Markups and Inequality*

Corina Boar† Virgiliu Midrigan‡

December 2019

Abstract

We study the aggregate and distributional impact of product market interventions and profit taxes using a model of firm dynamics and credit constraints in which wealth and firm ownership are highly concentrated and markups are endogenous. We show that uniform sales subsidies that remove the aggregate labor wedge redistribute towards richer households and reduce welfare. Size-dependent sales subsidies that remove the distortions due to markup dispersion lead to sizable welfare gains, even though they increase firm concentration and long-run misallocation. The effect of profit taxes is ambiguous and depends on the elasticity of investment in firm productivity and new varieties.

Keywords: entrepreneurs, inequality, markups, misallocation, redistribution, tax policy.

JEL classifications: D4, E2, L1.

*We thank Federico Kochen for superb research assistance, our discussants Salome Baslandze, Paco Buera, Basile Grassi for insightful feedback, as well as Adrien Auclert, Jess Benhabib, Mariacristina De Nardi, Mark Gertler, Mike Golosov, Oleg Itskhoki, Benjamin Moll, Gianluca Violante, Ludwig Straub and seminar participants at Barcelona GSE Forum, Boston University, Cleveland Fed, Copenhagen, Duke, Dutch National Bank Conference on Inequality, ERMAS, Harvard, Ischia Conference on Frontiers of Macroeconomics, Madrid Conference on Firm Dynamics and Macroeconomics, Minneapolis Fed, National Bank of Romania, NBER Summer Institute, NYU, OSU, Penn, Philadelphia Fed, Princeton, Rochester, Rome Conference on Macroeconomics, Sciences Po, SED, SITE, St Louis Conference on Macroeconomics of Inequality, Stony Brook and Warwick Conference on Inequality for valuable comments.

†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 product market concentration, profit shares and measured markups in recent decades.[1] Since firm ownership is highly concentrated, a growing concern is that markups redistribute income from workers towards firm owners, thus increasing inequality.[2]

Despite this concern, 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 acts as a uniform tax on production and reduces output. Second, firms with higher market share charge higher markups, and thus have a higher marginal product of capital and labor. The resulting dispersion in the marginal product reduces allocative efficiency. In this environment a policy that subsidizes firms in proportion to their markup restores efficiency. Even though this policy increases concentration and firm profits, it makes the representative consumer, who owns all firms, unambiguously better off. This policy prescription ignores, however, potentially important distributional consequences that increased markups and concentration have.

Our goal in this paper is to fill this gap in the literature. We study the consequences of policies aimed at alleviating the costs of markups in an environment in which firm ownership and wealth are highly concentrated, as in the U.S. data. We 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.

The economy we study consists of a large number of households who work and can run a private business. They face idiosyncratic shocks to their labor market efficiency and their entrepreneurial ability and can partially insure against these shocks by saving in capital, corporate stocks or government bonds. Private business owners have the option to incorporate. Those who do so retain a small ownership stake, an assumption that allows us to match the high degree of concentration of firm ownership in the data. While private firms face a collateral constraint, as in Buera et al. (2011), corporate firms have unlimited access to external finance. Each firm supplies a differentiated variety and charges a markup that

[1] De Loecker et al. (2018), Hall (2018), Autor et al. (2017), Hartman-Glaser et al. (2018).
[2] Stiglitz (2012), Atkinson (2015).

increases in its market share.

We draw three lessons from this exercise. First, uniform sales subsidies that remove the aggregate labor and investment wedges induced by markups redistribute towards wealthier households. Since such subsidies must be financed with distortionary income taxes, they reduce after-tax wages and lower most households' welfare. This result stands in sharp contrast to the prediction of representative agent models (Edmond et al., 2018). Second, product market concentration is not costly in and of itself. If larger firms have a higher marginal product, as the evidence suggests, size-dependent sales subsidies that reallocate production towards these firms increase wages and most households' welfare, despite increasing markups and wealth inequality. Third, the effect of profit taxes is ambiguous and depends on the elasticity of investment in firm productivity.

We explicitly model entrepreneurial activity and financial constraints because these are important determinants of wealth and income inequality, as pointed out by Quadrini (2000), Cagetti and De Nardi (2006) and Peter (2019). According to the 2013 Survey of Consumer Finances, even though entrepreneurs represent only 6.5% of all households, they hold 31% of all wealth and earn 18% of all income. Dispersion in entrepreneurial ability, combined with the collateral constraint, gives rise to dispersion in the rates of return on savings and is an important determinant of wealth inequality.

The assumptions we make on the demand system imply that the demand elasticity a producer faces decreases in its market share, so larger producers charge higher 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. 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, as well as salient facts about the product market. We calibrate the parameters of the model to match moments of the wealth and income distribution, several 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. 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 consumers face 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.

We next study size-dependent sales subsidies which remove the dispersion in the marginal product of labor, but leave the aggregate markup unchanged. 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. The resulting decline in TFP is gradual, however. Indeed, TFP increases on impact since the policy removes the dispersion in the marginal product of labor. This short-run increase in TFP and the reallocation of capital towards unconstrained corporate firms increases labor productivity and after-tax wages. Even though the policy increases firm concentration, markups and inequality, it benefits most households. The median welfare gain is equivalent to a 1.7% permanent increase in consumption.

We then turn our attention to profit taxes and consider two sets of interventions. First, we study the impact of a 25% tax on all profits. Second, we study the impact of a 25% tax that only applies to profits above a cutoff. We find that taxing all profits leads to a 3% drop in steady-state wages, owing to a nearly 15% drop in the mass of corporate firms and the resulting drop in the demand for labor. However, since personal income taxes fall due to an increase in tax revenues, the after-tax wage increases in the short-run. Since this increase is fairly persistent, most households benefit from this policy, with the median welfare gain equal to 1.7%. Taxing only profits above a cutoff leads to smaller welfare gains due to the lower amount of tax revenue collected.

As we show in our robustness section, however, the effects of profit taxes depend on the details of how we model entry into the corporate sector. An otherwise identical Hopenhayn (1992) – style economy with free entry into the corporate sector implies a much more elastic response of the mass of corporate firms to profit taxes. A 25% profit tax leads to a much larger drop in TFP and wages, and generates welfare losses for most households. Interestingly, taxing only profits above a cutoff is now even more costly, since it redistributes towards the relatively wealthy private business owners.

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 distortions. 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 evidence that the average revenue product of labor increases with firm size, size-dependent sales 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 model of oligopolistic competition among a small number of producers. Mergers 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.

Related Work. In addition to the work on markups discussed above, our paper builds on studies of wealth and income inequality, originating with Castaneda et al. (2003) 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 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 studying the taxation of private businesses (Hurst and Pugsley, 2017, Dyrda and Pugsley, 2018, Bhandari and McGrattan, 2018), the decision to incorporate (Short and Glover, 2011, Peter, 2019) and is motivated by work documenting facts about allocative efficiency (Hsieh and Klenow, 2009, Baqaee and Farhi, 2018), and the rise in inequality (Piketty and Goldhammer, 2014, Kuhn and Rios-Rull, 2016).

The remainder of the paper proceeds as follows. Section 2 presents several facts on inequality and entrepreneurial activity 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 by summarizing several statistics that describe the prevalence of firm owners in the wealth and income distribution in the 2013 Survey of Consumer Finances (SCF). Though these facts are well-known (see Quadrini, 2000), we report them here in order to provide some context for our quantitative model.

We follow Cagetti and De Nardi (2006) in defining a firm owner as a self-employed business owner who actively manages a business. We distinguish between two types of firm owners: those who own a C-corporation and those who do not, who we refer to as entrepreneurs. We make this distinction because, as Dyrda and Pugsley (2018) argue, C-corporations differ from all other forms of legal organization along two important dimensions. First, C-corporations are taxed at the entity level, while all others are pass-through businesses and are not subject to the corporate income tax. Second, C-corporations enjoy a number of benefits, such as free transferability of interest and continuity of life, that allow them to more easily raise outside equity and diversify risk.

Table 1 shows that entrepreneurs represent only 6.5% of all households, but hold 31% of all wealth and earn 18% of all income. They represent a large fraction of households at the top of the wealth and income distribution. For example, entrepreneurs account for 49% of the wealthiest 1% of households and hold 49% of the wealth of this group. Owners of corporate firms are fewer, but wealthier and richer on average. They represent 0.6% of all households and account for 6.5% of wealth and 3.1% of all income.

