How to Tax Capitalists in the Twenty-First Century?*

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Abstract

We study a design of the optimal tax system in an economy featuring active business owners running closely held, highly profitable businesses–a.k.a. capitalists in the twenty-first century. In line with the current U.S. law, they choose a legal form of firm's organization between a pass-through entity and a C corporation, which determines the way their business income is taxed. The model captures a key trade-off between these forms, C corporations face double taxation of profits but have easier access to external equity and can insure better against investment risk, relative to pass-through entities. Through endogenous selection, our model generates the predominant position of the pass-through business owners in line with the U.S. data. We compute the optimal fiscal policy under two revenue-neutral scenarios. Under the current U.S. legal restrictions, we find that the reform maximizing social welfare of the population cuts corporate income tax by half and decreases the progressivity of the tax code. This implies sizeable switch of economic activity towards C corporations, which improves allocation of capital in the economy but worsens the insurance provision and resource redistribution for workers. Under the uniform tax code for business income, we find that progressivity of the labor tax code should rise and business income tax should be set to 36 percent. This optimal policy *strictly dominates* in terms of welfare the optimal policy computed under the current legal framework. Separation of labor income taxation from business income taxation enables the Ramsey planner to separate distortions of the labor supply margin from the distortions of the productive capital accumulation and the choice of the legal form of business organization margins.

Keywords: Firm heterogeneity; Legal forms of organization; Optimal taxation

JEL Codes: E62; H21; H32; L2

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1 Introduction

How to tax businesses efficiently? What is the optimal tax system that takes into account the peculiar characteristics of business income in the twenty-first century? In this paper, we tackle these questions in the context of the United States. The difficulty in addressing them stems from at least three features of the existing U.S. tax system, which are also present in many developed economies. First, the personal income tax code applies to wages and salaries, interest income, dividends and some business income, which implies labor income and some part of the capital income are subject to the same tax schedule. Second, business owners can choose their legal form of organization which has implications for whether their business income is taxed according to the corporate income tax code (C corporations) or personal income tax code (pass-through businesses).[1] Third, there is multidimensional heterogeneity among workers and business owners, which interacts with the tax code and complicates the design of an optimal tax system.

In this paper, we confront these challenges by studying an optimal design of a business income tax code in a quantitative, general equilibrium model, which incorporates heterogenous workers and entrepreneurs, an endogenous choice of a legal form of business organization and a realistic representation of the U.S. tax system. The endogenous choice of a legal form is a critical, novel feature of the model applied to the optimal policy analysis. As we document in Dyrda and Pugsley (2019b) past tax reforms induced U.S. businesses to adjust their organizational form to take advantage of the tax code. Following 1986 and 2001 reforms, which both reduced personal income taxes at the top of the income distribution, a significant number of U.S. firms organized as C corporations switched to the pass-through form.[2] Our model captures in a stylized way the trade-off entrepreneurs face between running the two organizational forms, which emerges from the existing legal framework in the United States. Profits of pass-through businesses are entirely channelled to the owners and taxed according to the personal income tax code. Owners of pass-through entities finance, using only their equity, a capital investment of the firm and face uninsurable investment risk. In contrast, profits of the C corporation are taxed first at the entity level based on the corporate income

[1] Recently, Smith, Yagan, Zidar, and Zwick (2019) document the rising importance of the pass-through business owners in the US economy post-1999 labelling them as capitalists in the 21 century. Also, using LBD data Dyrda and Pugsley (2019a) document that this trend goes back to 1980.

[2] The main type of pass-through businesses i.e. S corporation must be a domestic corporation with at most 100 individual share holders (an S corp cannot be a subsidiary of another corporation or partnership) with only one class of stock. Certain types of businesses such as those in financial services are also ineligible. In particular pass-through businesses can not be publicly traded companies. See https://www.irs.gov/businesses/small-businesses-self-employed/s-corporation

tax code and further, whenever the dividends are paid out, the owners pay the dividend income tax. Unlike the pass-through businesses, the owners of the C corporations can fully diversify the investment risk they face by having access to external equity. This feature of the model reflects the current legal status, in which pass-through businesses have limited ability to raise external equity. Apart from the double taxation of profits, another downside of running a C corporation is an overhead fixed cost. These features generate the economic trade-off between two legal forms: double taxation of profits with overhead costs but access to external equity for C corporations versus single taxation of profits but reliance on self-financing. The resolution of this trade-off in our model generates the selection pattern broadly observed in the data. Conditional on the level of wealth, the higher are the profits the larger is the propensity of entrepreneurs to organize as a C corporation. On the other hand, conditional on profits level, the wealthier the entrepreneur is the lower is her propensity to be organized as a pass-through business. On top of the heterogenous entrepreneurs, the model incorporates heterogeneity among the workers, who face uninsurable, idiosyncratic labor productivity risk following the standard incomplete markets model. Thus, we capture a broad spectrum of heterogeneity of business owners and workers in our environment.

We discipline the parameters of the model using four major sets of targets. We impose that the model replicates basic macroeconomic relationships between consumption, investment, capital, government expenditure and debt observed in the NIPA statistics. Second, we discipline the productivity process of the workers and entrepreneurs by income inequality statistics characterizing labor and business incomes in the IRS data. On the entrepreneurial side, we impose on the model the firm size distribution and flows between the legal forms, which are consistent with the administrative data from the Longitudinal Business Database (LBD). Finally, we replicate the non-linear personal income tax code with a flexible parametrization of the tax-transfer function proposed by Benabou (2002), which has been successfully implemented recently into the quantitative models with heterogeneity[3]. We alse test the endogenous selection mechanism by comparing the model-generated propensity to be organized as a pass-through business with the empirical counterparts from the Survey of the Consumer Finances (SCF). We conclude, that our quantitative theory generates selection patterns into different forms of business organization, which are broadly consistent with the one observed in the U.S. data.

The model disciplined by recent microeconomic data is our departure point for the optimal policy analysis. As a metric for policy evaluation, we use the notion of the social welfare

[3]See for instance Krueger and Ludwig (2016), Heathcote et al. (2017a) or Ferrière and Navarro (2018).

function, which is a weighted average of the social welfare of workers and entrepreneurs. Our optimal policy analysis seeks for the policies, which maximize welfare gains in terms of lifetime consumption[4] and are *revenue neutral*. We employ the Ramsey approach, in which we stick to particular parametric forms of taxes. We start with the experiment in which we restrict the tax system to the current US legal framework, where the personal income tax code applies to both labor income as well as to the business income from running a pass-through firm. Corporate income tax is imposed on profits of C corporations and dividend income is pulled with other personal income and taxed according to the personal income tax code.

The optimal system, which maximizes the weighted average social welfare calls for a reduction of the corporate income tax from 19.7 percent to 8.4 percent. The progressivity of the tax code falls by 17 percent (the progressivity parameter in our tax function drops from 0.095 to 0.079). The policy yields average welfare gain of 1.62 percent. Such policy induces a switch of economic activity towards C corporations, the fraction of businesses organized as pass-throughs falls from 70 percent to 10 percent. As a result, the economy experiences the reallocation labor and capital towards larger and more efficient firms with better access to external funding, which has positive consequences for the macroeconomic aggregates. The aggregate output increases by 2.3 percent, whereas the employment falls by 1.3 percent. Reallocation of capital leads to increase of wages, which is beneficial for workers and largely drives the implied welfare gains. To illustrate the tension between the interests of workers and entrepreneurs we analyze the policy maximizing only entrepreneurial welfare. Under this scenario the optimality calls for abandoning the corporate income tax and reduction in the progressivity of the tax code, with the progressivity parameter falling to 0.035. This policy further improves allocation of capital in the economy, since the distortion on the capital accumulation margin is reduced, but is detrimental from the insurance and redistributive perspectives of the workers. As a result, workers' welfare falls by 0.3 percent.

Next, we abandon the current U.S. legal framework, which imposes differential tax treatment of pass-throughs and C corporations and study the optimal design of the tax code assuming *uniform business income taxation*. Under this scenario, the profits of both pass-through businesses and C corporations are taxed according to the same tax code and double taxation of profits for C corporations is abolished. The return on safe assets (interest income), as well as the labor income, remain taxed according to the personal income tax code

[4]Current results are computed by a comparison of stationary equilibria. Maximizing welfare including transitional effects in this economy poses significant numerical challenges and it is currently a work in progress.

modelled as nonlinear tax-transfer schedule. The optimality in this case calls for an increase in the progressivity of tax-transfer system imposed on labor income, relative to the current U.S. system. Uniform business tax is set at the rate of 35.9 percent. The fraction of pass-through businesses falls by half to 36 percent. Such policy yields the average welfare gains in population of 5.75 percent, with average 0.18 percent gain for workers and 46.1 percent gain for entrepreneurs. Hence, this policy scenario *strictly dominates* the optimal policy under the current legal framework. These welfare gains are concentrated among workers since more progressive tax code offers insurance against productivity risk for them and redistribute resources towards the poorest ones. At the aggregate level this reform implies a decline in the aggregate capital and output, even though the economic activity is moved towards larger and more productive C corporations. The uniform business tax is more distortive for capital accumulation among the C corporations, as it replaces the distortion caused by the corporate income tax of 19.7 percent. Again, to illustrate the tension between the interests of workers and entrepreneurs we analyze the policy maximizing only entrepreneurial welfare. In this case the optimality calls for low and flat labor income tax and uniform business income tax of 29.9 percent. Such policy boosts labor supply, leading to increase in output and employment relative to the baseline economy, concentrated mostly among pass-through business forms. Importantly it is detrimental for workers, whose welfare falls by 0.84 percent due to lost benefits of the progressive tax code.

The key takeaway from our analysis is that separation of labor income taxation from business income taxation enables the Ramsey planner to separate distortions on the labor supply margin from the distortions on the capital accumulation and choice of the legal form of business organization. The uniform business income taxation allows the planner to alleviate the impact of the borrowing constraints for allocation of productive capital across the two legal forms, which can not be achieved under the current legal framework. The magnitude of the business income tax is largely driven by three factors: (i) the revenue neutrality requirement imposed on our experiments (ii) the weight of the workers in the planner's objective function (iii) the strength of the market incompleteness. The quantitative importance of these factors determines the level of the uniform business tax and the macroeconomic effects following the implementation of the optimal policy. We consider several extensions to our benchmark experiment (i) non-linear uniform business taxation (ii) taxation of capital gains (iii) endogenous the interest rate (iv) short-term secured borrowing with collateral constraint. The results of these extensions are still pending.

