0.0	30.9
Stocks	0.86	39.0	0.0	0.0	0.0	6.2	56.7	928.0
IRA, pensions	0.48	107.3	0.0	0.8	63.9	271.2	515.6	1,546.7
Other Financial	0.49	73.7	0.0	0.0	5.2	65.0	218.6	1,259.0
Nonfinancial Assets	0.08	383.5	14.4	132.3	300.1	643.4	1,138.4	4,905.9
Business	0.89	113.8	0.0	0.0	0.0	4.1	126.8	2,204.5
Housing and real state	0.33	243.8	0.0	103.1	257.8	515.6	824.9	2,515.9
Other Nonfinancial	0.09	25.9	5.9	14.8	28.9	48.3	67.0	171.2
Debt (−)	0.22	100.2	0.5	28.9	137.2	269.4	386.7	762.5
Housing, real state	0.53	83.0	0.0	0.0	116.5	237.2	360.9	710.4
Credit card, credit lines	0.59	3.1	0.0	0.0	1.5	7.7	14.4	37.3
Other debt	0.23	14.1	0.0	0.7	16.5	37.0	58.8	127.2

Notes: The numbers in the table are based on the 2013 SCF survey. With the exception of the first column, all variables are reported in thousands 2016 USD. Fr.=0 denotes the fraction of households with zero wealth, assets, or debt. Ch. and sav. acc. denotes checking and saving accounts held with a bank. Other Financial assets include Directly held mutual funds, Savings bonds, Cash value of life insurance, Other managed assets, and other non-classified financial assets. Other Nonfinancial assets include Vehicles, and other non-classified nonfinancial assets (e.g. durable goods or jewelry). Other debt includes Installment loans and other non-classified debt.

Table B.2: Income and its Components, Descriptive Statistics

	Fr.=0	Mean	25th	50th	75th	90th	95th	99th
Income	0.01	89.8	25.1	50.2	94.1	160.9	239.0	707.2
Wage	0.24	60.1	2.1	35.6	77.4	133.9	186.2	468.6
Business	0.81	11.8	0.0	0.0	0.0	11.5	37.7	209.2
Interest and dividends	0.78	2.9	0.0	0.0	0.0	0.8	4.9	58.4
Capital gains	0.92	4.2	0.0	0.0	0.0	0.0	0.6	50.2
Rent income	0.89	8.2	0.0	0.0	0.0	0.0	12.6	125.5
Pensions and annuities	0.67	10.5	0.0	0.0	11.5	34.5	53.4	106.9

Notes: The numbers in the table are based on the 2013 SCF survey. All income variables are for annual income. With the exception of the first column, all variables are reported in thousands 2016 USD. Fr.=0 denotes the fraction of households with zero income. Rent income includes income from net rents, trusts and royalties.

Table B.3: Entrepreneurs in the Wealth and Income Distribution

	Wealth distribution		Income distribution	
	Fraction of entrepreneurs	Share held by entrepreneurs	Fraction of entrepreneurs	Share held by entrepreneurs
Business owners				
All	0.12	0.53	0.12	0.33
Top 1%	0.81	0.85	0.72	0.77
Top 5%	0.57	0.72	0.51	0.64
Top 10%	0.43	0.65	0.37	0.55
Bottom 50%	0.04	-0.03	0.06	0.07
Business owners + active managament				
All	0.11	0.48	0.11	0.30
Top 1%	0.72	0.85	0.60	0.66
Top 5%	0.52	0.64	0.46	0.57
Top 10%	0.39	0.58	0.33	0.49
Bottom 50%	0.04	0.03	0.05	0.06
Business owners + active managament + self-employed				
All	0.07	0.37	0.07	0.21
Top 1%	0.58	0.62	0.46	0.55
Top 5%	0.40	0.52	0.34	0.46
Top 10%	0.29	0.46	0.23	0.38
Bottom 50%	0.02	0.03	0.04	0.04

Notes: The numbers in the table are based on the 2013 SCF survey.