To summarize, firm owners account for a large fraction of wealth and income in the United States. This observation makes it apparent that an analysis of the relationship between profits and inequality should encompass a role for private business ownership.

3 Model

The economy is inhabited by a unit mass of households who work and have the option to operate a private business. Private business owners have the option to incorporate and sell a fraction of their business to financial intermediaries. Private business owners and corporations compete among themselves.[3] Each supplies a differentiated variety of a good and charges a markup that increases with its market share. 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

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

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 business ownership, $T(i_t)$ is the amount the household pays in income taxes, and s_t are the proceeds from selling the business. 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.

The income of the household is

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

where W_t is the wage rate, e_t is the agent's idiosyncratic efficiency on the job, and π_t are the profits from the business. Profit income depends on one's incorporation status. Private business owners, who we refer to as entrepreneurs, earn profits $\pi_t^e\left(a_t, z_t\right)$, which depend on their wealth a_t, due to a leverage constraint, and entrepreneurial ability z_t. Owners of corporate firms earn $\chi \pi_t^c\left(z_t\right)$, which reflects their retained ownership stake χ and the profits of the corporate firm $\pi_t^c\left(z_t\right)$. Since corporate firms do not face financial frictions, their profits only depend on productivity. As we discuss below, $\pi_t = 0$ for most households in our economy.

[3] We show in the Appendix that the two types of firms coexist in every industry in the United States.

We assume that the logarithm of entrepreneurial and labor market efficiency, z_t and e_t, evolve according to independent AR(1) processes. Specifically,

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

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

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

We assume that taxes are determined according to the function

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

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 functions $\pi_t^e\left(a_t, z_t\right)$ and $\pi_t^c\left(z\right)$, we describe the goods markets.

3.2 Final Good Firms

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

$$Y_t = C_t + X_t + G.$$

This sector is competitive, with final good firms purchasing differentiated intermediate varieties from both entrepreneurs and corporate firms. Each intermediate goods producer is the monopoly supplier of such a variety and thus has market power. The final good sector operates a technology implicitly defined by the Kimball (1995) aggregator

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

where $y_t\left(\omega\right)$ is the quantity of variety ω purchased. Notice that even though the mass of potential varieties is equal to the mass of households, which we normalize to 1, not all varieties are produced in equilibrium. 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 ($\varepsilon = 0$). This functional form implies a demand elasticity

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

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 and international economics (Gopinath and Itskhoki, 2010). Importantly, explicitly modeling search frictions (Benabou, 1988) or oligopolistic competition in the product markets (Atkeson and Burstein, 2008) gives rise to a similar relationship between firm market share and 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 solution to this problem gives rise to the demand function

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

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.

3.3 Intermediate Goods Producers

Each variety ω is produced by a single firm with technology

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

where z_t is productivity, l_t is labor and k_t is capital. Producers pay W_t per unit of labor and R_t per unit of capital. The producer's profits are therefore

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

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

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

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

An entrepreneur's optimal choices of capital and labor imply a marginal cost of production

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

where

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

is the multiplier on the borrowing constraint (3). Constrained entrepreneurs, those with $\mu_t > 0$, 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,

$$p_t = \frac{\sigma}{\sigma - (y_t/Y_t)^{\frac{\varepsilon}{\sigma}}}\phi_t. \tag{4}$$

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

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

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.

Figure 1 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.

We finally explain why not all households choose to operate a business. 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 demand is zero. Producers with marginal cost exceeding this cutoff choose not to operate. Provided that $a > 0$, the productivity cutoff above which a firm operates is

$$\bar{z}_t = \frac{\sigma}{\sigma - 1} \exp\left(-\frac{1}{\varepsilon}\right) \frac{1}{D_t} \left(\frac{R_t}{\alpha}\right)^{\alpha} \left(\frac{W_t}{1-\alpha}\right)^{1-\alpha}. \tag{5}$$

We next describe how private businesses incorporate. We assume that the opportunity to sell the variety one owns arrives infrequently, at rate η and entails a fixed transaction cost F. We assume that the owner can only sell claims to a fraction $1 - \chi$ of the future profits from producing this variety and must retain the remaining fraction χ. Once incorporated the firm has unlimited access to external finance, but is subject to a linear corporate profit tax τ_c. We assume that all varieties exit at an exogenous rate φ and that the original owner of a variety ω that exits draws a new variety ω' immediately.[4] Since the original owner sells a claim to a specific variety, the corporation dissolves upon the exit of that particular variety.

3.4 Household Choices

A household's state variables are its assets a, entrepreneurial ability z and labor market efficiency e. There are two types of households: those who own their variety and those who sold it. We discuss the problem of each of these households separately.

Households who own a variety. Let

$$V_t^e = \eta \max\left[V_t^{ee}, V_t^{ec}\right] + (1-\eta) V_t^{ee}$$

denote the value function of a household who owns a variety. This value reflects the arrival rate η of the option to sell the variety which, if exercised, has value V_t^{ec} and the option of continuing to produce as a private business owner which has value V_t^{ee}.

The value continuing as a private business owner is

$$V_t^{ee}(a, z, e) = \max_{a' \geq 0, c, h} u(c, h) + \beta \mathbb{E}_t V_{t+1}^e(a', z', e')$$

subject to

$$c + a' = a + \frac{1-\tau}{1-\xi}\left[r_{t-1}a + W_t e h + \pi_t^e(a, z)\right]^{1-\xi},$$

where recall that income derives from interest, wages and profits. We refer to households for whom $\pi_t^e(a, z) = 0$ as workers and to those for whom $\pi_t^e(a, z) > 0$ as entrepreneurs.

[4] We make this timing assumption for tractability, to avoid enlarging the state space.

The value of selling the variety is

$$V_t^{ec}(a,z,e) = \max_{a',c,h} u(c,h) + \beta\left[(1-\varphi)\mathbb{E}_t V_{t+1}^c(a',z',e') + \varphi \mathbb{E}_t V_{t+1}^e(a',z',e')\right]$$

subject to

$$c + a' = a + \frac{1-\tau}{1-\xi}\left[r_{t-1}a + W_t e h + \pi_t^e(a,z)\right]^{1-\xi} + (1-\tau_k)(Q_t(z) - F),$$

where

$$Q_t(z) = \frac{1-\varphi}{1+r_t}\mathbb{E}_t\left[Q_{t+1}(z') + (1-\chi)(1-\tau_c)\pi_{t+1}^c(z')\right] \tag{6}$$

is the price the owner receives for selling a stake $1-\chi$ in the business and $V_t^c(a,z,e)$ is the value of a household who sold their variety, which we describe next. The budget constraint reflects that the proceeds from selling the business $Q_t(z) - F$ are subject to a capital gains tax τ_k and the assumption that it takes one period to incorporate. The price $Q_t(z)$ captures the exit rate of varieties φ and the assumption that financial intermediaries are perfectly competitive. No-arbitrage therefore requires that the rate of return on this asset is equal to the equilibrium interest rate r_t. Notice that the dividend flows only include the fraction of the business that the owner does not retain $1-\chi$ and nets out the corporate profit tax τ_c.

Households who do not own a variety. The value of a household who does not own a variety is

$$V_t^c(a,z,e) = \max_{a',c,h} u(c,h) + \beta\left[(1-\varphi)\mathbb{E}_t V_{t+1}^c(a',z',e') + \varphi \mathbb{E}_t V_{t+1}^e(a',z',e')\right]$$

subject to

$$c + a' = a + \frac{1-\tau}{1-\xi}\left[r_{t-1}a + W_t e h + \chi(1-\tau_c)\pi_t^c(z)\right]^{1-\xi}.$$

This value reflects the probability that the variety may exit, in which case the corporation dissolves and the household draws a new variety, which entails continuation value $V_{t+1}^e(a',z',e')$. Since the household retains a share χ of the business sold, it receives a fraction χ of the after-tax profits of the corporate firm $(1-\tau_c)\pi_t^c(z)$, which are then taxed again according to the personal income tax schedule.