2 Related literature

This paper is linked to the quantitative macro public finance literature. There is a vast and important literature studying the effects and design of the tax systems in heterogeneous agents models with idiosyncratic labor income risk in either Ramsey or Mirrlees tradition—see Golosov et al. (2003), Domeij and Heathcote (2004), Conesa, Kitao, and Krueger (2009), Poschke et al. (2012), Krueger and Ludwig (2016) Heathcote et al. (2017a) or Stantcheva (2017) among many others. At the same time there is also a large body of the literature inspecting the effects of the capital income taxes in the presence of the uninsurable investment risk - see Panousi (2008), Meh and Terajima (2009), Panousi and Reis (2012), Evans (2014). In particular Scheuer (2014) studies optimal taxation of profits and labor income under endogenous firm formation in two cases, when profits and labor income are subject to the same schedule and under the assumption of differential treatment of profits and labor income. Our exercise of separating labor income tax code from uniform business tax is similar in spirit. A number of interesting and important lessons emerge from these studies on the effects of capital income and labor income taxation in an environment with idiosyncratic and uninsurable shocks (be it capital or labor income shocks). Nonetheless, the existing papers abstract from legal forms of organization of businesses and the possibility of reorganization, which directly affects whether the same business activity is taxed as labor, capital or both. We show that incorporating an endogenous choice of business legal form is important to understand the full effects of both business and personal income tax reforms in a quantitative framework. Thus, the main contribution of this paper is to study the optimal design of the tax system in a quantitative model, which incorporates this margin explicitly.

There are few related papers, which model explicitly legal forms of organization. Short and Glover (2019) focus on the incorporation decision of entrepreneurs and quantify the role of the limited liability, which is the dimension of heterogeneity among entrepreneurs we abstract from in the paper. Chen et al. (2014) evaluate the effects of corporate tax cuts on the employment in a model, where the choice of legal form is endogenous. They abstract from the accumulation of capital by entrepreneurs and risk premium, the features which are central to our analysis and relevant for the economic mechanism we propose. Recently, Bhandari and McGrattan (2018) develop a theory of pass-through businesses and estimate an aggregate sweat equity value of 0.65 times GDP, with little cross-sectional dispersion in valuations when compared to business net incomes and large cross-sectional dispersion in rates of return.

Smith, Yagan, Zidar, and Zwick (2019) show that pass-through income of top earners

more closely reflects returns to high human capital embodied in individuals than returns to capital. They attribute a significant fraction of the rise in top incomes to these pass-through business owners. We use their label of "Capitalists in the Twenty-First Century" for pass-through businesses who are predominant in our model.

3 The importance of pass-throughs in the US

3.1 Overview of the legal forms of organization in the U.S.

Business owners in the United States may organize their enterprises in a variety of ways, subject to the applicable laws of their state. The choice would usually reflect their needs for capital, as for flexibility, and to limit their personal liability for any business debts by their business equity. The choice of the organizational form also determines how a business will be taxed at the federal level. An early and fundamental decision the owner must make is whether to incorporate. Corporations may have an unrestricted number and type of owners, and the typically have four characteristics: (i) limited liability (ii) centralized management (iii) free transferability of interest (iv) continuity of life. Limited liability implies that each owner's liability for the debts of the firm is limited to the amount of his or her investment. The centralized management means that the decision making belongs to the board of directors and not directly to the general owners. Free transferability of interest implies that each owner may sell his or her interest without the permission of the other owners. The continuity of life ensures that the firm does not automatically dissolve upon the death, bankruptcy, or withdrawal of the owner. These capabilities of an incorporated business are desirable, if not essential, for a growing business with significant need for outside equity. However, for a smaller scale business the flexibility of a corporate organizational form may be unnecessary.

The decision about incorporation affects how a business is taxed, but it is not the only one. All the unincorporated businesses are taxed in the same way but not all the corporations are taxed identically. The main legal forms of organization in the United States are: (i) sole proprietorship (ii) general partnership (iii) limited partnership (iv) limited liability company (iv) S corporation (v) C corporation. Their main characteristics are illustrated in Table 1. In terms of limited liability the owners of sole properietorship and general partnership are not protected from the debts of the firm, whereas other unincorporated businesses (limited partnership, LLCs) offer some or full protection. In terms of the taxation, C corporation pay the corporate income tax on their profits at the entity level. Then, whenever the after-tax profits are distributed to the shareholders in forms of the dividends, shareholders pay

dividend income tax. Also, shareholders pay tax on any capital gains they realize when they sell shares of stock in the corporation. The profits of an S corporation "pass through" to its owners income taxes according to each owners equity stake in the business. The cost of this simplicity is rigid rules on the type and number of S corporation shareholders.[5] S corporations, along with the other unincorporated legal forms do not pay corporate income tax on profits. Instead, all profits pass through to their owners, who pay individual income tax on them, independently on whether the profits were actually distributed or not. Hence, the common names for these businesses - "pass-through" entities.

Table 1: Main Characteristics of Different Organizational Forms for Businesses

	Number of Owners	Liability Protection	Taxation of Profits
Sole Properietorship	1	No	Pass-through
General Partnership	More than 1	No	Pass-through
Limited Partnership	1+	No for partners Yes for limited part.	Pass-through
LLC*	1+	Yes	Pass-through
S Corporation	$1-100$	Yes	Pass-through
C Corporation	1+	Yes	Entity level

*LLC - Limited Liability Company.

3.2 Empirical decomposition: Entrants vs. Incumbents

In 2012 the LBD data the pass-throughs constituted 78 percent of all US businesses and they rose by roughly 30 percent from 1980, which we illustrate in Figure 1. To understand the determinants of the increasing share of pass-throughs we adopt the simple dynamic decomposition from Pugsley and Sahin (2015) to capture the effects on the entry, exit and

[5]S corporations must be a domestic corporation with at most 100 individual share holders (an S corp cannot be a subsidiary of another corporation or partnership) with only one class of stock. Certain types of businesses such as those in financial services are also ineligible. See https://www.irs.gov/businesses/small-businesses-self-employed/s-corporation

conversion margins.[6] To do this Let $\Omega_t = (C_t, P_t)'$ be a vector with the number of firms in each organizational form, and let ω_t be the vector expressed as a share, that is normalized by the total number of firms, $\Omega_t'\iota$. This can be easily generalized to more states, e.g., letting type also depend on firm age or sector. The law of motion for the number of firms can be written as

$$\Omega_t = \begin{bmatrix} \theta_{ct}^c (1 - x_{ct}) & \theta_{pt}^c (1 - x_{pt}) \\ \theta_{ct}^p (1 - x_{ct}) & \theta_{pt}^p (1 - x_{pt}) \end{bmatrix} \Omega_{t-1} + \begin{bmatrix} \theta_t^c \\ \theta_t^p \end{bmatrix} S_t$$

Here, x_{lt} is the exit rate of firms of type l between $t-1$ and t; $\theta_{lt}^{l'}$ is the share of surviving type l firms that switch from l to l' in period t; θ_t^l is the share of entering firms that are type l; S_t is the total number of new firms.

We can further simplify this law of motion as

$$\Omega_t = \Theta_t' \text{diag}\,(1 - x_t)\,\Omega_{t-1} + \theta_t S_t,$$

where we refer to the matrix $\Theta_t \equiv \left[\theta_{it}^j\right]$, which collects the conversion shares of surviving firms, as the reorganization matrix. By convention, row i is current type, l, and column j is new type, l', so the matrix is transposed in the law of motion. x_t is a vector of each type's exit rate, and $\text{diag}(1 - x_t)$ puts the vector of survival rates on the diagonal of a symmetric square matrix with zeros everywhere else. Finally, θ_t is a vector of the startup shares, i.e., the initial distribution of each type.

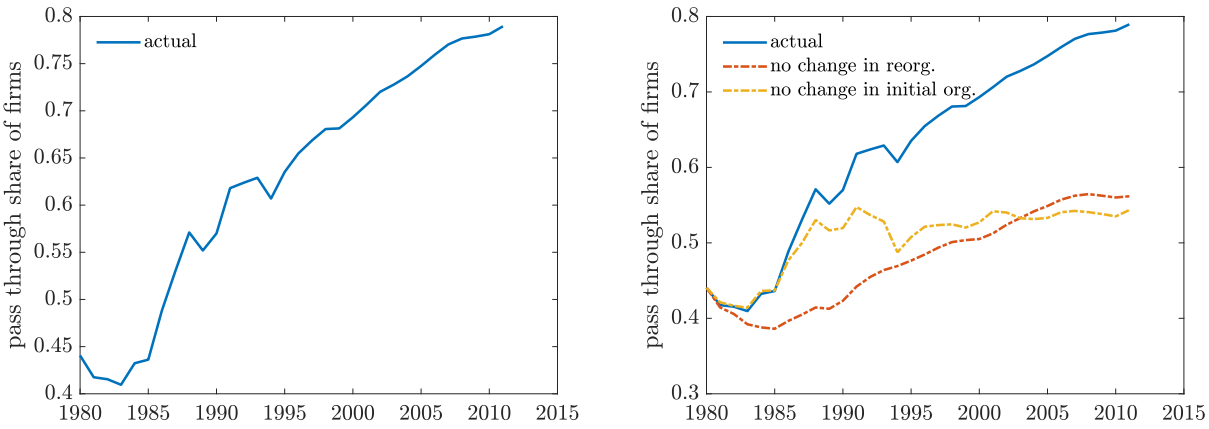
We then normalize by the total number of firms to express the law of motion in shares

$$\omega_t = \Theta_t' \text{diag}\,(1 - x_t)\,\frac{\omega_{t-1}}{1 + g_t} + \theta_t s_t. \tag{3.1}$$

Here, ω_t, is the vector each type's share of the total number of firms in year t; g_t is the growth rate of the total number of firms; and s_t is the startup rate of new firms (number new firms/total number of firms). We measure the empirical counterparts to these objects using the Census Bureau's Longitudinal Business database for the years 1980 to 2011. The law of motion provides an exact decomposition, which allows us to isolate the roles of reorganization and initial choice of legal form in determining the changes in the distribution of legal forms while taking into account their full dynamic effects.

[6] See also Dent et al. (2016).

Figure 1: Fraction of pass-thorughs in the US and roles of changing reorganization and initial organization, 1980-2012



Source: Census LBD and Business Register

Role of changing reorganization patterns. First, we isolate the role of changes in the reorganization patterns by constructing the following counterfactual evolution of the distribution of legal forms over time $\{\widetilde{\omega}_t^{\bar{\Theta}}\}$. Starting from the initial distribution of legal forms ω_{1980}, we solve forward along equation (3.1) using the *actual* sequence of exit x_t, startup rates, s_t, growth in the number of firms g_t, and initial distribution of legal forms, θ_t, but holding the reorganization matrix fixed at its 1980-83 average, $\bar{\Theta}_{80} = \frac{1}{4}\sum_{t=1980}^{1983}\Theta_t$,

$$\widetilde{\omega}_t^{\bar{\Theta}} = \bar{\Theta}_{80}' \text{diag}\,(1-x_t)\,\frac{\widetilde{\omega}_{t-1}^{\bar{\Theta}}}{1+g_t} + \theta_t s_t.$$

The counterfactual sequence of shares $\{\widetilde{\omega}_t^{\bar{\Theta}}\}$ captures the predicted evolution in the distribution of legal forms had there been no changes (because of the TRA1986, for example) in the patterns of incumbent reorganization. We then label the gap $\omega_t - \widetilde{\omega}_t^{\bar{\Theta}}$ between the actual evolution of legal forms and the counterfactual evolution as due to changes in incumbent reorganization.

