

A Flat Tax Reform in an Economy with Occupational Choice and Financial Frictions

Radim Boháček and Jozef Zubrický*

Pagehead: A Flat Tax Reform with Occupational Choice

Abstract

This paper studies a flat-tax reform and capital-tax reform in an economy with occupational choice and borrowing constraints. Building on previous models with heterogeneous agents and the flat-tax reform within the representative firm framework, we introduce entrepreneurs as an occupation. Occupational choice is subject to financing constraint due to the limited commitment problem. We model endogenous entry and exit of firms whose size, number, and production decisions are affected by the tax system. We compare steady state allocations in the benchmark economy with a progressive tax schedule to steady states with a flat tax at different exemption levels with or without a capital tax reform. We find that for low exemption levels the flat tax reform is efficient as well as welfare improving for both occupations.

*We are grateful to the Grant Agency of the Academy of Sciences of the Czech Republic for financial support (grant IAA700850602). This paper uses data from SHARELIFE release 1, as of November 24th 2010 or SHARE release 2.5.0, as of May 24th 2011. The SHARE data collection has been primarily funded by the European Commission through the 5th framework programme (project QLK6-CT-2001- 00360 in the thematic programme Quality of Life), through the 6th framework programme (projects SHARE-I3, RII-CT- 2006-062193, COMPARE, CIT5-CT-2005-028857, and SHARE-LIFE, CIT4-CT-2006-028812) and through the 7th framework programme (SHARE-PREP, 211909 and SHARE-LEAP, 227822). Additional funding from the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, Y1-AG-4553-01 and OGHA 04-064, IAG BSR06-11, R21 AG025169) as well as from various national sources is gratefully acknowledged (see www.share-project.org for a full list of funding institutions). We have received valuable comments and suggestions from the editor and referees, seminar participants at Universidad Autonoma in Barcelona, CREI, DIW Berlin, CERGE-EI, and the 2006 SED Meetings in Vancouver. All errors are our own. Contact: Economics Institute, Politických veznu 7, 111 21 Prague 1, Czech Republic. Email: radim.bohacek@cerge-ei.cz.

1 Introduction

The question of optimal personal income taxation, that is taxation of incomes of households and entrepreneurs, is widely discussed in the literature. Most papers, however, deal only with the changes in the economic decisions of households, leaving the question of how the tax reform influences entrepreneurial activity unanswered. Yet recent papers by Quadrini and Rios-Rull (1997) and Quadrini (1999) show that entrepreneurship is an important determinant of investment and wealth distribution. Gentry and Hubbard (2000) report that entrepreneurs produce a half of the total output, account for more than 41% of total wealth and receive 22% of total income. Optimizing the taxation system such that it increases entrepreneurial activity and efficiency may therefore have significant consequences on welfare, aggregate allocations and distribution of resources.

In this paper, we present a general equilibrium model with heterogeneous agents who choose their occupations optimally given their wealth and skills. Each agent faces the following option: to work as a worker or to become an entrepreneur, comparing the expected value he or she would obtain from a paid job to the expected value of profits accruing from running a firm. A worker receives a wage and lends assets to entrepreneurs who can use them more productively. An entrepreneur establishes a firm with capital investment, employs other agents as workers, and realizes profit from a decreasing-returns-to-scale production technology.

In order to run a business at an efficient size, an entrepreneur needs a sufficient amount of accumulated assets from which he or she can invest. An alternative is to borrow funds from a competitive banking sector. Since the outcome of a business project is risky and can result in large negative profits, the bank requires collateral for the credit. This collateral, motivated by limited commitment, guarantees not only the repayment of the loan but also positive consumption of the entrepreneur if the project fails. As a result, low-wealth agents may be constrained in their investment and some of them may be unable to borrow to finance their business projects in spite of having a very good entrepreneurial idea. In fact, if a risk-averse entrepreneur must invest disproportionately into one irreversible project with uncertain returns, he or she may forgo the plan and work for a wage. Also, for many agents the opportunity cost of working for a competitive wage may be larger than the entrepreneurial profits. On the other hand, successful firms grow endogenously over time as the financial constraint is alleviated from reinvested business profits.

Entrepreneurial decisions are influenced by wealth and managerial ability of the entrepreneur, equilibrium prices and the tax system. This paper analyzes the effects of a progressive tax schedule and those of a flat tax reform with different exemption levels. Progressive taxation lowers taxes to low income households and leaves them more after-tax income. This may enable the productive but low income households to accumulate collateral and run their own business, thus increasing entrepreneurial activity on the extensive margin. The progressive tax may also increase entrepreneurial activity on the

intensive margin, since a higher after-tax income not only allows for investment into the firm's growth but also provides an insurance against a bad realization of profits.