Incorporation choice. Figure 2 shows the regions of the state space in which households choose to operate a business and to sell their business, provided they have the opportunity to do so. As equation (5) shows, the threshold for operating a business is independent of household wealth a_t, provided $a_t > 0$. Due to the fixed transaction cost F, the threshold for selling the business depends on both entrepreneurial productivity z_t and wealth a_t. More productive and poorer agents find it optimal to incorporate, a choice that allows them to overcome the borrowing constraint and diversify entrepreneurial risk. Also notice that very productive and very wealthy households choose not to sell the business as the gains from diversification are outweighed by the fixed cost and the tax consequences of incorporating.

3.5 Financial Intermediaries

Households deposit their savings with perfectly competitive financial intermediaries who use these resources to buy capital, shares in corporate firms and government bonds.

The budget constraint of the financial intermediary is

$$K_{t+1} + B_{t+1} - A_{t+1} + \int Q_t(z) S_{t+1}(z) \, \mathrm{d}z = (R_t + 1 - \delta) K_t + (1 + r_{t-1}) B_t - (1 + r_{t-1}) A_t$$
$$+ (1 - \varphi) \int (Q_t(z) + (1 - \chi)(1 - \tau_c) \pi_t^c(z)) S_t(z) \, \mathrm{d}z,$$

where K_t is the capital stock, B_t is government debt, A_t denotes the deposits from the households, $S_t(z)$ denotes the number of shares in corporate firms with productivity z, and $Q_t(z)$ is the price of such shares. In equilibrium

$$S_{t+1}(z) = N_t^c(z) + \nu_t(z),$$

where $N_t^c(z)$ is the mass of existing corporate firms and $\nu_t(z)$ is the mass of new corporate firms with productivity z.

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

$$A_{t+1} = K_{t+1} + \int Q_t(z) S_{t+1}(z) \, \mathrm{d}z + B_{t+1}.$$

Absent aggregate uncertainty, no-arbitrage requires that the rate of return on all these investments is equal, which implies the expression for the price of shares derived in (6) and

$$R_{t+1} = r_t + \delta.$$

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

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

We relegate a formal definition of the equilibrium to the Appendix.

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 $\tau_c = 0.36$ and $\tau_k = 0.20$, consistent with the corporate profit tax on C-corporations (Bhandari and McGrattan, 2018) and the capital gains tax in the United States in 2013. We set the exit rate of corporate firms $\delta_c = 0.04$, to match that exiting firms account for approximately 4% of employment.[5] We choose $\chi = 0.2$ to match the evidence on the median inside equity share in the United States from Himmelberg et al. (2002). The last parameter we assign is the ratio ε/σ. As equation (4) 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 distance between a number of moments in the model and in the data.

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

Parameters in Group 1. The parameters included in the first group are those governing the average demand elasticity σ, the maximum leverage ratio λ, and the income tax schedule τ and ξ. 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 $\sigma = 29.2$ to match an aggregate markup of 1.15, corresponding to the midpoint of recent estimates in the literature.[6] We set $\lambda = 1.74$ to match a size-weighted average debt 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. 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 $\tau = 0.259$ and $\xi = 0.073$, 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 7 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 wealth and income distributions, and the prevalence of entrepreneurs and corporate firms in the economy. 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, the persistence and the standard deviation of the process for labor market efficiency ρ_e and σ_e, the fixed transaction cost F and the arrival rate η of the opportunity to sell the business.

We choose these parameters to minimize the distance between 12 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 wealth and income Gini coefficients for all households, as well as for entrepreneurs and workers in isolation. All these statistics are computed using the 2013 SCF. We also target the fraction of C-corporations and their sales share reported by Dyrda and Pugsley (2018).

We next discuss how our model matches these targets. The percentage of households who are entrepreneurs is 6.5% in the data and 6.4% in the model. As discussed in Section 2, we

[6] See, for example, Barkai (2017), Gutierrez and Philippon (2017), Hall (2018).

define entrepreneurs in the data as self-employed business owners that are actively involved in managing their business and are not legally organized as a C-corporation. In the model, we define entrepreneurs as households who own their variety and produce a positive amount of output. The wealth to income ratio is 6.1 in the data and 6.0 in the model. The model also reproduces well the other moments we have targeted. It matches well the wealth Gini coefficient (0.81 in the data and 0.82 in the model) and the income Gini coefficient (0.58 in both the data and the model). The model reproduces reasonably well the wealth and income Gini coefficients for entrepreneurs and workers in isolation. Even though it matches the share of income held by entrepreneurs (0.18 vs. 0.19), it understates the share of wealth they hold (0.31 vs. 0.25). Finally, the model reproduces well the fraction of corporate firms (0.05) and their sales share (0.63 vs. 0.57).

Panel C of Table 2 reports the values of the calibrated parameters. The discount factor is $\beta = 0.928$. The process for entrepreneurial ability has persistence $\rho_z = 0.991$ and standard deviation $\sigma_z = 0.069$. The process for labor market efficiency has persistence $\rho_e = 0.955$ and standard deviation $\sigma_e = 0.341$. The fixed cost of selling the business is $F = 40.52$, which implies that total incorporation costs represent 0.6% of GDP, and the arrival rate η of the opportunity to incorporate is 0.021.

Intuition for Identification. We next provide some intuition for how the various moments we target 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 they have available to accumulate wealth and grow out of the borrowing constraint. Matching the relatively high wealth share 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 and the degree of wealth and income inequality among entrepreneurs. 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). Finally, the arrival rate η and the fixed cost F are jointly pinned down by the relative size and the fraction of corporate firms.

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 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. For example, the wealthiest 1% of households hold 36% of wealth in both the data and the model. Similarly, the richest 1% of households earn 20% of income in the data and 21% 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 in the data and 2% in the model, while households in the bottom half of the income distribution earn 14% of income in both the data and 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, 49% of the households in the top 1% of the wealth distribution are entrepreneurs in the data and 38% in the model. Of the households in the bottom half of the wealth distribution, only 2% are entrepreneurs in the data and 3% 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 49% of the wealth of the top 1% wealthiest households in the data and 51% in the model. In contrast, entrepreneurs hold a much smaller share of wealth and income at the bottom, in both the data and in the model.

So far, we have focused on statistics that describe entrepreneurs as distinct from owners of corporate firms. Panel H of Table 3 shows that the model matches well the share of firm owners overall and their wealth and income shares. In particular, when we include the agents that have incorporated and retained a share of their business, the overall fraction of households that own a business is 7%, as large as in the data. These households hold 37% of all wealth and 21% of all income in both the data and the model.

Stockholdings in the Wealth Distribution. As Panel G of Table 3 shows, our model also matches the concentration of stock ownership. In the data, the wealthiest 5% of all households own 66% of all stocks. In the model, the portfolio composition is not determinate, but assuming that all households hold the same share of their wealth in publicly traded stocks, the model implies that the wealthiest 5% of households own 64% of all stocks. Note that in the model stock ownership is more concentrated than wealth because households who incorporate retain a fraction of their business.

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).[7] In the model, an identical regression gives a slope coefficient of 0.036. 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, stock 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 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 first report the size of the wedges in the first-order optimality conditions for capital and labor and 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. Some algebra reveals that the aggregate labor share is equal to

$$\frac{W_t L_t}{Y_t} = \frac{1-\alpha}{M_t}, \tag{7}$$

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

where

$$M_t = \int m_{it} \frac{l_{it}}{L_t} \mathrm{d}i \tag{8}$$

is the aggregate markup, an employment-weighted average of individual firm markups m_{it}.[8]

Similarly, the aggregate capital share is

$$\frac{R_t K_t}{Y_t} = \frac{\alpha}{\Lambda_t}, \tag{9}$$

where

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

is a capital-weighted average of the individual firm wedges $\lambda_{it} = m_{it}\nu_{it}$ and $\nu_{it} = \frac{R_t + \mu_{it}}{R_t}$ reflects the credit constraint.

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 labor share of 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 (1.33) and more dispersed, ranging from 1.11 to 1.80. The last columns of the table report these statistics separately for entrepreneurs and corporations. The markup of entrepreneurs is smaller than that of corporations (1.13 vs. 1.17) because entrepreneurs are smaller on average. In contrast, the average capital wedge of entrepreneurs is approximately 1.65, implying that their capital-output ratio is 60% of its unconstrained level.