Overall, changes in reorganization patterns had major effect on the long run increase in the number of businesses organized as pass throughs. Figure 1 plots the actual and counterfactual sequences of pass through shares from 1980 to 2012. The gap between the red and blue line represents the increase in pass throughs our decomposition attributes to shifts in the patterns of reorganization. Over the long run, changes in reorganization patterns have contributed a relatively large share to the increase in pass throughs. By 2012, the share of

pass throughs would be 25 percentage points lower had it not included the cumulative effects of changes since the early 1980s in reorganization. During a period beginning roughly with the TRA1986, shifts in reorganization explained almost overall increase in pass throughs.

Role of changing initial organization patterns. The other margin for explaining the long run increase in pass throughs is shifting reorganization but shifting patterns initial organization. We next construct a counterfactual sequence of shares $\{\widetilde{\omega}_t^{\bar{\theta}}\}$ designed to capture this margin. Again starting from the initial distribution of legal forms ω_{1980}, we solve forward along equation (3.1) using the *actual* sequence of exit x_t, startup rates, s_t, growth in the number of firms g_t, and reorganization matrix Θ_t, but now holding the initial distribution of legal forms fixed at its 1980-83 average, $\bar{\theta}_{80} = \frac{1}{4}\sum_{t=1980}^{1983}\theta_t$,

$$\widetilde{\omega}_t^{\bar{\theta}} = \Theta_t' \text{diag}\,(1 - x_t)\,\frac{\widetilde{\omega}_{t-1}^{\bar{\theta}}}{1 + g_t} + \bar{\theta}_{80} s_t.$$

The counterfactual sequence of shares $\{\omega_t^2\}$ captures the predicted evolution in the distribution of legal forms had there been no changes in the initial choice of legal forms of entrants. We attribute the gap $\omega_t - \widetilde{\omega}_t^{\bar{\theta}}$ to changes in the distribution of initial legal form. As we illustrate in Figure 1 this margin started to play an important role in the post 1995 period.

4 Model with endogenous choice of legal form

In this section we develop a model with heterogenous workers and entrepreneurs featuring endogenous choice of the legal form of organization for entrepreneurs. The model captures stylized trade-off between the legal forms. The income of the pass-through entities is taxed once according to the personal income tax code. Owners of the pass-through entities finance capital from their own equity and are subject to the undiversified investment risk. The income of the C corporation is subject double taxation, to the corporate income tax is levied on profits at the entity level and the dividend income tax is levied on the dividend payouts to the owners. Contrary to the pass-through entity, C corporations have access to the perfectly elastic supply of external equity and their owners can diversify completely an investment risk. On the top of that running the C corporation is associated with some overhead, fixed costs. These features introduce trade-off between fully diversified risk but double taxation of profits and fixed costs of operation and undiversified investment risk but single taxation of profits. We exploit this trade-off and illustrate how it changes as a result of the tax reforms and secular shifts in productivity and further how endogenous choice of the legal form of

organization translates into the income distribution. In what follows we present the details of the model.

Demographics. There is a measure one of individuals in the economy. Each individual is one of the two types: worker or entrepreneur. The lifespan of both types is infinite. We denote the fraction of entrepreneurs in the model by μ. The fundamental difference between these two types is that entrepreneurs have access to the production technology and use it to run a firm, while workers do not and they supply their labor services in the market. Entrepreneurs can organize their businesses in two ways: as a pass-through entity or as C corporation. We denote the fraction of entrepreneurs organized as pass-through entities by p. Thus in every period we have $(1-\mu)$ of workers, μp of pass-through entrepreneurs and $\mu(1-p)$ of entrepreneurs with firms organized as C corporations in the model economy.

Preferences. Households in the economy have standard preferences over consumption c and leisure $1-h$ ordered by

$$\mathbb{E}_0\left[\sum_{t=0}^{\infty}\beta^t u\left(c_t, 1-h_t\right)\right]$$

where $\beta \in (0,1)$ is the discount factor, u satisfies standard conditions and expectation operator is with respect to the idiosyncratic shocks.

Technology. Every entrepreneur has an access to the decreasing returns to scale technology $f(z,k,n)$ transforming physical capital k and labor input n into the consumption good. Variable z represents the entrepreneur-specific productivity shock which follows the Markov process Γ_z. We impose the following functional form for the technology

$$f(z,k,n) = z^{1-\nu}\left(k^{\alpha}n^{1-\alpha}\right)^{\nu}$$

where the presence of fixed factor z induces the decreasing returns to scale. Given the installed capital k and productivity z every firm generates the gross profits

$$\pi(k,z) = \max_{n}\left\{z^{1-\nu}\left(k^{\alpha}n^{1-\alpha}\right)^{\nu} - wn\right\}. \tag{4.1}$$

It will be convenient to express gross profits according the following lemma.

Lemma 1 *Given the homogeneity of the technology in z, k, and n and if labor markets are competitive where each unit of labor n is paid its marginal product, gross profits may be*

expressed as the sum of the return to capital and the return to the entrepreneur's productivity (Ricardian rent), i.e.,

$$\pi(k, z) = f_k k + f_z z.$$

Proof. Given the technology is homogeneous of degree 1 in all factors, the result follows immediately from Euler's theorem noting with a competitive labor market, $f_n = w$. ■

Timing. The timing of the events within a period is as follows:

1. The entrepreneur makes a decision about the legal form of organization and about investment into a business.
2. Productivity shock z, ε are realized.
3. Labor supply and labor inputs are decided.
4. Production occurs. All agents receive their respective earnings.
5. The government levies taxes on personal, dividend and corporate income, then makes transfers and finances the exogenous government spending.
6. Consumption, saving decisions are made.

Workers. The individual state of the worker is an asset position $a \in \mathcal{A}$ and idiosyncratic productivity shock $\varepsilon \in \mathcal{E}$, where ε follows the Markov process Γ_ε. Workers choose consumption c, labor supply h and next period asset position a' subject to the budget constraint and no borrowing constraint. Their income y consists of interest income ra and labor income $wh\varepsilon$. Thus the problem of the worker is

$$\begin{aligned} V^W(a, \varepsilon) &= \max_{c.h,a'} u(c, 1-h) + \beta \mathbb{E}\left[V^W(a', \varepsilon') | \varepsilon\right] \\ &\quad \text{subject to} \\ &\quad c + a' = a + y - T_i(y) \\ &\quad y = ra + wh\varepsilon \\ &\quad a' \geq \underline{a} \end{aligned} \tag{4.2}$$

where $T_i(\cdot)$ is the personal income tax schedule.

Entrepreneurs: pass-through entity. The individual state of the pass-through entrepreneur is $a \in \mathcal{A}$ personal asset position, $e \in \mathcal{E}$ capital invested in the business and productivity shock $z \in \mathcal{Z}$, where z follows the Markov process Γ_z. Entrepreneur chooses consumption c and savings s, which further in the next stage are split into safe asset a' and next period capital invested into the business e'(the split depends on the choice of the legal form of organization). Her income y consists of the return on the individual asset ra and the profits form running a firm $\pi(e, z)$. Undepreciated value of the capital $(1-\delta)e$ is added to her budget constraint. Income net of the value of depreciated capital is subject to the personal income tax levied according to the tax schedule $T_i(\cdot)$ specified later. An entrepreneur can finance the capital stock only through her own equity and is subject to exogenous borrowing constraint. Hence, the dynamic programming program becomes

$$\begin{aligned} V^P(a, e, z) &= \max_{s,c} u\left(c, 1-\overline{h}\right) + \beta W^P(s, z) \\ &\quad \text{subject to} \\ &\quad c + s = y + a + (1-\delta)e - T_i(y - \delta e) \\ &\quad y = ra + \pi(e, z) \\ &\quad s \geq \underline{a} \end{aligned} \tag{4.3}$$

where W^P is the continuation value that takes into account discrete decision about changing the legal form of organization, which is specified later on.

Entrepreneurs: C corporation. The individual state of the entrepreneur that enters the period as C corporation consists of personal $a \in \mathcal{A}$ personal asset position and productivity shock $z \in \mathcal{Z}$, where z follows the Markov process Γ_z. Entrepreneur chooses consumption c and savings s. Her income consists of the return on the individual assets ra and the Ricardian rents (dividend) from running the C corporation $D(z)$, which are net of the corporate income tax. The tax base for the corporate income tax is reduced by the fixed costs associated with running the C corporation, which are denoted by c_f. Income is subject to the dividend income tax levied on Ricardian rents and returns on assets according to the tax schedules

$T_d(\cdot)$. Hence, the dynamic programming problem of the C corproation owner becomes

$$\begin{aligned} V^C(a,z) &= \max_{s,c} u\left(c, 1-\overline{h}\right) + \beta W^C(s,z) \\ &\text{subject to} \\ &c + s = y + a - T_i(ra + D(z)) \\ &y = ra + D(z) \\ &D(z) = (1-\tau_c)\left(f_z(k^*)z - c_f\right) \\ &s \geq \underline{a} \end{aligned} \tag{4.4}$$

where W^C is the continuation value that takes into account discrete decision about changing the legal form of organization, which is specified below.

Continuation values: converting decision. At the beginning of every period entrepreneur chooses the legal form of organization. The pass-through entrepreneur may continue to operate with current legal form or convert to a C corporation by selling its equity to the mutual fund. The revenue from the transaction adds up to the personal assets. If she chooses to continue as pass-through entrepreneur she has to decide how much to invest into the business, i.e. $'e'$. Thus, the continuation value for pass-through entrepreneur is

$$W^P(s,z) = \max\left\{\mathbb{E}\left[V^C(s,k^*(z),z')\middle| z\right] + f_{PC}, \max_{e'\leq s-\bar{a}}\left\{\mathbb{E}\left[V^P(s-e',e',z')\middle| z\right]\right\}\right\}.$$

The owner of the C corporation can convert to the pass-through entity or continue to operate with the current legal form. If she converts, she has to decide how much to invest into the business, i.e. e'. Therefore, the continuation of the pass-through entrepreneur value becomes

$$W^C(s,z) = \max\left\{\mathbb{E}\left[V^C(s,k^*(z),z')\middle| z\right], \max_{e'\leq s-\bar{a}}\left\{\mathbb{E}\left[V^P(s-e',e',z')\middle| z\right] + f_{CP}\right\}\right\}.$$

The switching costs f_{CP} and f_{PC} are i.i.d. with a logistic distribution with dispersion parameter σ_f. Hence the continuation values of can be written as

$$\begin{aligned} W^P(s,z) &= \sigma_f \ln\left\{\exp\left\{\frac{\mathbb{E}\left[V^C(s,k^*(z),z')\middle| z\right] - f_{PC}}{\sigma_f}\right\}\right. \\ &\quad \left. + \exp\left\{\frac{\max_{e'\leq s-\bar{a}}\mathbb{E}\left[V^P(s-e',e',z')\middle| z\right]}{\sigma_f}\right\}\right\}. \end{aligned}$$

and the decision rule becomes conditional choice probability

$$\Pr\left(C\left|s,P\right.\right) = \frac{\exp\left\{\frac{\mathbb{E}\left[V^{C}(s,k^{*}(z),z')\middle|z\right]-f_{PC}-\max_{e'\leq s-\bar{a}}\mathbb{E}\left[V^{P}(s-e',e',z')\middle|z\right]}{\sigma_{f}}\right\}}{1+\exp\left\{\frac{\mathbb{E}[V^{C}(s,k^{*}(z),z')|z]-f_{PC}-\max_{e'\leq s-\bar{a}}\mathbb{E}[V^{P}(s-e',e',z')|z]}{\sigma_{f}}\right\}}$$

and $W^{C}\left(s,z\right)$, $\Pr\left(C\left|s,P\right.\right)$ are determined accordingly.