However, it is important to keep in mind that all these decisions and allocations are dynamic, always considering the present discounted value rather than profits in the current period (see Lucas (1978) for a comparison). In particular, a successful firm will grow over time and its profits will eventually fall into a high tax bracket. A progressive tax schedule therefore reduces the future entrepreneurial income. Running a business may no longer be as attractive as working and may reduce the entrepreneurial activity on the extensive margin. A progressive tax may also influence allocations on the intensive margin since it reduces the firm size of high income businesses by taking away funds that could have been used for further investment.

A flat tax is likely to influence the economy in the opposite directions. If households are financially constrained, a flat tax may reduce entry (extensive margin), since it takes relatively more funds from low income groups. It may also reduce entrepreneurial activity on the intensive margin, since low income entrepreneurs may not have enough funds to increase their firms' size. On the other hand, it may increase the firm size of large profitable firms since it leaves them relatively more funds for investment. By taking relatively less funds from the high income groups, the flat tax can make entrepreneurship more attractive in the present value and increase the entrepreneurial activity on the extensive margin.

Importantly, occupational choices and entrepreneurial decisions are not only influenced by these size and entry effects but also by equilibrium prices. Changes in the equilibrium wage and interest rate are crucial for both effects and the resulting allocations in the economy.

In order to analyze the steady state allocations of resources, efficiency, welfare and distribution of resources for a progressive and a flat tax system, we build a dynamic quantitative general equilibrium model with heterogeneous agents, occupational choice and financial frictions. An important aspect of the flat tax reform is the amount which households can exempt from their taxable income. The exemption level effectively determines the progressiveness of the flat tax system. In our numerical simulations, we compare the benchmark, progressive tax system currently in place in the United States with revenue neutral flat tax reforms with a zero, 20%, 40% and 60% tax exemption rate (relative to the average income). We also simulate these reforms accompanied by the reduction of the capital income tax.

We find that the efficiency gain from the flat-tax reform in the steady state is around 5% of GDP but only for the low exemption levels. The welfare gain from these low exemption reforms is around 3% in the steady state and around 2% taking account the transition. Wealth inequality increases but not dramatically. The average firm size grows while the fraction of entrepreneurs decreases. The flat-tax reforms result in a large shift of the tax burden. In the progressive tax steady state, entrepreneurs pay 61% of all personal income taxes while in the flat-tax steady state only 30%. However,

the increase in equilibrium wages seem to fully compensate the workers for this extra cost.

Our main result, that the flat tax reform is welfare and efficiency improving for both occupations only at low exemption levels is an important policy recommendation. Governments often sell the flat tax reform by offering high exemption levels, presumably to compensate workers and small entrepreneurs for the higher absolute and relative tax burden after the reform. However, the general equilibrium forces and the higher tax rate associated with such high exemption levels lead to welfare losses for both occupations. With high exemption levels, the number of entrepreneurs increases but they are poorer, operating at lower efficiency levels. Assets become more concentrated among entrepreneurs and inequality of income and wealth increase. The same mechanism, although at a higher level of accumulated assets, occurs when the flat tax reforms are accompanied by the capital tax reform.

In the recent literature, several important papers addressed the flat tax reform in general equilibrium models. While Hall and Rabushka (1995) build a tax system that comprises progressive tax on wage income and flat-tax on capital income to motivate investment, Ventura (1999) shows that a system with flat tax on both wage and capital is even more efficient. Engel and Gale (1996) form a stochastic model, in which they compare both types of taxes. They argue that a flat tax can better eliminate the distortions that arise from the stochastic process of production shocks. This would have a positive effect on consumption smoothing and lead to greater amount of funds spent on investment. Other references on flat tax reform include Aaron and Gale (1996), Altig et. al. (1999) and Stokey and Rebelo (1995).

Authors of these papers consider an exogenous number of firms (typically one representative firm) and a given number of households that work for a competitive wage (mostly measure one of heterogeneous agents). The tax system has only a “size effect” on the representative firm via the consumption-saving and labor-leisure decisions of households. In our model we allow the agents to choose their occupation, i.e., to choose whether to work for a competitive wage or run a business. Those who choose to be entrepreneurs hire workers and rent capital. In this setup, the tax system influences the economy also on the extensive margin as it determines entry and entrepreneurial activity. We will call this the “entry effect”.