5.2 Aggregate Implications

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

$$Y_t = Z_t K_t^{\alpha} L_t^{1-\alpha} \tag{10}$$

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

$$Z_t = \left[\left(\int \nu_{it}^{\alpha} \frac{q_{it}}{z_{it}} \mathrm{d}i \right)^{1-\alpha} \left(\int \nu_{it}^{\alpha-1} \frac{q_{it}}{z_{it}} \mathrm{d}i \right)^{\alpha} \right]^{-1}, \tag{11}$$

where

$$q_{it} = \left[1 - \varepsilon \log \left(m_{it} \frac{\nu_{it}^{\alpha}}{z_{it}} \Omega_t \frac{\sigma}{\sigma - 1} \right) \right]^{\frac{\sigma}{\varepsilon}}, \tag{12}$$

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

and $\Omega_t = Z_t \Lambda_t^{-\alpha} M_t^{-(1-\alpha)} / D_t$.

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. Panel B of Table 4 shows that the aggregate productivity losses from misallocation are 9.0% in our baseline economy.

Consider next the effect of markups and credit constraints on the equilibrium wage,

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

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

We conduct a simple accounting exercise aimed at quantifying the aggregate impact of markups and credit constraints. Consider first the effect of removing both distortions. As Table 4 shows, this has a sizable impact, increasing TFP by 9%, the capital to output ratio by 29%, aggregate labor productivity by 28% and wages by 42%. The last two columns of the table decompose these effects into those due to the markup and credit frictions. Removing the markup distortions increases TFP by 0.1%, the capital-output ratio by 16%, labor productivity by 8% and wages by 22%. Removing the credit distortions raises TFP by 8.1%, the capital-output ratio by 17%, labor productivity by 21% and wages by 23%.

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.[9]

6 Product Market Policies

We next evaluate the macroeconomic, distributional and welfare consequences of product market interventions aimed at alleviating 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.

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.

[9] See Itskhoki and Moll (2019) for an analysis of policies aimed at alleviating the impact of credit constraints in an economy without markups.

We show that this policy benefits most households, especially workers, by increasing wages and aggregate productivity, even though it increases product market concentration.

We draw two broader lessons from this analysis. First, a uniform production subsidy does not necessarily benefit workers, despite the resulting increase in the labor share. Such a policy disproportionately increases the demand for capital and the return to wealth, thus benefiting the rich. Second, product market concentration is not costly in and of itself. What is costly is dispersion in the marginal product of factors of production, so policies that remove such dispersion increase welfare, even though they may lead to more inequality.

6.1 Uniform Sales Subsidies

We first study uniform sales subsidies. We assume that firms receive a subsidy τ_s that increases their revenue to $(1+\tau_s)\, p_t y_t$. The firm's optimal price 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. We also consider alternative ways of financing this subsidy.

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. The subsidy increases output by 1.3%, primarily due to an increase in capital and the mass of corporate firms. The wage rate increases by 16% and the interest rate by 0.8 percentage points. The increase in interest rates modestly reduces wealth inequality, by allowing the poor to save more. For example, the top 1% wealth share falls from 0.36 to 0.35. Since the subsidy is financed with higher personal income taxes, the median average tax rate increases from 0.15 to 0.29 and the median marginal tax rate increases from 0.21 to 0.34.

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 the use of 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 implications of the uniform subsidy. To do so, we first calculate the transition dynamics resulting from this policy reform.

Figure 3 shows the dynamics of the key macroeconomic aggregates during the transition. Output increases by approximately 1%, while consumption falls and hours worked increase initially, before gradually converging to their new steady state values. TFP falls, owing to a reallocation of production towards the larger unconstrained corporate firms which increases the losses from misallocation. Even though the wage rate jumps sharply, the median after-tax wage decreases due to the increase in personal income taxes. In contrast, the median after-tax interest rate increases, owing to the disproportionate impact the sales subsidy has on the demand for capital and the resulting sharp increase in the equilibrium interest rate.

We next describe how we calculate the welfare gains from this policy reform. We define the consumption-equivalent welfare change as the permanent increment in consumption Δ_i that leaves the household indifferent between the status-quo and the reform, implicitly defined as

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

where a tilde denotes allocations following the reform.

Panel B of Table 5 shows that only 27% of households gain from this policy and that the median household loses 1.8% of permanent consumption. Only 26% of workers benefit from the policy reform, with a median consumption-equivalent loss of 1.8%. Slightly less than half of firm owners gain, with a median loss of 0.4%.

To understand who are the winners and losers from the reform, Figure 4 reports how the welfare gains vary across the wealth distribution. Households at the bottom of the wealth distribution experience a welfare loss of approximately 3%. 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 3.5% due to the higher after-tax interest rate.

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. For completeness, Table 5 also reports the impact of a uniform sales tax of 15%. This policy has exactly the opposite implications and leads to an increase in welfare of 2.3% for the median household.

Alternative Financing of Uniform Sales Subsidy. We also consider an alternative in which we finance the uniform sales subsidy by increasing the progressivity of the income tax code, as determined by the parameter ξ. We isolate the effect of the uniform sales subsidy by conducting two experiments. In the first experiment, we only increase ξ to 0.15. In the second one, we both increase ξ to 0.15 and introduce the uniform sales subsidy. Thus, in the second experiment, we implicitly finance the subsidy by increasing tax progressivity. For each experiment, we adjust the level of personal income taxes τ_t to ensure that the government budget is satisfied each period.

Panel B of Table 6 shows that the utilitarian welfare gains from increasing progressivity are very high, 9.1%, despite the large resulting output losses. Adding the uniform subsidy reduces these gains to 7.2%, so the net effect of the uniform sales subsidy is a welfare loss of 1.9%, identical to that in our baseline experiment in which progressivity is unchanged. We thus conclude that uniform subsidies are costly, regardless of how one finances them.

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. Motivated by the work of Edmond et al. (2018), the subsidy we use has the form

$$S(p_t y_t) = \frac{1}{1+\tau_s} \left(\Upsilon \left(\frac{p_t y_t}{p_t Y_t} \right) - \Upsilon(0) \right) D_t Y_t - p_t y_t, \tag{13}$$

where $\tau_s > 0$ is a uniform tax that allows us to isolate the role of removing the dispersion in markups, while keeping their aggregate level unchanged.[10] This formulation implies that the marginal subsidy is proportional to the markup of the firm:

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

[10]Subtracting the term $\Upsilon(0)$ ensures that only firms that produce a positive amount receive a subsidy. In practice, this has a negligible effect.

and ensures that the price the firm charges is 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, now equal to

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

We choose $\tau_s = 0.143$ 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.[11] This choice of τ_s also implies that the aggregate labor share is unchanged. The left panel of Figure 5 illustrates how the marginal subsidy varies with firm sales. The majority of firms (99.5%) are taxed under this policy, with a small minority of very large firms receiving the subsidy.

Macroeconomic and Distributional Implications. Panel A of Table 7 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 one third, primarily due to a large drop in the fraction of entrepreneurs. The policy disproportionately benefits the larger corporate firms and increases their sales share from 57 to 62%. 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 aggregate markup increases from 1.15 to 1.17.

We also note that the TFP losses from misallocation increase in the new steady state, from 9.0 to 9.2%. 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.

This policy reform leads to a non-negligible 0.8% increase in wages. Intuitively, the reallocation of production towards larger, unconstrained corporate firms reduces the capital wedge and increases the demand for labor. We also note that steady-state wealth inequality increases at the very top, with the wealth share of the top 0.1% increasing from 19 to 21%, owing to the increase in the profits of the richest firm owners.

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

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 6 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. Output and productivity eventually converge to values below those in the initial steady state, due to the decline in entrepreneurs' wealth and the resulting increase in misallocation.

Panel B of Table 7 shows that 94.4% of households gain from this policy. The median household experiences a welfare gain of 1.7%. All workers and approximately one-fifth of firm owners 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 7 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 15%. These agents operate relatively small businesses and are taxed by this policy. Finally, extremely productive firm owners, those who own very large firms, benefit from the subsidies brought about by the reform, with the most productive ones experiencing a welfare gain of approximately 15%.

To summarize, we find that size-dependent subsidies aimed at reducing the dispersion in the marginal product of labor benefit workers, even though they increase firm profits, markups and concentration. Because such policies increase aggregate labor productivity, they increase wages and benefit most households.

For completeness, we also evaluate the impact of size-dependent sales taxes, as in the work of Guner et al. (2008), that halve the sales share of the largest 0.1% of firms, thus reducing concentration. As the last column in Table 7 shows, such an intervention leads to a decline in markups, but comes at the cost of a sharp decline in allocative efficiency, wages, and welfare.