Mutual fund. The owners of the C corporations in the model have access to the infinitely elastic supply of outside equity, through the mutual fund, at the cost of $1+r$. The mutual fund is an institution that makes investment decisions for the C corporations and aggregates the idiosyncratic risks faced by their owners and hence by the law of large number it is able to fully diversify it, so that it does not face any uncertainty with respect to the aggregate profits. Thus, the optimal capital stock $k^{*}(z)$ is determined by equalizing the expected marginal return on the capital net of depreciation and corporate income tax with the marginal opportunity cost of investing one more unit of physical capital, i.e.

$$\mathbb{E}[(1-\tau_{c})\left(\pi_{k}(k^{*};z')-\delta\right)|z]+1=1+r \tag{4.5}$$

where τ_{c} is the corporate income tax.

Aggregation and Market Clearings. In every period there is a fixed fraction $1-\mu$ of workers and μ of entrepreneurs in the economy. Let $a\in A=[a_{\min},\infty]$ and $\varepsilon\in\epsilon$, where ϵ is the domain of the productivity shock and further let $(A\times\epsilon,\mathcal{B}\left(A\right)\times\mathcal{B}\left(\epsilon\right))$ be a measurable space of individual assets and workers productivities, where $\mathcal{B}\left(A\right)$ and $\mathcal{B}\left(\epsilon\right)$ denote the Borel sets. Let $\lambda_{w}:\mathcal{B}\left(A\right)\times\mathcal{B}\left(\epsilon\right)\rightarrow[0,1]$ be the measure of over the space of individual assets and productivities for workers. It evolves according to

$$\lambda_{w}'\left(\mathcal{A},\vartheta\right)=\int_{A\times\epsilon}\mathbb{I}\left\{a'\left(a,\varepsilon\right)\in\mathcal{A}\right\}\Gamma\left(\varepsilon'|\varepsilon\right)d\lambda_{w}\left(a,\varepsilon\right)\quad\forall\mathcal{A},\vartheta\in\mathcal{B}\left(A\right)\times\mathcal{B}\left(\epsilon\right) \tag{4.6}$$

Let $e\in E=[0,\infty]$ and $z\in Z$ where Z is the domain of firm's productivity shocks. Let $(A\times Z,\mathcal{B}\left(A\right)\times\mathcal{B}\left(Z\right))$ be a measurable space of individual assets and firm's productivities of the C corporation owners and let $(A\times E\times Z,\mathcal{B}\left(A\right)\times\mathcal{B}\left(E\right)\times\mathcal{B}\left(Z\right))$ be a space of individual assets, capital invested in a firm and firm's productivities of the pass-through owners. Then define $\lambda_{C}:\mathcal{B}\left(A\right)\times\mathcal{B}\left(Z\right)\rightarrow[0,1]$ as the measure of C corporation owners over the individual states and $\lambda_{P}:\mathcal{B}\left(A\right)\times\mathcal{B}\left(E\right)\times\mathcal{B}\left(Z\right)\rightarrow[0,1]$ as the measure of pass-through owners over the individual states. They evolve according to the following law for all $\mathcal{A},\mathcal{E},\mathcal{Z}\in$

$\mathcal{B}(A) \times \mathcal{B}(E) \times \mathcal{B}(Z)$:

$$\begin{aligned} \lambda'_P(\mathcal{A}, \mathcal{E}, \mathcal{Z}) &= \int_{A \times E \times Z} (1 - \Pr(P|s, C)) \mathbb{I}\{s - e' \in \mathcal{A}\} \mathbb{I}\{e' \in \mathcal{A}\} \Gamma(z'|z) \, d\lambda_P(a, e, z) \\ &+ \int_{A \times Z} \Pr(C|s, P) \, \mathbb{I}\{s - e' \in \mathcal{A}\} \mathbb{I}\{e' \in \mathcal{A}\} \Gamma(z'|z) \, d\lambda_C(a, z) \end{aligned} \tag{4.7}$$

where we skip the dependence of the policy functions on the individual states to economize on notation. The law of motion for the measure of C corporation owners is, for all $\mathcal{A}, \mathcal{Z} \in \mathcal{B}(A) \times \mathcal{B}(Z)$, given by

$$\begin{aligned} \lambda'_C(\mathcal{A}, \mathcal{Z}) &= \int_{A \times Z} (1 - \Pr(C|s, P)) \mathbb{I}\{s \in \mathcal{A}\} \Gamma(z'|z) \, d\lambda_C(a, z) \\ &+ \int_{A \times E \times Z} \Pr(P|s, C) \, \mathbb{I}\{s \in \mathcal{A}\} \Gamma(z'|z) \, d\lambda_P(a, e, z) \end{aligned} \tag{4.8}$$

where we again skip the dependence of the policy functions on the individual states to economize on notation. The number of pass-through owners p is endogenous in the model and determined by

$$p = \mu \left(\int_{A \times E \times Z} (1 - \Pr(P|s, C)(a, e, z)) \, d\lambda_P(a, e, z) + \int_{A \times Z} \Pr(C|s, P)(a, z) \, d\lambda_C(a, z) \right) \tag{4.9}$$

and then by construction the fraction of the C corporation owners is $(1 - \mu)(1 - p)$. Market clearing for labor requires

$$\begin{aligned} \int_{A \times \epsilon} h(a, \varepsilon) \, d\lambda_w(a, \varepsilon) &= \int_{A \times Z} n^*(z) \, d\lambda_C(a, z) \\ &+ \int_{A \times E \times Z} n(a, e, z) \, d\lambda_P(a, e, z) \end{aligned} \tag{4.10}$$

and market clearing for the capital stock requires

$$\begin{aligned} \int_{A \times Z} k^*(z) \, d\lambda_C(a, z) &= \int_{A \times \epsilon} a'(a, \varepsilon) \; d\lambda_w(a, \varepsilon) + \int_{A \times Z} a'(a, z) \; d\lambda_C(a, z) \\ &+ \int_{A \times E \times Z} a'(a, e, z) \; d\lambda_P(a, e, z) \end{aligned} \tag{4.11}$$

where $a' = s - e'$ for the pass-through entrepreneur and $a' = s$ for the C corporation owner.

Government. Government in our model has to finance an exogenous stream of expenditure G using the corporate income tax schedule $T_c(\cdot)$ and personal income tax schedule $T_i(\cdot)$, government debt. It also has access to the lump sum transfer instrument which balances the budget. The revenues from the personal income tax, R_i, the dividend income tax, R_d, the corporate income tax, R_c are

$$\begin{aligned} R_i &= \int_{A\times\epsilon} T_i(wh\varepsilon)\ d\lambda_w(a,\varepsilon) + \int_{A\times E\times Z} T_i(\pi(e,z)-\delta e)\ d\lambda_P(a,e,z) \\ &+ \int_{A\times Z} T_i(D(z)+ra)\ d\lambda_C(a,z) + \int_{A\times E\times Z} T_i(ra)\ d\lambda_P(a,e,z) + \int_{A\times\epsilon} T_i(ra)\ d\lambda_w(a,\varepsilon) \\ R_c &= \int_{A\times Z} \tau^c(\pi(k^*(z);z)-c_f)\ d\lambda_C(a,z) \end{aligned}$$

Hence the intertemporal government budget constraint becomes

$$G + (1+r)B + T = B' + R_i + R_c \tag{4.12}$$

Equilibrium. The general equilibrium is defined as follows.

Definition 1 *Given government policy* $\{G, T_i, T_d, T_c\}$, ***a recursive competitive equilibrium*** *is a set of value functions* $\{V^W, V^P, V^C\}$, *allocations of workers* $X_W = \{a', c, h\}$, *allocations of pass-through entrepreneurs* $X_P = \{a', e', c, d_P\}$, *allocations of C corporation owners* $X_C = \{a', c, d_C\}$, *allocations of labor for pass-through firms and C corporations* $\{n^*, n\}$, *allocation of capital for C corporations* $\{k^*\}$, *prices* $\{r, w\}$ *and measures* $\{\lambda_w, \lambda_P, \lambda_C\}$ *such that*

1. *Given prices, allocations* X_W, X_P, X_C *and value functions* $\{V^W, V^P, V^C\}$ *solve respectively problems* (4.2), (4.3), (4.4).
2. *Given prices, allocations of labor* $\{n^*, n\}$ *and capital* $\{k^*\}$, *solve respectively* (4.1) *and* (4.5).
3. *The probability measures* $\{\lambda_w, \lambda_P, \lambda_C\}$ *evolve according to* (4.6), (4.7), (4.8).
4. *Government budget constraint* (4.12) *is satisfied.*
5. *Market clearing conditions* (4.10), (4.11) *hold.*

5 Qualitative properties of the model

5.1 The role of risk premium

Undiversified investment risk associated with running a pass-through entity induces there exists a risk premium, i.e. pass-through entrepreneurs demand higher return from running the business relative to the owners of the C corporation. The existence of the premium implies different allocation of capital across two legal forms of business organization. The following lemma illustrates that point.

Lemma 2 *Suppose T_i, T_d, T_c are set to zero and the borrowing constraint is slack. Then the allocations of capital for pass-through entities and C corporations are:*

$$e'(a,e,z) = \left[\left(\frac{\Delta}{r+\delta}\right)\left(\frac{\mathbb{E}\left[u_c\left(c(a',e',z')\right),\left(z'^{\frac{1-\nu}{1-(1-\alpha)\nu}}\right)|z\right]}{\mathbb{E}\left[u_c\left(c(a',e',z')\right)|z\right]}\right)\right]^{\frac{1-(1-\alpha)v}{1-v}}$$

$$k^*(z) = \left[\left(\frac{\Delta}{r+\delta}\right)\mathbb{E}\left[\left(z'^{\frac{1-\nu}{1-(1-\alpha)\nu}}\right)\right]\right]^{\frac{1-(1-\alpha)v}{1-v}}$$

where Δ is a constant depending on production function parameters. Moreover, for a given z we have $e' < k^*$ as long as $Cov\left(u_c\left(c(a',e',z')\right),\left(z'^{\frac{1-\nu}{1-(1-\alpha)\nu}}\right)\right) < 0$.