Table B.4: Entrepreneurs' Wealth and its Components, Descriptive Statistics

	Fr.=0	Mean	25th	50th	75th	90th	95th	99th
Wealth	0.0	2,846.8	179.9	668.2	2,328.6	6,832.4	11,058.6	28,640.0
Assets (+)	0.0	3,061.3	332.9	818.8	2,460.2	7,188.2	12,104.1	29,146.5
Financial Assets	0.0	899.5	15.3	103.3	544.9	1,877.9	4,035.2	10,422.4
Ch. and sav. acc.	0.0	123.9	3.6	13.4	58.8	204.2	415.5	1,684.8
Bonds	1.0	31.3	0.0	0.0	0.0	0.0	0.0	555.8
Stocks	0.7	166.6	0.0	0.0	0.8	134.0	583.6	3,093.3
IRA, pensions	0.4	266.9	0.0	18.6	195.9	692.9	1,450.8	3,712.0
Other Financial	0.3	310.7	0.0	0.9	61.9	412.4	1,000.2	4,740.0
Nonfinancial Assets	0.0	2,161.8	259.1	599.1	1,635.7	4,947.1	7,929.2	21,785.2
Business	0.1	1,302.3	21.7	128.9	670.2	3,093.3	5,155.5	15,466.6
Housing and real state	0.1	793.2	124.2	309.3	817.7	1,804.4	3,038.1	7,784.8
Other Nonfinancial	0.0	66.2	11.3	26.8	51.8	104.1	192.2	546.5
Debt (−)	0.2	214.6	16.5	103.1	279.9	538.2	804.3	1,620.4
Housing, real state	0.3	191.2	0.0	89.7	247.5	509.4	758.9	1,617.8
Credit card, credit lines	0.6	7.0	0.0	0.0	3.1	15.5	25.8	103.1
Other debt	0.2	16.3	0.0	0.0	18.6	36.1	60.8	148.5

Notes: The numbers in the table are based on the 2013 SCF survey. With the exception of the first column, all variables are reported in thousands 2016 USD. Fr.=0 denotes the fraction of households with zero wealth, assets, or debt. Ch. and sav. acc. denotes checking and saving accounts held with a bank. Other Financial assets include Directly held mutual funds, Savings bonds, Cash value of life insurance, Other managed assets, and other non-classified financial assets. Other Nonfinancial assets include Vehicles, and other non-classified nonfinancial assets (e.g. durable goods or jewelry). Other debt includes Installment loans and other non-classified debt.

Table B.5: Entrepreneurs' Income and its Components, Descriptive Statistics

	Fr.=0	Mean	25th	50th	75th	90th	95th	99th
Income	0.01	270.2	47.1	92.1	219.7	523.0	880.8	2,929.0
Wage	0.36	83.1	0.0	27.2	84.7	209.2	313.8	831.6
Business	0.11	119.8	6.3	31.4	85.8	235.4	462.4	1,457.2
Interest and dividens	0.61	13.5	0.0	0.0	1.0	20.9	47.1	214.9
Capital gains	0.80	35.6	0.0	0.0	0.0	8.0	57.5	274.1
Rent income	0.52	87.1	0.0	0.0	41.8	144.4	397.5	1,359.9
Pensions and annuities	0.72	14.2	0.0	0.0	5.2	37.7	75.3	296.0

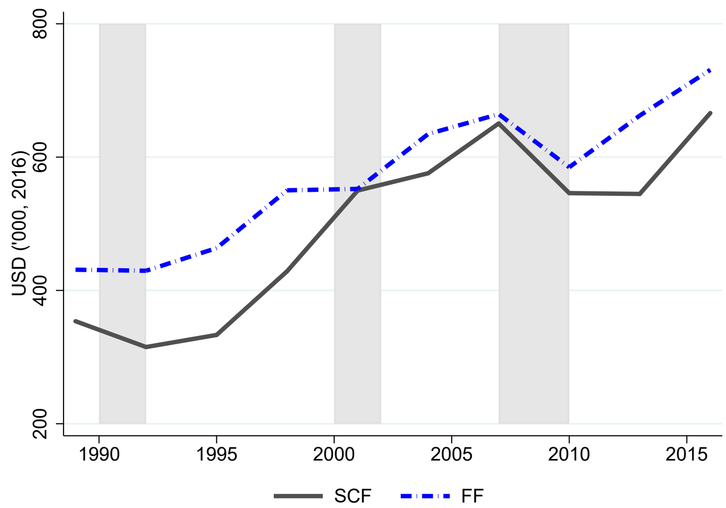
Notes: The numbers in the table are based on the 2013 SCF survey. All income variables are for annual income. With the exception of the first column, all variables are reported in thousands 2016 USD. Fr.=0 denotes the fraction of households with zero income. Rent income includes income from net rents, trusts and royalties.