We have also shown in Boar and Midrigan (2019) that alternative product market interventions, such as quantity and price caps, have similar implications as explicit size-dependent taxes and subsidies. Our conclusions are therefore not driven by the assumption that size-dependent policies take the form of explicit sales taxes, as opposed to other restrictions on firm size.

To conclude, product market concentration is not necessarily costly, even in an environment with highly unequal firm ownership. What is costly is dispersion in the marginal product of factors of production. If the efficient size-distribution of firms is more concentrated than the actual one, as Hsieh and Klenow (2009) document, policies that induce reallocation towards the more efficient firms benefit the median worker, despite the resulting increase in top wealth inequality.

7 Profit Taxes

We next evaluate the implications of a profit tax aimed at directly alleviating the distributional consequences of markups. 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. 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.[12] Since profits amount to 17% of GDP in our economy, the additional tax revenue collected 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 profit 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.[13] Even though this policy affects a minority of producers, the high concentration of profits in our economy implies that approximately one-half of all profits, or 8% of GDP, are taxed.

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 8. We note that the tax increases the number of active producers by 19%, primarily reflecting an increase in the fraction of entrepreneurs from 6.4 to 7.7%. The mass of corporate producers

[12] The results we report below scale linearly with the size of the tax.

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

falls considerably, by 14%, owing to a reduction in after-tax profits which depresses the incentives to incorporate. 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 1.5% drop in TFP. Wealth inequality falls significantly, with the the top 1% wealth share declining from 36 to 31%. The drop in TFP and tightening of credit constraints reduces the demand for labor and capital, which lowers the wage rate by 3.4%. Even though the policy reduces personal income taxes, the median after-tax wage falls by approximately 1%.

Figure 8 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 4% in the median household's after-tax wage. This increase is fairly long-lived, as it takes more than 50 years for the median after-tax wage to fall below its initial value. Interest rates, in contrast, fall initially, owing to the sharp decline in the demand for capital.

Panel B of Table 8 shows that 86.1% of all households gain from the introduction of a profit tax. The median household experiences a welfare gain of 1.7%. Not surprisingly, firm owners lose from the reform, with the median owner experiencing a welfare loss of 0.9%.

Tax on Profits Above Cutoff. Consider next the implications of only taxing profits in excess of the cutoff. As the last column of Table 8 shows, the qualitative implications of this policy are similar to those of a tax on all profits, but smaller in magnitude: the tax reduces the mass of corporate firms by 3.1%. As Panel B of Table 8 shows, 82.2% of households benefit from this policy, with the median household experiencing a welfare gain of 0.6%.

To summarize, a tax on profits that redistributes income from firm owners to workers increases the welfare of the median household, despite the resulting drop in output, productivity and wages. As we show below, however, this conclusion is sensitive to the details of how one models entry into the corporate sector.

8 Alternative Model Variants

We showed above that policies that eliminate the dispersion in the marginal product of labor benefit most households, despite the resulting rise in firm concentration. We also showed that most agents in our economy benefit from a tax on profits that redistributes from firm owners to workers.

We next study several perturbations of our model in an attempt to gauge the robustness of these results. We first study a variation of the model with free entry into the corporate sector, and show that the welfare consequences of product market interventions are robust to this modification. In contrast, profit taxes reduce welfare because they lead to a much sharper drop in the number and productivity of corporate firms.

We then study a simplified version of our model in which firms are subject to 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 Free Entry into the Corporate Sector

Here we assume that entrepreneurs cannot incorporate. Instead, financial intermediaries create new corporate firms by paying a fixed cost and drawing a permanent productivity level z from a log-normal distribution with mean $\bar{z}_c$ and variance $\sigma_{z_c}^2$. We discuss this version of the model in greater detail in Boar and Midrigan (2019). Here, we simply note that the free-entry condition is

$$F \geq \frac{1-\varphi}{1+r_t}\mathbb{E}_z\left(Q_{t+1}(z) + (1-\tau_c)\pi_{t+1}^c(z)\right),$$

where

$$Q_t(z) = \frac{1-\varphi}{1+r_t}\left(Q_{t+1}(z) + (1-\tau_c)\pi_{t+1}^c(z)\right)$$

is the value of a corporate firm with productivity z and F is the entry cost. In this version of the model the mass of potential firms is endogenous and responds to changes in the environment due to changes in firm entry. The rest of the model is otherwise the same as our benchmark economy. We report the details of the calibration in the Appendix.

Product Market Policies. As Table 9 shows, the welfare implications of product market interventions are nearly unchanged. For example, a uniform sales subsidy generates a social welfare loss of 1.6%, compared to 1.9% in our benchmark model. Size-dependent sales subsidies generate a welfare gain of 1.2%, compared to 1.4% in our benchmark model. The model's implications for macroeconomic aggregates and concentration are also similar to those in our benchmark economy. Interestingly, a size-dependent subsidy reduces wealth inequality in the economy with free entry, by redistributing away from private business owners.

Profit Taxes. Table 9 shows that a tax on all profits now leads to a social welfare loss of 0.1%, in sharp contrast to our benchmark model in which a profit tax leads to a social welfare gain of 1.7%. The reason for this discrepancy is that in the model with free entry, unlike in our benchmark model, the distribution of productivity is endogenous. Specifically, a profit tax depresses the incentive to create new corporate firms, reducing their mass by much more than in our benchmark model: 32% vs. 14%. In addition, since firms learn their productivity after deciding whether to enter, the profit tax reduces the mass of both productive and unproductive corporate firms equally. This results in a much larger decline in TFP compared to our benchmark model in which only the unproductive firms choose not to incorporate in response to the higher profit taxes.

Interestingly, a tax on profits above a cutoff leads to even larger welfare losses in the model with free entry. Intuitively, 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 entrepreneurs, more than half of whom benefit from such a policy.

We therefore conclude that the welfare consequences of taxing profits depend greatly on the exact details of the model. Though a Lucas (1978) – style model in which the productivity distribution is exogenous indeed predicts positive gains from taxing this relatively inelastic margin, a Hopenhayn (1992) – style model in which the distribution of firm productivity is elastic predicts exactly the opposite. More generally, adding additional margins of adjustment, such as firm innovation investments, as in the work of Atkeson et al. (2018), would reduce the scope for using profit taxes as a tool of redistribution. Given the uncertainty surrounding the elasticity of such investments to corporate profit taxes (Akcigit et al., 2018a), such a margin is an important empirical and theoretical avenue for future research but is beyond the scope of this paper.

8.2 Random Subsidies

One concern that is often voiced in discussions about concentration is that size differences across firms reflect not only fundamental differences in productivity, quality or demand[14], but also other factors that benefit some firms at the expense of others. For example, some

[14] 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.

firms may have better political connections and receive implicit or explicit subsidies (Akcigit et al., 2018b), benefit from monopsony power (Gouin-Bonenfant, 2018, Berger et al., 2019) 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.

The firm's optimal price in this economy is

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

and its 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 expand. 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 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 leave all parameters, including the super-elasticity, unchanged and choose the variance of the log-normal distribution of these subsidies to generate a TFP loss from misallocation of 25%. If the correlation between the subsidy and productivity were zero, the model would predict a strong negative relationship between size and average labor productivity. To match the positive relationship in the data, it must be that the correlation between productivity and the subsidy is negative, so we calibrate it accordingly, to reproduce the 0.039 elasticity of labor productivity to firm sales.

Table 10 reports the results of these experiments. Panel A contrasts the outcomes in the model without subsidies with the allocations chosen by a planner who only places weight on the utility of workers. Under the planner's allocations the welfare of the consumer increases by 17%, reflecting redistribution from the firm owners and the removal of the production distortions induced by markups. We next introduce the size-dependent subsidy in (13), 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. As earlier, welfare increases despite an increase in firm concentration.

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 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.

8.3 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 8.2, 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.[15]

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 the welfare of the consumer increases by 16%. 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 sales 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.

[15] See Atkeson and Burstein (2008).

8.4 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 the combined market share of the firms that merge.[16]

As Panel B of Table 11 shows, the mergers generate large welfare losses. The consumer experiences a welfare loss of 27% relative to the planners' allocations. This loss reflects a further increase in the income share of firm owners and more severe production distortions.