It's clear from the Lemma 2, that as long as the marginal utility of consumption is negatively correlated with the productivity shock then conditional on the current productivity level the amount of capital invested into the pass-through company will be lower than the amount of capital invested into the C corporation. Thus, it follows from the decreasing marginal products property of the production function that the return has to be higher. The inability to insure against productivity risk is crucial for the covariance to be negative. In the complete markets world the idiosyncratic shocks would be perfectly insured and consumption would be unaffected by them. As a result the risk premium would vanish. Following this argument, the lemma below offers a decomposition of the net-of-tax, expected return on private equity.

Lemma 3 *Suppose dividend income tax is linear. Then, the net-of-taxes expected return on equity can be decomposed as follows:*

$$\mathbb{E}\left[\left(1-T_y'\right)\left(f_e-\delta\right)|z\right] = \left(1-\tau_d\right)r - \frac{Cov\left[u_c,\left(1-T_y'\right)f_e|z\right]}{\mathbb{E}\left[u_c|z\right]} + \frac{\zeta}{\beta\mathbb{E}\left[u_c|z\right]}$$

where ζ is the multiplier on the borrowing constraint of the pass-through entrepreneurs.

The first term in the decomposition provided in Lemma 3 is equal to the net-of-tax return on the safe asset. The second term follows from the presence of the uninsurable, investment risk, which ties the marginal utility of consumption with the marginal product of capital for every realization of the individual productivity shock. Market incompletness implies that the covariance term is negative, hence it pushes the rate of return on private equity above the rate of return on safe assets. Finally, the third term reflects the presence of the potentially binding borrowing constraints in the problem of pass-through entrepreneur. Whenever, the constraint is binding, then $\zeta > 0$, which increases the rate of return on private equity.

5.2 The role of taxes

The presence of distortionary taxes on the individual income, dividend income and corporate profits affects the allocation of physical capital and through this channel the distribution of income in the model economy. To illustrate their role the following lemma is useful.

Lemma 4 *Suppose tax schedules are linear, there is no idiosyncratic risk associated with productivity, i.e. z is fixed and borrowing constraint is slack. Then the allocations of capital for pass-through entities and C corporations are:*

$$e'(a,e,z) = \left[\left(\frac{\Delta}{r+\delta}\right)\left(z^{\frac{1-\nu}{1-(1-\alpha)\nu}}\right)\right]^{\frac{1-(1-\alpha)v}{1-v}}$$

$$k^*(z) = \left[\left(\frac{\Delta}{\frac{1}{(1-\tau_c)}r+\delta}\right)\left(z^{\frac{1-\nu}{1-(1-\alpha)\nu}}\right)\right]^{\frac{1-(1-\alpha)v}{1-v}}$$

where Δ is a constant depending on production function parameters. Moreover, for a given z we have $e' < k^*$ as long as $\tau_c > 0$.

Whenever the taxes are linear and there is no idiosyncratic uncertainty the allocation of the capital for the pass-through entrepreneur is unaffected and equal to the undistorted one. As for the capital allocation for the C corporations the presence of the corporate income tax distorts the allocation. It is immediate to see that as long corporate income tax is positive the capital allocated into the C corporation is going to be lower than the one allocated by the pass-through business owner.

6 Calibration

6.1 Model parametrization

In this section we describe the functional forms imposed on the model as well as the calibration strategy. The baseline parameter values and targeted moments are summarized in Table 2 and Table 3.

Preferences. We impose the following preferences for the workers

$$u(c, 1-h) = \frac{c^{1-\sigma}}{1-\sigma} - \psi \frac{h^{1+\frac{1}{\theta}}}{1+\frac{1}{\theta}} \tag{6.1}$$

We abstract from the labor supply decision of the entrepreneurs. We set the risk aversion parameter σ to 1.5. Frisch elasticity of labor supply, θ is set to 0.85, closely in line with estimates provided by Chetty et al. (2011). To discipline the discount factor β we match in the model the capital to output ratio, we take the mean from 2012 to 2016, which is 1.25, where we define capital as the sum of fixed private assets and durable consumption. The parameter governing disutility of labor, ψ, is pinned down by targeting the average hours worked at the household level in the CPS data, where we normalize the total available hours to 1. Hence, we end up with the target value being 0.33.

Demographics and Technology. The fraction of workers in the model economy, μ is exogenous and we discipline it by averaging across waves the fractions of workers in the SCF data, which is 87.9 percent, hence our economy consists of 12.1 percent of entrepreneurs. We impose the following production technology for entrepreneurs

$$f(z, k, n) = z^{1-\nu} \left(k^{\alpha} n^{1-\alpha}\right)^{\nu}$$

The span of control parameter ν and depreciation rate δ are disciplined by matching the set of targets specified in Table 2. The elasticity of the capital stock α is disciplined by the labor income share of 0.64. To discipline the fixed cost of running C corporation we target the average fraction of the C corporations among businesses in LBD between 2004 and 2012, which is equal to percent 25 percent. In order to discipline the fixed costs associated with changing the legal form of business organization f_{PC} and f_{CP} we exploit the panel dimension of LBD data and our estimates of the transition matrices between these two legal forms.

Table 2: Target Statistics and Model Counterpart GE

Statistic	**Source**	**Model**	**Target**
Capital/Output	NIPA	1.17	1.25
Investment/Output	NIPA	0.13	0.13
Avg Labor Supply	CPS	0.38	0.33
Agg Debt to Income	FA	0.23	0.27
Share of Top 1 income	IRS	0.14	0.20
Share of Top 10 income	IRS	0.44	0.48
Share ABOs Income Top 1	IRS	0.46	0.44
Share ABOs Income Top 10	IRS	0.24	0.25
Top 1 Wor Inc Share	IRS	0.91	0.81
Top 10 Wor Inc Share	IRS	0.61	0.55
Fraction of P ent	LBD	0.70	0.75
Flow CP	LBD	0.02	0.02
Flow PC	LBD	0.01	0.01
Logit CH	SCF	-0.68	-1.08
Logit Prof.	SCF	-1.60	-0.93
Logit CH&Prof.	SCF	0.25	0.06

Table 3: Model Parameters

Parameter	Symbol	Discipline	Value
Exogenously imposed			
Fraction of workers	μ	SCF data	0.88
Cons. curvature workers	σ_w	-	1.50
Cons. curvature entrep.	σ_e	-	1.50
Frisch elasticity	ν	-	0.85
Endogenously calibrated			
Discount factor	β	Targets in Table 2	0.91
Depraciation rate	δ	Targets in Table 2	0.11
Labor disutility	ψ	Targets in Table 2	14.46
Borr.constraint	$\underline{a}$	Targets in Table 2	-0.33
Returns to scale	ν	Targets in Table 2	0.85
Persistance ent.	ρ_e	Targets in Table 2	0.98
Std ent. product.	σ_e	Targets in Table 2	0.26
Mean prod. wor.	μ_w	Targets in Table 2	1.39
Persistance wor.	ρ_w	Targets in Table 2	0.94
Std wor. product.	σ_w	Targets in Table 2	0.31
Fixed cost C corp.	c_f	Targets in Table 2	0.01
Switching cost CP	f_{CP}	Targets in Table 2	10.72
Switching cost PC	f_{PC}	Targets in Table 2	14.43
Extreme value shock std	σ_{extr}^{CP}	Targets in Table 2	3.44
Extreme value shock std	σ_{extr}^{PC}	Targets in Table 2	4.48

Productivity processes. We assume labor productivity for workers and entrepreneurs follows the AR1 process governed separate parameters. We also allow for the means of these processes to differ across the occupations. These parameters are mostly pinned down by the labor income inequality statistics, the occupational composition of the top income shares and the total income top shares. The specific targets together with the parameter values are presented in Table 2 and Table 3.

Tax system. The tax system in the model consists of three instruments: the corporate income tax τ_c, the dividend income tax τ_d and the schedule for the personal income tax. We assume that both corporate and dividend income taxes are linear. As for the personal income tax schedule we apply the tax and transfer formula introduced into the class of models with heterogenous agents by Benabou (2002) and used also by Heathcote et al. (2017b) and Ferrière and Navarro (2018):

$$T(y) = y - \lambda_y y^{1-\tau_y}$$

The parameter τ_y determines the degree of progressivity of the tax system and the second parameter, λ_y, shifts the tax function and determines the average level of taxation in the economy.

In order to discipline the corporate income tax, we compute the time series of the average corporate income tax rate following the method proposed by McGrattan and Prescott (2005). We average the tax rate from 2012 to 2016 and set it to 19.7 percent. We discipline the linear dividend income tax by the data on the average marginal dividend income tax computed using TAXSIM. We take the mean of the averages from 2012 to 2012 and set it to 27.7 percent. To estimate the progressivity parameter τ_y we exploit the data on the average marginal income tax on wages, salaries and entrepreneurial income provided by Mertens and Olea (2018) as well as the data from the IRS. We average the progressivity measure from 2012 to 2016 and set τ_y to 0.095. Finally, the λ_y, which controls the average level of personal income taxes, is pinned down by the average tax revenues to GDP in NIPA between 2012 and 2016, which amounts to 21.0 percent.

6.2 Selection into the legal forms: model vs. data

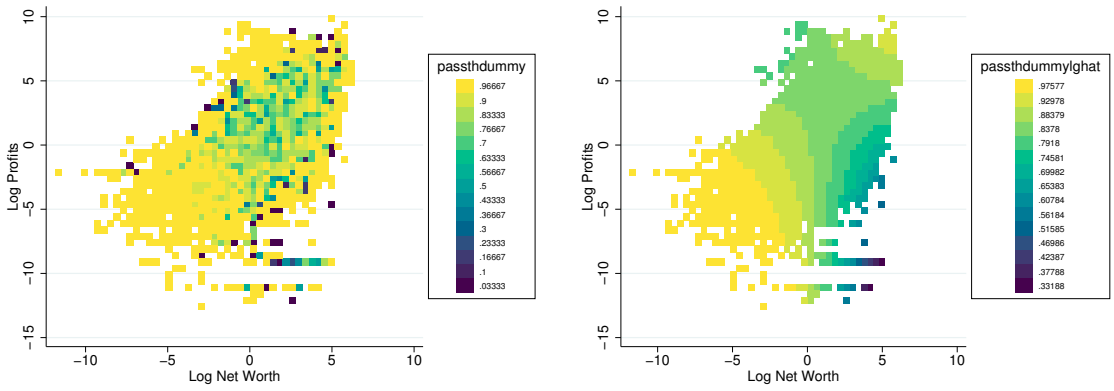
Figure 2 presents the selection into the legal form of organization in the SCF data and the quantitative model. We present two statistics informative about the selection. The left panels in both figures illustrate the empirical distributions of pass-through businesses over profits and wealth. The right panels present the results of the logit regression, which links pass-

through form to profits and wealth. To run the logit regression we split the SCF population into workers and Active Business Owners (ABO) and attach the legal form of organization to each ABO. Next, we run for the ABOs the following logistic regression:

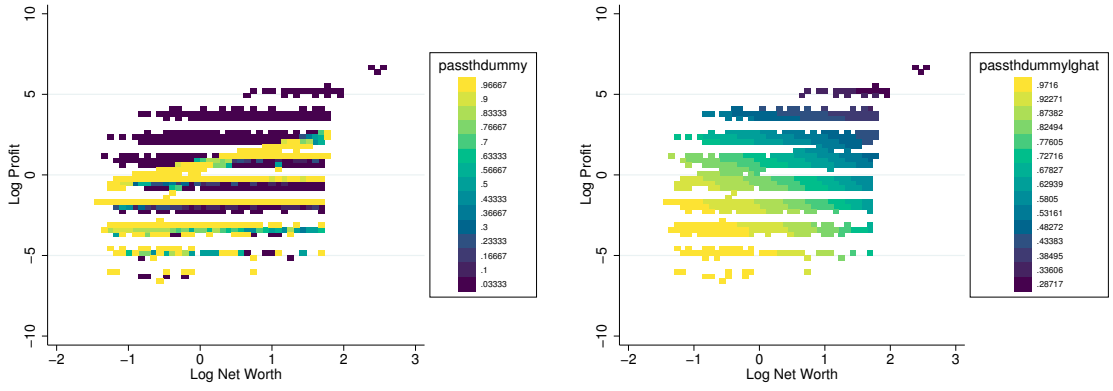
$$\Pr\left(D_{it}=1\right)=F\left(\mu_t+\gamma_1\log\Pi_{it}+\gamma_2\log X_{it}+\gamma_3\log\Pi_{it}\times\log X_{it}\right)$$

where D_{it} is the pass-through dummy, μ_t is the year fixed effect, Π_{it} are profits, X_{it} is the net worth and $F\left(x\right)=\frac{e^x}{1+e^x}$. We use the following SCF waves $t\in\{2004,2007,2010,2013,2016\}$. Under both measures it is clear, that the model replicates increasing number of C corporation as profits are rising, i.e. larger and more profitable businesses are organized as C corporations. However, the model falls short of replicating precisely falling number of pass-through businesses along wealth dimension for a given profit level.

Figure 2: Conditional Probability of observing the pass-through - empirical distribution (left panel), logit regression (right panel). Data (top panel) vs. data (bottom panel)



Notes: SCF waves 2004-2016, the variables are deviations from annual average



Notes: The variables are deviations from average

7 Optimal Policy Experiments

7.1 Social Welfare Function

In order to evaluate tax policies we use the concept of the average social welfare function. We define it separately for workers and entrepreneurs. For workers we have

$$SWF_w(\mathcal{T}) = \int_{A\times Z} V_1^W(a,\varepsilon;\mathcal{T})\, d\lambda_0(a,\varepsilon) \tag{7.1}$$

where $V_1^W(a,\varepsilon;\mathcal{T})$ is the value function in the first period of the transition induced by new tax system $\mathcal{T}$ and $\lambda_0(a,\varepsilon)$ is the initial distribution of workers in the stationary equilibrium under the status quo policy. For the entrepreneurs we first transform the problems 4.4 and 4.3, using cash on hand, x, that entrepreneur has after the production took place and before consumption, savings and investment decisions have been made. The details of this procedure are described in the Appendix. Next, we define the welfare function for entrepreneurs as

$$SWF_e(\mathcal{T}) = \int_{X\times Z} pV_1^P(x,z;\mathcal{T})\, d\lambda_{0P}(x,z) + (1-p)\, V_1^C(x,z;\mathcal{T})\, d\lambda_{0C}(x,z) \tag{7.2}$$

where $V_1^P(x,z;\mathcal{T})$ and $V_1^C(x,z;\mathcal{T})$ are the value functions in the first period of the transition induced by new tax system $\mathcal{T}$ and $\lambda_{0P}(x,z)$, $\lambda_{0P}(x,z)$ are the initial distributions of pass-through businesses and C corporations respectively in the stationary equilibrium under the status quo policy. With the two welfare measures defined by 7.1 and 7.2 we define the social welfare function for the whole population as the weighted sum of the two, i.e.

$$SWF(\mathcal{T}) = \mu\, SWF_w(\mathcal{T}) + (1-\mu)\, SWF_e(\mathcal{T}) \tag{7.3}$$

where μ is the fraction of workers in the population.

7.2 Optimal Tax System

In our optimal policy analysis we seek for the levels of corporate income tax and progressive tax schedule, which maximize the social welfare function defined in 7.3. Therefore, given initial conditions (K_0, B_0), initial fiscal policy $\{\tau_{c,0}, \tau_{y,0}, \lambda_{y,0}\}$ and cross-section of agents determined by a stationary equilibrium, the optimal tax reform is defined as the sequence $\mathcal{T}^* = \{\tau_{c,t}, \tau_{y,t}, \lambda_{y,t}\}_{t=0}^{\infty}$ that maximizes the social welfare function, i.e., that solves, i.e. we

aim to solve the following problem:

$$\mathcal{T}^* \in \arg\max_{\mathcal{T}\in\Gamma} SWF(\mathcal{T})$$

Here Γ is the set of policies for which an associated competitive equilibrium exists. Unfortunately the set Γ is too large a policy space to optimize over. Our objective here is to characterize the optimal one-time policy reform, by restricting the sequences that are being optimized over to:

$$\tau_{c,t} = \tau_{c,1}$$
$$\tau_{y,t} = \tau_{y,1}$$

for all $t \geq 1$. To make sure that the budget constraint is satisfied we adjust $\lambda_{y,t}$ so that the tax revenues to GDP stay at the initial stationary equilibrium level, thus all our reform scenarios are revenue neutral.

7.3 The Optimal Tax System - current U.S. legal framework

In this section we present preliminary results from experiments we have conducted so far. In this section we describe the optimal tax system preserving the common tax schedule for workers and pass-through entrepreneurs, in line with the current legal framework in the US. We relax this restriction in the following section. Table 4 presents the results from the experiment.

We start by maximizing the social welfare defined in 7.3, which is labeled as Optimal Tax System in Tables 4 and 5. The optimal tax system calls for the decline in the progressivity from 0.095 to 0.079. At the same time the corporate income tax is reduced from 19.7 percent to a high rate of 8.4 percent. The fiscal closure parameter, which controls the level of the average tax rises from 0.207 to 0.21. The policy yields significant average welfare gain for entrepreneurs equal to 12.7 percent of lifetime consumption and average welfare gain for workers is 0.1 percent of lifetime consumption. As a result the average welfare gain for the population is 1.6 percent of lifetime consumption. Alternatively, we look for the policies, which maximize entrepreneurial welfare. Maximizing welfare of entrepreneurs calls for further reduction of tax-transfer schedule progressivity with progressivity parameter equal to 0.035 and the corporate income tax rate of 0.0 percent. The average tax rate of labor and pass-through income is similar to the one from maximizing the average welfare experiment, with the fiscal closure parameter equal to 0.212. Such policy is welfare detrimental for workers who

Table 4: Current Legal Framework: The Optimal Tax Schedules

	Baseline Economy	**Optimal Tax System**	**Max. Entr. Welfare**
Progressivity, τ_y	0.095	0.079	0.035
Corporate Income Tax, τ_c	0.197	0.084	0.000
Fiscal closure, $1 - \lambda_y$	0.207	0.210	0.212
Debt to GDP	1.021	1.021	1.021
Revenues to GDP	0.210	0.210	0.210
$\Delta SWF_w(\%)$	-	0.10	-0.34
$\Delta SWF_e(\%)$	-	12.69	13.72
$\Delta SWF(\%)$	-	1.62	1.36

Notes: Welfare gains are reported in terms of Consumption Equivalent Vari ation, i.e. as the percentage by which benchmark consumption has to be increase d in order to make a household indifferent between the two tax systems.

loose 0.3 percent of lifetime consumption, whereas the entrepreneurs gain as much as 13.7 percent of lifetime consumption, which averages to the societal welfare gain of 13.6 percent. The optimal tax-transfer schedules are presented in Figure 3. It is clear that the optimal shape of the schedule in the baseline experiment is driven mostly by large weight of workers in the welfare function.

Macroeconomic effects of the tax reform. The policy experiments we conduct has significant macroeconomic effects, which are illustrated in Table 5. Optimal Tax System policy induces business owners to massively switch towards C corporations, the fraction of pass-through businesses falls to 10.1 percent. As a result the economy experiences the reallocation labor and capital towards larger and more efficient firms, which has positive consequences for the macroeconomic aggregates. The aggregate output increases by 2.3 percent, whereas the employment falls by 1.3 percent. Reallocation of capital leads to increase of wages, which is beneficial for workers and drives welfare gains for them up. As an alternative we solve for the optimal policy, which maximizes the welfare of entrepreneurs. This experiment is much closer in spirit to finding the policy, which maximizes the efficiency of allocation in the model economy. The aggregate picture of the outcomes are even better relative to the baseline economy. Both employment and output increase by 0.2 and 4.4 percent accordingly. The policy leads to a further decline in the fraction of pass-through businesses.