Table B.6: Sector shares

	Sales	Employment
Aggregate		
Corporate	0.64	0.52
Private	0.36	0.48
Microdata		
Compustat	0.56	0.43
SBO-PUMS	0.44	0.57

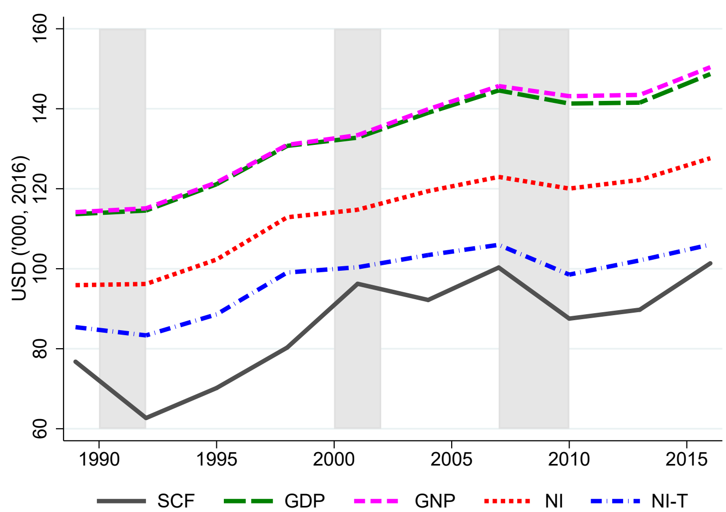
Notes: Aggregate data refers to SBO aggregate statistics for the year 2007.

Figure B.1: Wealth in FF and SCF



Notes: FF wealth correspond to assets - liabilities of Households and Nonprofit Organizations.

Figure B.2: Total Income in NIPA and SCF



Notes: GDP denotes Gross Domestic Product, GNP denotes Gross National Product, NI denotes National Income, and NI-T denotes Personal Income minus Personal current transfer receipts.