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 sales 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.

As this stylized example makes it clear, even though size-dependent sales 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.

[16] See, for example, Brooks et al. (2016) and Gaubert and Itskhoki (2018).

9 Conclusions

We study the implications of product market interventions and profit taxes using a model of firm dynamics and incomplete markets in which firm ownership is highly concentrated and 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 draw three lessons from this exercise. First, uniform sales subsidies that remove the aggregate labor wedge and increase the labor share redistribute towards richer households due to general equilibrium effects. They therefore generate welfare losses for most consumers, in sharp contrast to the predictions of representative agent models in which firm ownership is equally distributed. Second, product market concentration is not costly in and of itself, even though it increases markups and wealth inequality at the top. If larger firms have a higher marginal product, as the evidence suggests, reallocating workers towards these firms increases wages and the median household's welfare. Third, the effect of redistributive profit taxes is ambiguous and depends the elasticity of investments in new varieties.

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Table 1: Firm Owners in the Wealth and Income Distribution

	Fraction of entrepreneurs	Share held by entrepreneurs	Fraction of C-corp owners	Share held by C-corp owners
Panel A. Wealth distribution				
All	0.065	0.308	0.006	0.065
Top 1%	0.489	0.494	0.108	0.150
Top 5%	0.341	0.421	0.059	0.097
Top 10%	0.253	0.380	0.037	0.084
Bottom 50%	0.021	0.032	0.001	0.002
Panel B. Income distribution				
All	0.065	0.183	0.006	0.031
Top 1%	0.382	0.452	0.076	0.095
Top 5%	0.295	0.384	0.050	0.074
Top 10%	0.199	0.320	0.031	0.060
Bottom 50%	0.035	0.040	0.002	0.003

Notes: The numbers in the table are based on the 2013 SCF survey. Entrepreneurs are defined as self-employed non C-corp business owners who are actively engaged in managing the business. C-corp owners are defined as self-employed who own at least one C-corp business and are actively engaged in its management.

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	6.5	6.4
Average debt to capital ratio	0.35	0.35	Wealth to income ratio	6.1	6.0
Average income tax rate	0.23	0.23	Wealth share of entrepreneurs	0.31	0.25
Average income tax rate p95-99	0.27	0.27	Income share of entrepreneurs	0.18	0.19
Average income tax rate p99-99.5	0.31	0.30	Gini wealth, all hhs	0.81	0.82
Average income tax rate p99.5-99.9	0.33	0.33	Gini income, all hhs	0.58	0.58
			Gini wealth, entrepr.	0.76	0.86
			Gini income, entrepr.	0.69	0.78
			Gini wealth, workers	0.78	0.75
			Gini income, workers	0.52	0.52
			Fraction of corporate firms	0.05	0.05
			Sales share of corporate firms	0.63	0.57

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	0.36	corporate profits tax
τ_k	0.20	capital gains tax
φ	0.04	exit rate, corporations
χ	0.20	retained ownership stake

C. Calibrated Parameter Values

Group 1			Group 2		
σ	29.24	demand elasticity	β	0.928	discount factor
λ	1.737	leverage constraint	ρ_z	0.991	AR(1) z
τ	0.259	income tax schedule, level	σ_z	0.069	std. dev. z shocks
ξ	0.073	income tax schedule, progressivity	ρ_e	0.955	AR(1) e
			σ_e	0.341	std. dev. e shocks
			F	40.52	cost of selling business
			η	0.021	probability selling opportunity

Table 3: Non-targeted Moments

	Data	Model		Data	Model
A. Wealth Distribution			**B. Income Distribution**		
Share top 1%	0.36	0.36	Share top 1%	0.20	0.21
Share top 2%	0.47	0.43	Share top 2%	0.26	0.26
Share top 5%	0.63	0.56	Share top 5%	0.36	0.37
Share bottom 50%	0.01	0.02	Share bottom 50%	0.14	0.14
Share bottom 25%	0.00	0.00	Share bottom 25%	0.04	0.05
C. Fraction Entrep in Wealth Distribution			**D. Fraction Entrep in Income Distribution**		
Top 1%	0.49	0.38	Top 1%	0.38	0.30
Top 2%	0.43	0.25	Top 2%	0.38	0.22
Top 5%	0.34	0.17	Top 5%	0.29	0.15
Bottom 50%	0.02	0.03	Bottom 50%	0.04	0.04
Bottom 25%	0.02	0.00	Bottom 25%	0.03	0.03
E. Wealth by Entrep in Wealth Distribution			**F. Income by Entrep in Income Distribution**		
Share in top 1%	0.49	0.51	Share in top 1%	0.45	0.60
Share in top 2%	0.46	0.45	Share in top 2%	0.44	0.50
Share in top 5%	0.42	0.37	Share in top 5%	0.38	0.39
Share in bottom 50%	0.03	0.07	Share in bottom 50%	0.04	0.05
Share in bottom 25%	0.03	0.00	Share in bottom 25%	0.03	0.03
G. Stockholdings in Wealth Distribution			**H. All Firm Owners**		
Share top 1%	0.36	0.46	Fraction in population	0.07	0.07
Share top 2%	0.48	0.52	Share of wealth	0.37	0.37
Share top 5%	0.66	0.64	Share of income	0.21	0.21
Share bottom 50%	0.01	0.02			
Share bottom 25%	0.00	0.00			

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 and not legally organized as a C-corp. Stockholdings in the model are calculated assuming that all households hold the same share of their wealth in publicly traded stocks.

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	1.33	1.13	1.65	1.17
p10	1.08	1.11	1.06	1.09	1.11
p25	1.11	1.14	1.09	1.15	1.13
p50	1.15	1.18	1.12	1.41	1.16
p75	1.18	1.25	1.16	1.90	1.20
p90	1.22	1.80	1.19	2.53	1.23

B. Macroeconomic Implications

	Baseline	No distortions	No markup distortions	No credit distortions
Losses from misallocation, $\times 100$	9.0	0	8.8	0.9
Aggregate labor wedge, M	1.15	1	1	1.12
Aggregate capital wedge, Λ	1.33	1	1.14	1.12
Labor share, WL/Y	0.58	0.67	0.67	0.59
Sales share of corporate firms	0.57	0.27	0.63	0.20
$\Delta \log TFP$, $\times 100$		9.0	0.1	8.1
$\Delta \log K/Y$, $\times 100$		28.9	16.0	17.2
$\Delta \log Y/L$, $\times 100$		27.9	8.2	20.7
$\Delta \log W$, $\times 100$		41.9	22.2	23.0

Table 5: Effect of Uniform Sales Taxes and Subsidies

	Baseline	Uniform subsidy	Uniform tax
A. Steady-State Implications			
number active producers	1	1.01	0.99
percentage entrepreneurs	6.4	6.4	6.3
corporate sales share	0.57	0.59	0.54
top 1% wealth share	0.36	0.35	0.38
top 0.1% wealth share	0.19	0.18	0.20
aggregate markup	1.15	1.15	1.15
tfp loss misallocation, %	9.0	9.4	8.4
Δ output, %	–	1.3	-1.7
Δ mass corp. firms, %	–	2.6	-5.9
Δ tfp, %	–	-0.4	0.5
Δ wage, %	–	15.6	-18.6
interest rate, %	2.0	2.8	1.2
median average tax rate	0.15	0.29	-0.06
median marginal tax rate	0.21	0.34	0.02
B. Welfare Gains, Consumption Equivalent			
utilitarian welfare gains, %		-1.9	2.3
all households			
percent better off		27.2	72.7
p25 gains, %		-2.8	-0.3
p50 gains, %		-1.8	2.3
p75 gains, %		0.1	3.5
workers			
percent better off		25.8	74.2
p50 gains, %		-1.8	2.3
firm owners			
percent better off		46.6	52.0
p50 gains, %		-0.4	0.3

Table 6: Alternative Financing of Uniform Sales Subsidy

A. Progressivity Unchanged $\xi = 0.073$

	no uniform subsidy	uniform subsidy
average tax bottom 50%	0.11	0.26
average tax top 5%	0.33	0.44
Δ output, %	–	1.3
utilitarian gains, $\times 100$	–	-1.9