Figure 3: Current US legal framework: The Optimal Tax-transfer Schedules

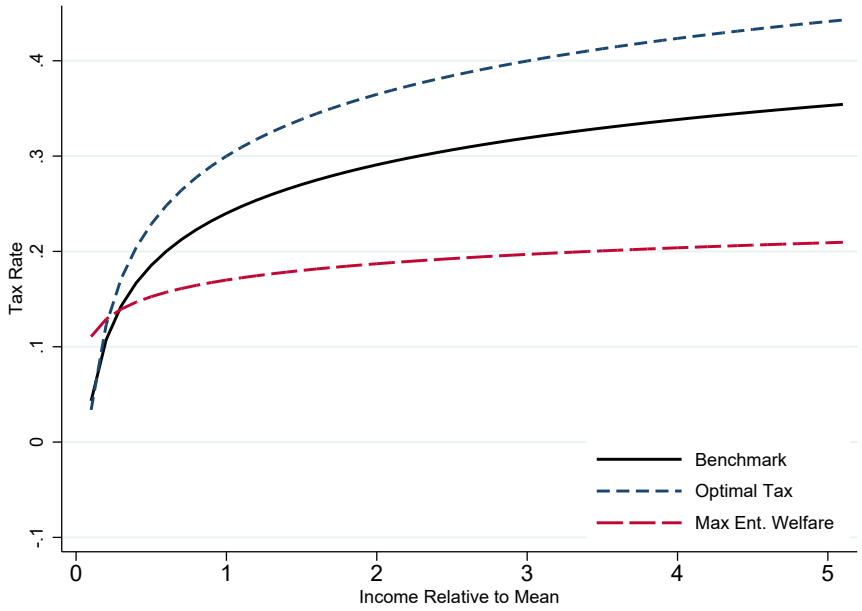
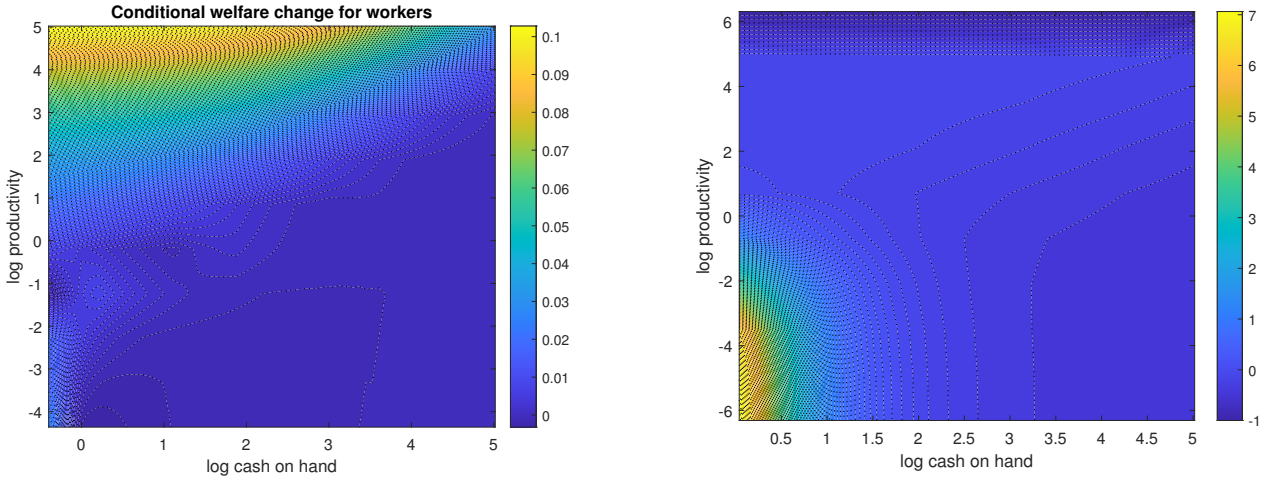


Table 5: Current Legal Framework: Macro Aggregates

	Baseline Economy	**Optimal Tax System**	**Max. Entr. Welfare**
Employment	0.747	0.737	0.749
Output	0.704	0.720	0.735
Capital	0.823	0.933	0.974
Wage	0.603	0.625	0.627
Employment C	0.539	0.653	0.656
Employment P	0.207	0.085	0.094
Output C	0.508	0.637	0.643
Output P	0.195	0.083	0.092
% of Pass-Throughs	69.7	10.1	10.0

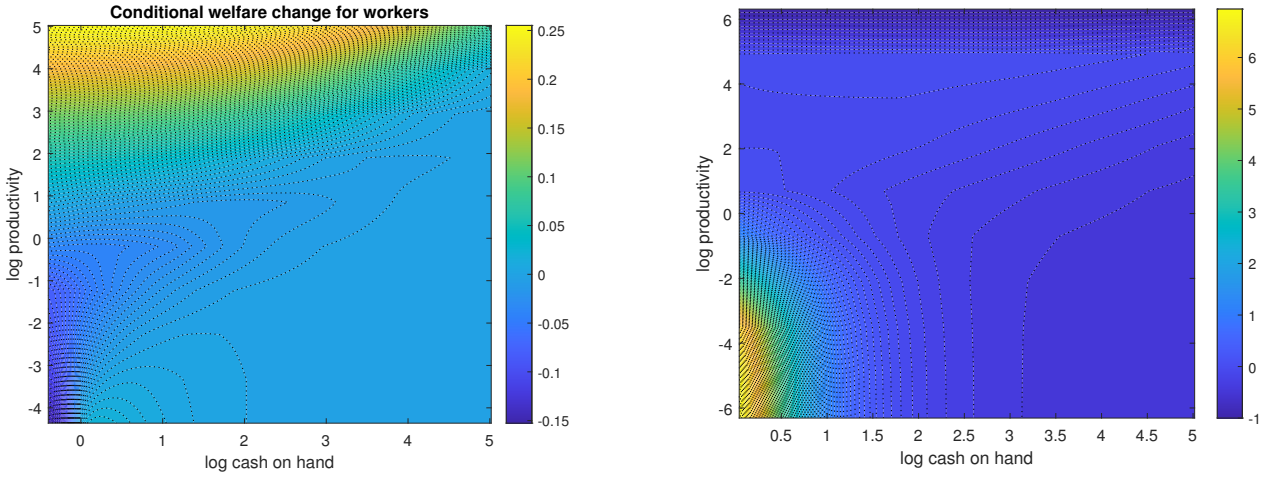
Conditional welfare changes. Figures 4-5 present the conditional welfare measures associated with the two reform experiments we conduct. They are presented in the cash-on-hand and productivity space for both workers and entrepreneurs, hence every individual state variables pair in the initial equilibrium has a separate welfare measure. Unsurprisingly rich and productive workers benefit from the tax reform, which reduces the progressivity of the tax-transfer system. On the other hand, poor and unproductive entrepreneurs are among the beneficiaries of the tax reform, as they change their legal form of organization to C corporations. Of course, by construction the average of these measures is not equal to the average social welfare (ex-ante) given by the formula 7.3 due to Jensen inequality.

Figure 4: Consumption equivalence of optimal tax rates (Optimal Tax System)



(a) Workers (b) Entrepreneurs

Figure 5: Consumption equivalence of optimal tax rates (Max. Entreprenurs Welfare)



(a) Workers (b) Entrepreneurs

Table 6: Current Legal Framework: Inequality Statistics

	Baseline Economy	**Optimal Tax System**	**Max. Entr. Welfare**
Coeff. of Var. Pop	2.07	2.11	2.16
Top 1% Share (%)	13.70	13.25	13.70
Top 10% Share (%)	44.28	44.47	44.78
% of ABOs in Top 1%	46.19	37.69	40.91
% of ABOs in Top 10%	23.74	16.61	17.67
Coeff. of Var. Bus. Inc.	11.95	10.93	11.22
Std(log TFPR)	0.09	0.13	0.13
% of Pass-Throughs	69.7	10.1	10.0

Distributional effects of the reform. The optimal tax reform under the current legal framework leads to mild changes in distribution of income in the economy, which are summarized in Table 6. While the coefficient of variation in the population is increasing slightly, the top income shares remain stable. Though, their composition changes. Increasing wages and the large decline in the number of pass-through businesses leads to a decline in the number of ABOs at the top of the income distribution. At the same time the dispersion of income among entrepreneurs is falling, whereas the dispersion in the TFPR is rising. This can be rationalized by improvement of insurance against idiosyncratic risk via the channel of legal forms of business organization.

7.4 Uniform taxation of business income

In this section we relax the assumption imposed in the current US law and allow for the uniform taxation of business income independent on the legal form of business organization. Thus, under this scenario the profits of the C corporations and pass-throughs are subject to the same tax rate τ_b, hence the name of the scenario - uniform taxation of business income. The safe asset income remains taxed according to the personal income tax code for all agents in the economy.

We again start by maximizing the social welfare defined in 7.3, which is labeled as Optimal Tax System in Tables 7 and 8. The optimal tax system calls for an increase in the progressivity from 0.095 to 0.122, which drives up the welfare gains for the workers. At the same time the business income tax increases from 19.7 percent to a high rate of 35.9 percent.

Table 7: Uniform Business Tax: The Optimal Tax Schedules

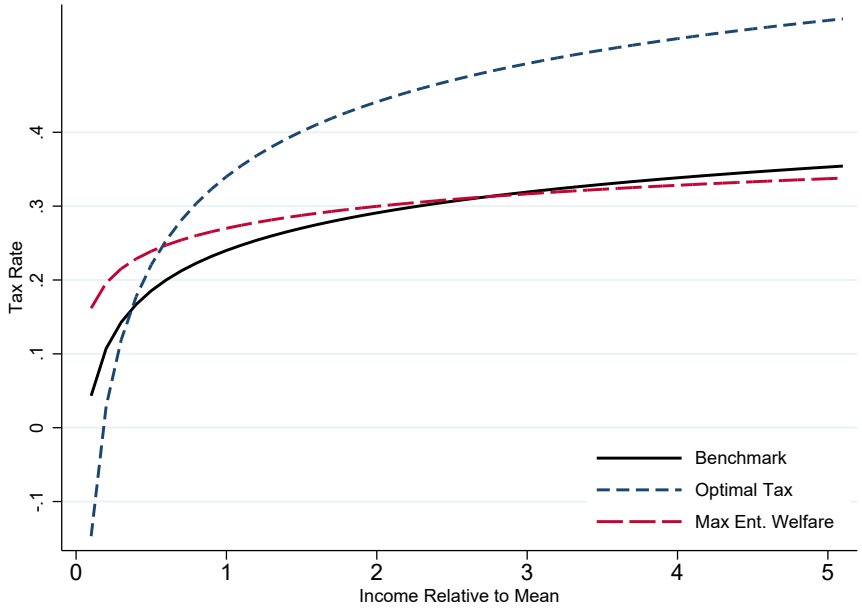
	Baseline Economy	**Optimal Tax System**	**Max. Entr. Welfare**
Progressivity, τ_y	0.095	0.122	0.000
Uniform Business Tax, τ_b	0.197	0.359	0.299
Fiscal closure, $1-\lambda_y$	0.207	0.195	0.190
Debt to GDP	1.021	1.021	1.021
Revenues to GDP	0.210	0.210	0.210
$\Delta SWF_w(\%)$	-	0.18	-0.84
$\Delta SWF_e(\%)$	-	46.15	47.20
$\Delta SWF(\%)$	-	5.75	4.97

Notes: Welfare gains are reported in terms of Consumption Equivalent Vari ation, i.e. as the percentage by which benchmark consumption has to be increase d in order to make a household indifferent between the two tax systems.

The fiscal closure parameter, which controls the level of the average tax falls from 0.207 to 0.195. The policy yields significant average welfare gain for entrepreneurs equal to 4.6 percent of lifetime consumption and average welfare gain for workers is 0.2 percent of lifetime consumption. As a result the average welfare gain for the population is 5.8 percent of lifetime consumption. This number strictly dominates the welfare gains obtained under the existing restrictions of the current US tax system. Alternatively, we look for the policies, which maximize entrepreneurial welfare. Again, this experiment illustrates sharp contrast between the interests of workers and entrepreneurs. Maximizing welfare of entrepreneurs calls for a flat tax-transfer schedule with progressivity parameter equal to 0.0 and the corporate income tax rate of just 29.9 percent. Such policy is welfare detrimental for workers who loose 0.84 percent of lifetime consumption, whereas the entrepreneurs gain as much as 47.2 percent of lifetime consumption, which averages to the societal welfare gain of 4.97 percent. The optimal tax-transfer schedules are presented in Figure 3. The contrast between the policy, which maximizes workers and entrepreneurs welfare is very sharp, high corporate income tax finances the transfers towards the workers whose position is dominant in the welfare function.