Figure B.3: Components of Income in NIPA and SCF

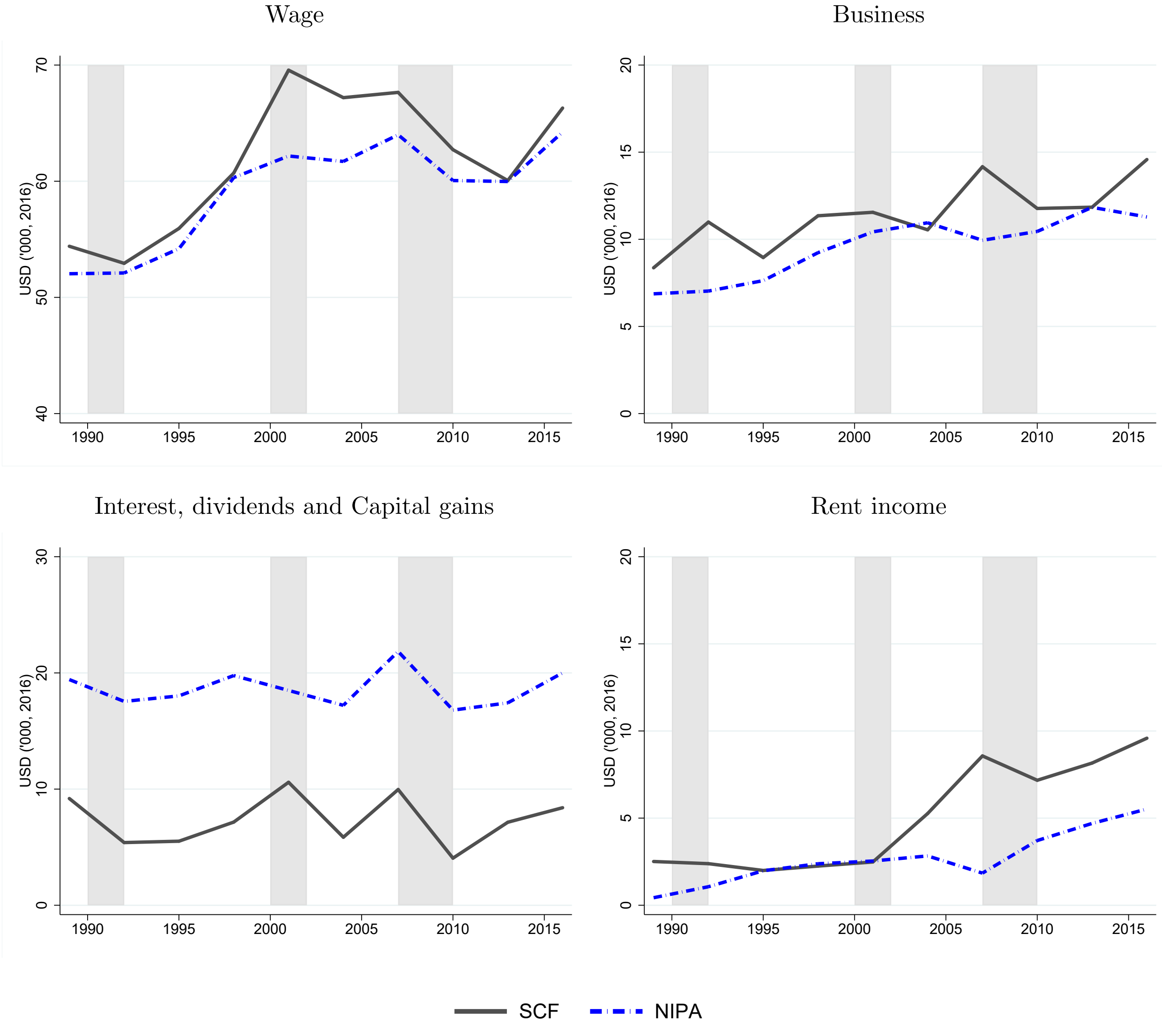
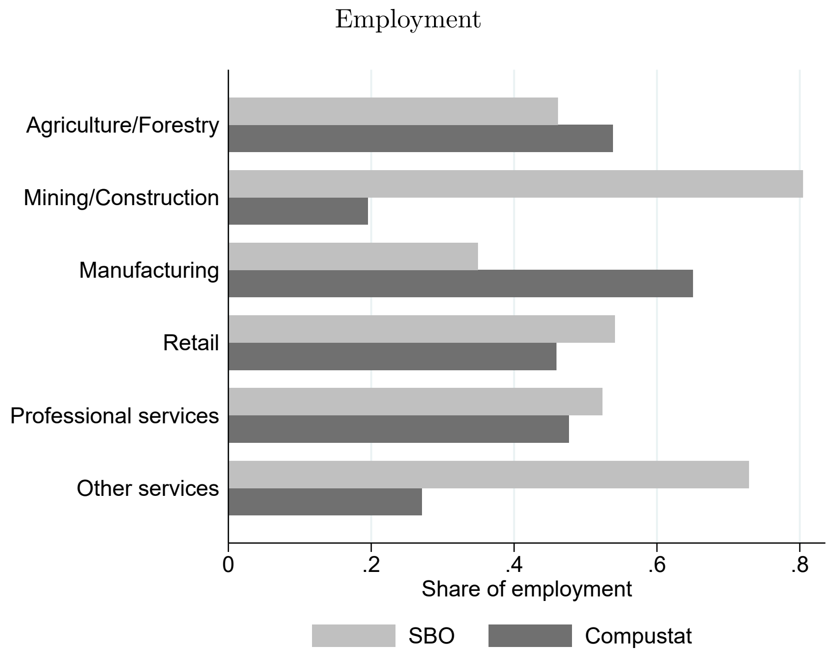
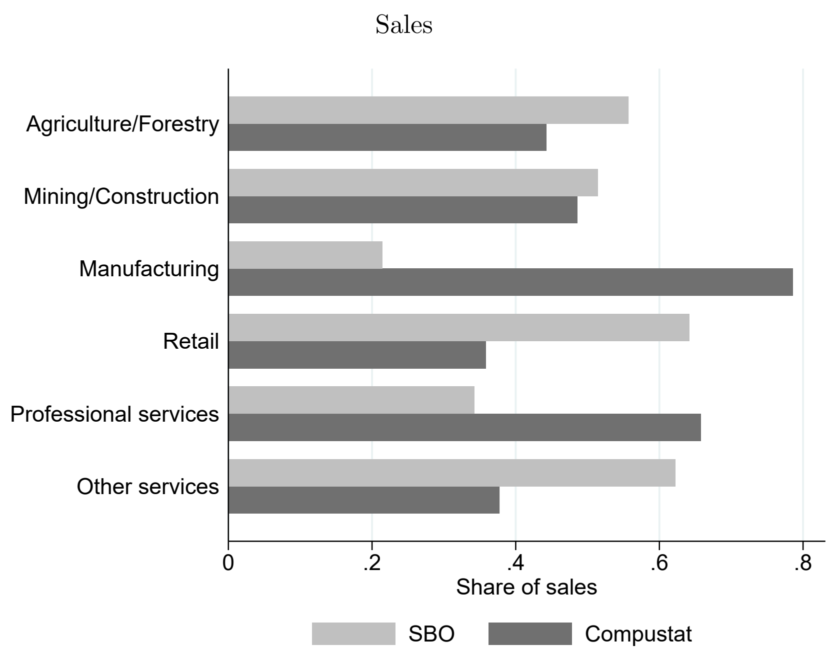


Figure B.4: Entrepreneurial and corporate firms, by industry





Notes: Shares sum up to one within each industry. The data is for the year 2007.