B. Increased Progressivity $\xi = 0.15$

	no uniform subsidy	uniform subsidy
average tax bottom 50%	0.03	0.19
average tax top 5%	0.44	0.53
Δ output, %	-11.1	-10.0
utilitarian gains, $\times 100$	9.1	7.2

Table 7: Effect of Size-Dependent Sales Taxes and Subsidies

	Baseline	Size-dependent subsidy	Size-dependent tax
A. Steady-State Implications			
number active producers	1	0.67	1.45
percentage entrepreneurs	6.4	4.2	9.3
corporate sales share	0.57	0.62	0.46
sales share top 0.1% firms	0.28	0.28	0.14
top 1% wealth share	0.36	0.36	0.36
top 0.1% wealth share	0.19	0.21	0.15
aggregate markup	1.15	1.17	1.12
tfp loss misallocation, %	9.0	9.2	12.4
Δ output, %	–	-0.1	-3.5
Δ mass corp. firms, %	–	-19.5	22.6
Δ tfp, %	–	-0.2	-3.4
Δ wage, %	–	0.8	-9.3
interest rate, %	2.0	2.1	1.8
median average tax rate	0.15	0.15	0.14
median marginal tax rate	0.21	0.21	0.20
B. Welfare Gains, Consumption Equivalent			
utilitarian welfare gains, %		1.4	-7.6
all households			
percent better off		94.4	3.2
p25 gains, %		1.6	-8.3
p50 gains, %		1.7	-8.1
p75 gains, %		1.8	-7.5
workers			
percent better off		99.9	0.0
p50 gains, %		1.7	-8.1
firm owners			
percent better off		18.8	48.0
p50 gains, %		-2.3	-0.4

Table 8: Effect of Profit Taxes

	Baseline	25% tax all profits	25% tax above cutoff
A. Steady-State Implications			
number active producers	1	1.19	1.00
percentage entrepreneurs	6.4	7.7	6.4
corporate sales share	0.57	0.60	0.58
top 1% wealth share	0.36	0.31	0.33
top 0.1% wealth share	0.19	0.15	0.16
aggregate markup	1.15	1.15	1.15
tfp loss misallocation, %	9.0	10.5	9.5
Δ output, %	–	-3.4	-1.3
Δ mass corp. firms, %	–	-14.0	-3.1
Δ tfp, %	–	-1.5	-0.5
Δ wage, %	–	-3.4	-1.0
interest rate, %	2.0	2.1	2.0
median average tax rate	0.15	0.13	0.14
median marginal tax rate	0.21	0.19	0.20
B. Welfare Gains, Consumption Equivalent			
utilitarian welfare gains, %		1.7	0.6
all households			
percent better off		86.1	82.2
p25 gains, %		0.8	0.2
p50 gains, %		1.7	0.6
p75 gains, %		2.3	0.9
workers			
percent better off		89.7	82.7
p50 gains, %		1.8	0.6
firm owners			
percent better off		36.2	74.4
p50 gains, %		-0.9	0.4

Table 9: Economy with Free Entry

	Baseline	Uniform subsidy	Uniform tax	Size-dependent subsidy	Size-dependent tax	25% profit tax all	25% profit tax above cutoff
Δ mass corp. firms, %	–	6.2	-10.1	0.0	-7.6	-31.8	-20.5
percentage entrepreneurs	7.1	6.0	7.0	3.9	8.7	7.2	7.2
Δ output, %	–	1.2	-1.9	-1.1	-2.9	-5.1	-1.8
Δ tfp, %	–	0.0	-0.1	-0.4	-4.4	-4.3	-2.1
top 1% wealth share	0.29	0.25	0.33	0.25	0.36	0.26	0.29
top 0.1% wealth share	0.15	0.13	0.18	0.13	0.16	0.13	0.14
Δ wage, %	–	16.2	-19.4	-0.8	-9.1	-6.9	-2.6
interest rate, %	2.0	2.9	1.1	2.3	1.4	1.8	1.7
median average tax rate	0.16	0.30	-0.05	0.16	0.15	0.13	0.14
median marginal tax rate	0.22	0.35	0.03	0.22	0.21	0.22	0.20
utilitarian welfare gains, %	–	-1.6	1.8	1.2	-8.7	-0.14	-0.21
percent workers better off	–	28.2	71.6	99.9	0.0	41.8	37.2
median worker gains, %	–	-1.7	1.9	1.4	-9.3	-0.2	-0.3
percent firm owners better off	–	44.1	54.9	25.0	30.0	8.9	55.9
median firm owners gains, %	–	-0.5	0.5	-1.2	-3.9	-1.7	0.1

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

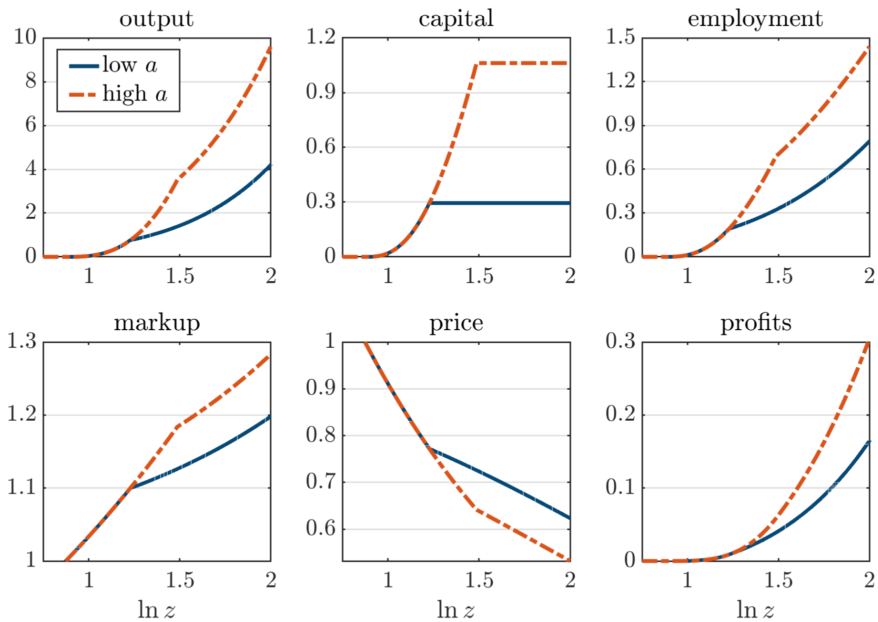
Notes: output, tfp, consumption, hours and welfare gains are expressed relative to the baseline economy (without random subsidies in Panel A and with random subsidies in Panel B).

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: 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 2: Discrete Choice