Macroeconomic effects of the tax reform. The policy experiments we conduct induce large macroeconomic effects, which are illustrated in Table 8. Optimal Tax System policy induces business owners to switch towards C corporations, the fraction of pass-throughs falls from 69.7 to 35.8 percent. While the economic activity is moved to larger firms with better

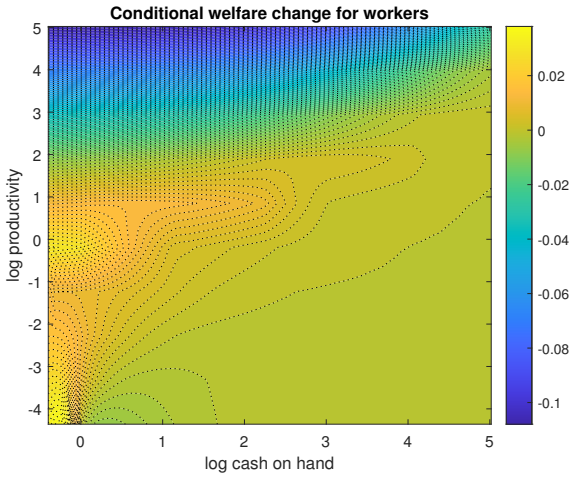
Figure 6: Uniform Business Taxation: the optimal tax-transfer schedules



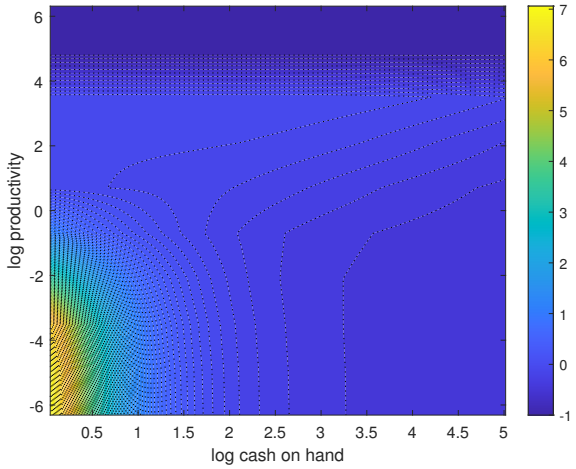
access to the external equity, the aggregate capital falls significantly. This is due to a level of business income tax, which is set at the level of 35.9 percent and increases the distortion on the capital accumulation margin for both C corporations and pass-through businesses. Maximizing only entrepreneurial welfare leads to reversal of this pattern. Both output and employment increase, as the distortion on the capital accumulation declines. The fraction of pass-throughs falls by additional 7 percentage points to 28.7 percent.

Conditional welfare changes. Figures 7-8 present the conditional welfare measures associated with the two reform experiments we conduct. They are presented in the cash-on-hand and productivity space for both workers and entrepreneurs, hence every individual state variables pair in the initial equilibrium has a separate welfare measure. It is clear, that the reform maximizing the weighted welfare function hurts the C corporation owners concentrated in high productivity-low cash on hand parts of the figure and benefits poor and relatively unproductive entrepreneurs. The reform maximizing population welfare benefits mostly poor workers as the progressivity of the tax system rises. On the contrary, the flat tax reform benefits mostly the productive workers. Of course, by construction the average of these measures is not equal to the average social welfare (ex-ante) given by the formula 7.3 due to Jensen inequality.

Figure 7: Consumption equivalence of optimal tax rates (Optimal Tax System)

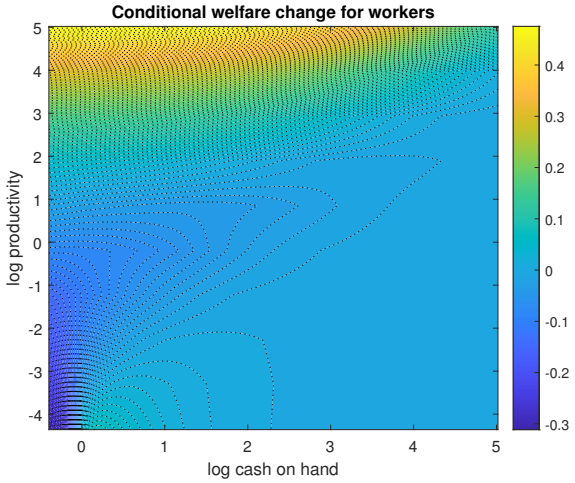


(a) Workers

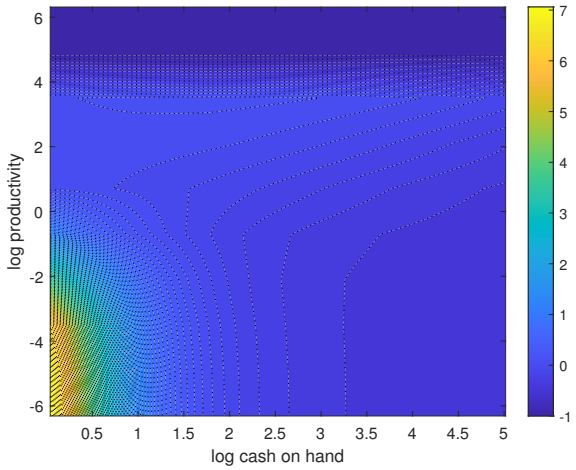


(b) Entrepreneurs

Figure 8: Consumption equivalence of optimal tax rates (Max. Entreprenurs Welfare)



(a) Workers



(b) Entrepreneurs

Table 8: Uniform Business Tax: Macro Aggregates

	Baseline Economy	**Optimal Tax System**	**Max. Entr. Welfare**
Employment	0.747	0.738	0.765
Output	0.704	0.689	0.715
Capital	0.823	0.727	0.781
Wage	0.603	0.598	0.598
Employment C	0.539	0.274	0.353
Employment P	0.207	0.464	0.412
Output C	0.508	0.256	0.330
Output P	0.195	0.433	0.385
% of Pass-Throughs	69.7	35.8	28.7

Distributional effects of the reform. The inequality effects of the optimal tax reform under the Uniform Business Tax scenario are presented in Table 9. Income inequality rises sharply, as the overall tax burden on the entrepreneurial income falls. Top 1 percent income share increases by 7 percentage points, which is largely driven by an increase in the fraction of ABOs in this group be 32 percentage points. The same is true for the top 10 percent income share. Interestingly the coefficient of variation of business income falls, business income becomes less concentrated but higher relative to the labor income.

Table 9: Uniform Business Tax: Inequality Statistics

	Baseline Economy	**Optimal Tax System**	**Max. Entr. Welfare**
Coeff. of Var. Pop	2.07	3.13	3.02
Top 1% Share (%)	13.70	20.37	19.52
Top 10% Share (%)	44.28	50.81	50.15
% of ABOs in Top 1%	46.19	78.55	73.81
% of ABOs in Top 10%	23.74	44.18	40.38
Coeff. of Var. Bus. Inc.	11.95	9.15	9.04
Std(log TFPR)	0.09	0.13	0.13
% of Pass-Throughs	69.7	35.8	28.7

8 Conclusions

We study a design of the optimal tax system in an economy featuring active business owners running closely held, highly profitable businesses–a.k.a. capitalists in the twenty-first century. In line with the current U.S. law, they choose a legal form of firm's organization between a pass-through entity and a C corporation, which determines the way their business income is taxed. Our key finding is that the optimal policy under the uniform business taxation scenario *strictly dominates* in terms of welfare the optimal policy computed under the current legal framework. Separation of labor income taxation from business income taxation enables the Ramsey planner to separate distortions on the labor supply margin from the distortions on the productive capital accumulation and the choice of the legal form of business organization margins. Our model can be extended in multiple ways, for example to incorporate the taxation of the capital gains or the collateral constraints for the entrepreneurs. We leave these extensions for the future.

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A Appendix

To economize on the individual state variables we rewrite problems in terms of cash on hand. Let x to be cash on hand that entrepreneur has after the production took place and before consumption, savings and investment decisions have been made. Then, the continuation value depends on the legal form of organization and denote x'_C and x'_P to be respectively the continuation value in case entrepreneur chooses to run C corporation and continuation value in case entrepreneur chooses to run pass-through entity. Thus, we have for the C corporation

$$\begin{aligned} x'_C &= y'_C(z') + a' - T_i(ra') - T_d(f_z(k^*(z))z') + T - c_f \qquad \forall z' \\ y'_C(z') &= ra' + f_z(k^*(z))z' \qquad \forall z' \end{aligned}$$

and for the pass-through entrepreneurs we have

$$\begin{aligned} x'_P &= y'_P(z') + a' + (1-\delta)e' - T_i(y'_P(z') - \delta e') + T \quad \forall z' \\ y'_P(z') &= ra' + \pi(e', z') \qquad \forall z' \end{aligned}$$

With these continuation values at hand one can rewrite the problem of C corporation entrepreneur as

$$\begin{aligned} V(x,z,C) &= \max_{c,a',d_C} u(c) + \beta\mathbb{E}\left[d_C V(x'_C(z'), z', C) + (1-d_C)\mathbf{1}_{\{a' \geq k^*(z)\}} V(x'_P(z'), z', P)\right] \\ &\quad \text{subject to} \qquad (A.1) \\ x'_C &= y'_C(z') + a' - T_i(ra') - T_d(f_z(k^*(z))z') + T - c_f \qquad \forall z' \\ x'_P &= y'_P(z') + a' + (1-\delta)k^*(z) - T_i(y'_P(z') - \delta k^*(z)) + T \quad \forall z' \\ y'_C(z') &= ra' + f_z(k^*(z))z' \qquad \forall z' \\ y'_P(z') &= ra' + \pi(k^*(z), z') \qquad \forall z' \\ x &= a' + c \\ a' &\geq \underline{a} \end{aligned}$$

and the problem of the pass-through entrepreneur as

$$
\begin{aligned}
V(x,z,P) &= \max_{c,a',d_P} u(c) + \beta \mathbb{E}\left[d_P V\left(x'_P(z'),z',P\right) + (1-d_P) V\left(x'_C(z'),z',C\right)\right] \\
&\quad \text{subject to} \qquad (A.2)\\
x'_C &= y'_C(z') + a' + e' - T_i\left(r\left(a'+e'\right)\right) - T_d\left(f_z\left(k^*(z)\right)z'\right) + T - c_f \quad \forall z' \\
x'_P &= y'_P(z') + a' + (1-\delta)e' - T_i\left(y'_P(z') - \delta e'\right) + T \quad \forall z' \\
y'_C(z') &= r\left(a'+e'\right) + f_z\left(k^*(z)\right)z' \quad \forall z' \\
y'_P(z') &= ra' + \pi\left(e',z'\right) \quad \forall z' \\
x &= a' + e' + c \\
a' &\geq \underline{a}
\end{aligned}
$$