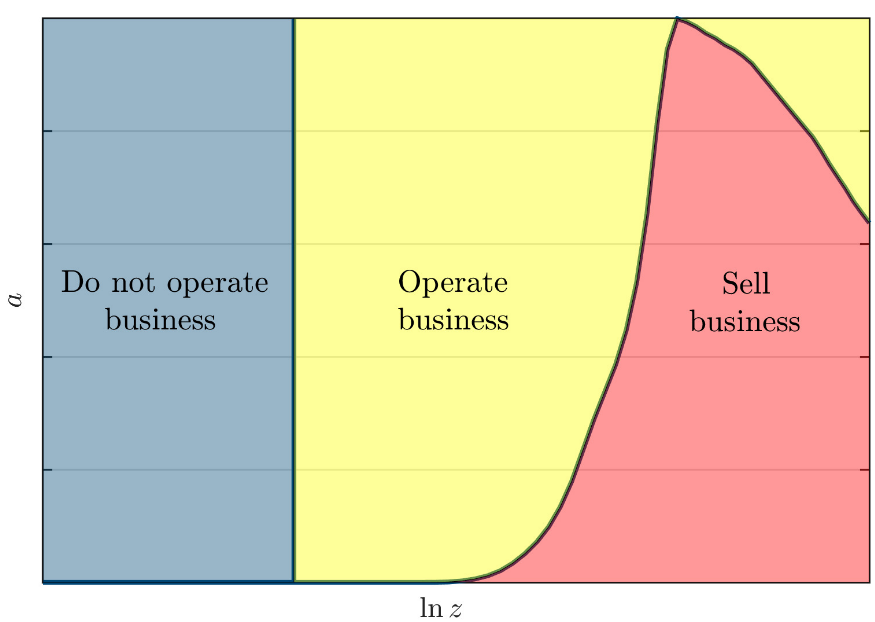
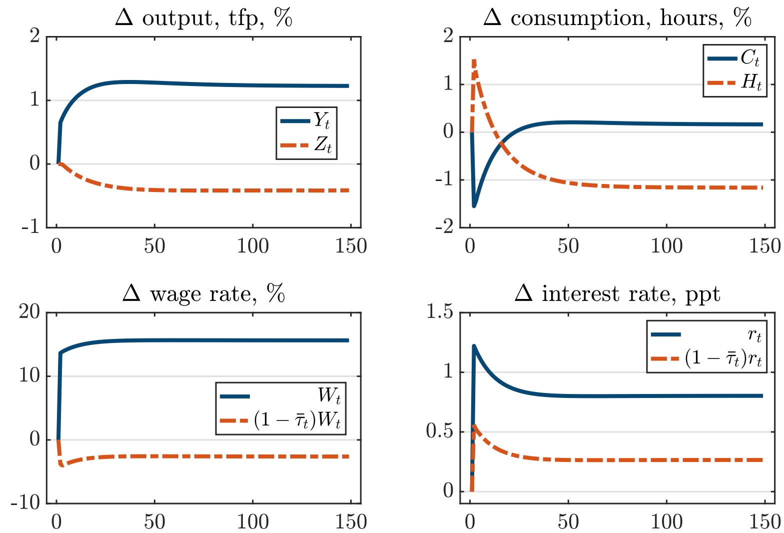
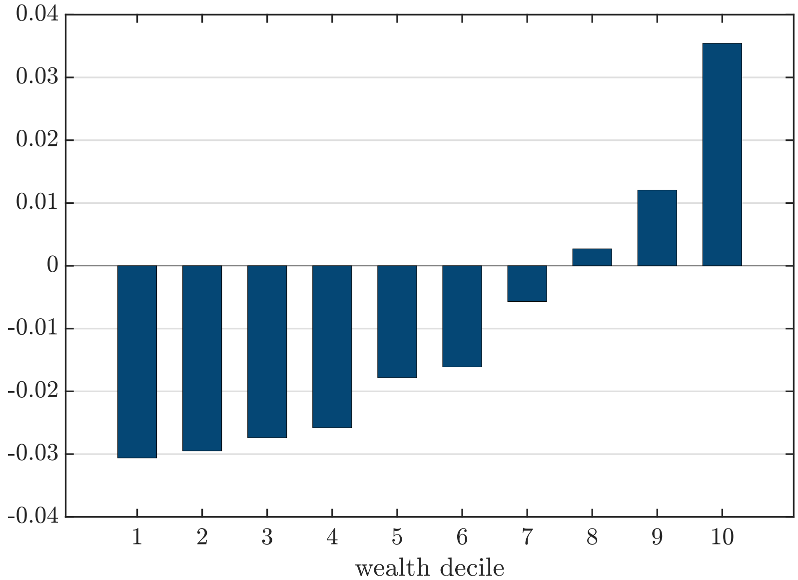


Figure 3: Transition Dynamics: Uniform Subsidy



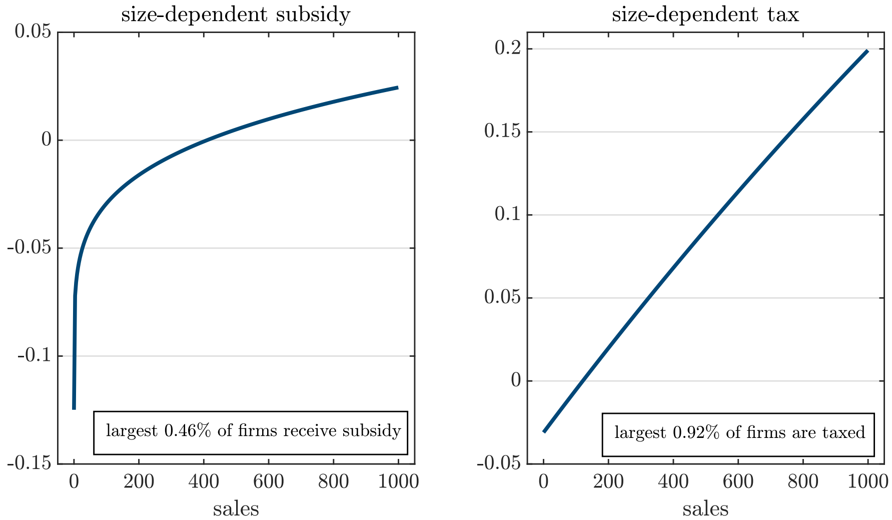
Notes: The figure shows the transition dynamics after the introduction of a 15% sales subsidy. With the exception of interest rates, all graphs report % deviations from the initial steady state. The x-axis shows years after the policy reform.

Figure 4: Welfare Gains from Uniform Subsidy



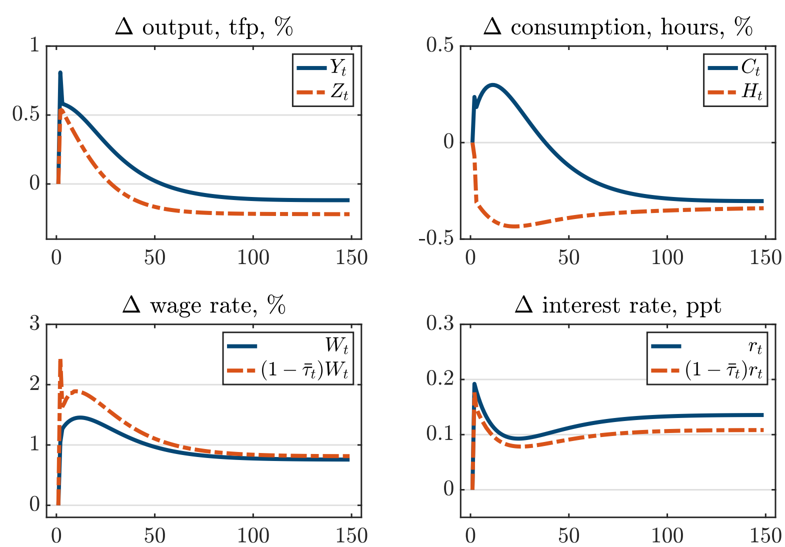
Notes: The figure reports the mean consumption-equivalent welfare gains by wealth decile.

Figure 5: Size-Dependent Policies



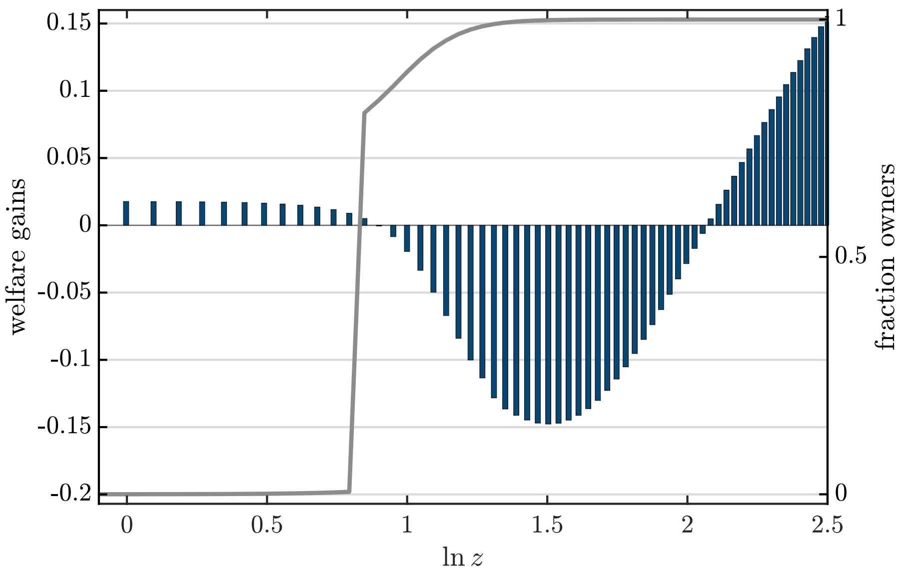
Notes: The left panel shows the marginal subsidy used in the experiment with size-dependent subsidies. The right panel shows the marginal tax used in the experiment with size-dependent taxes.

Figure 6: 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 7: Welfare Gains from Size-Dependent Subsidy



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

Figure 8: Transition Dynamics: 25% Tax on All Profits