Early occupational choice models include Evans and Jovanovic (1989) and Greenwood and Jovanovic (1990), later followed by Erosa (2001), Bohacek (2007) and Gine and Townsend (2004). Chari et al. (2002) build a partial equilibrium model with heterogeneous agents and an occupational choice decision between working and running a business. Successful entrepreneurs are then bought by corporations, and households that ran those firms receive capital income from the corporation. Cagetti and De Nardi (2006) in their deterministic occupational choice, overlapping generations model find that abolishing estate tax and raising income tax to balance the government budget constraint has a negative effect on output and increases wealth inequality. Bohacek and

Mendizabal (2003) deal with the issue of how monetary policy shocks can reduce the number of unconstrained firms and thus increase efficiency.

In a model with occupational choice and entrepreneurial sector, Meh (2007) finds that the removal of the corporate income tax increases the after-tax return on savings and increases capital accumulation. However, the number of entrepreneurs falls by 21% as there is no longer the incentive to become an entrepreneur to avoid the double taxation of corporate income. As entrepreneurs have higher marginal rates of savings, the aggregate capital increases only by 6.9% (in models without occupational choice it usually around 20-30%) and inequality falls by around 3%. Firms become smaller, enter less and exit more frequently. Similar results are obtained in Meh (2005), where he studies the effects of proportional taxation. Finally, Kitao (2008) shows that a reduction of the capital income tax increases the aggregate capital and output, but because of general equilibrium effects, lowering of the business income tax could be much more effective: a lower tax burden on entrepreneurs encourages the entry into the business and increases the investment by the most productive entrepreneurs. This is similar to our model, where elimination of the capital income tax shifts the burden of taxation to workers, increases the aggregate levels and in general, strengthens the results of the plain flat-tax reform. On the other hand, positive capital income tax may be optimal in different environments. Based on the original Mirrlees (1971) work, Kocherlakota (2005), Golosov et al. (2003) or Albanesi and Sleet (2006) study optimal social planner policies with asymmetric information. In these economies, positive capital income taxes are optimal despite the associated efficiency loss. Also, Conesa et al. (2009) establish a positive capital income tax in life cycle models.

Compared to our paper, entrepreneurs in the above models choose their firm allocations after all uncertainty has been realized. Not only they can choose not to operate the firm if they draw a bad ability shock, they also receive the wage. Thus the entrepreneurs always receive positive income and the only cost they face is the foregone return on the capital stock they had to commit in the previous period (plus sometimes the learning process attached to entrepreneurial ideas). On the contrary, in this paper business losses can be substantial and are the main motivation for the limited commitment problem behind the financing constraint that restrains the amount of loans an entrepreneur can take.

The paper is organized as follows. In section 2, we describe the basic model and discuss the main forces influencing the results. Section 3 characterizes the entrepreneurial decisions. Parameters and taxes are presented in section 4. Results are analyzed in section 5. Section 6 concludes. Results from alternative specifications of the model are in the appendix.

2 The Model

2.1 Setup and Timing

The economy is populated by a continuum of measure one infinitely lived heterogeneous agents. There is one perfectly divisible good in the economy. Agent's preferences are such that they maximize the utility from consumption c given by the utility function

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

where $u(\cdot)$ is a bounded, strictly increasing, strictly concave, and twice differentiable continuous function that satisfies the Inada conditions and $\beta \in (0, 1)$ is a discount factor.

Each agent is identified by the level of accumulated assets $a \in A = [\underline{a}, \infty]$ and an ability $z \in Z = [\underline{z}, \bar{z}]$. Here z can be interpreted as an idea or skill signal in the beginning of each period. After an agent makes the occupational choice he or she draws an effective ability shock z' which corresponds to the real productivity in the business project or a job position. The effective ability shock z' is transferred to the idea in the beginning of the next period.

If an agent chooses to be an entrepreneur, he or she must commit productive inputs before the effective ability shock z' is known. In other words, capital k and workers hired n are functions of (a, z) only.

The output is produced by a technology $y = z'f(k, n)$, where $f(\cdot, \cdot)$ is a decreasing returns to scale and a continuous, twice differentiable increasing and strictly concave production function. Entrepreneurs draw z' from a first-order Markov process $Q(z, z')$, satisfying Feller, monotonicity and mixing conditions. We assume that $\underline{z} = 0$ and $Q(\underline{z}, \underline{z}') = 1$. This implies that even the wealthiest agents with a signal \underline{z} always prefer to work for a wage. To guarantee the exit of entrepreneurs, we assume $Q(z, \underline{z}') > 0$ for all $z \in Z$. To guarantee entry we choose \bar{z} high enough it pays off for some agents to become entrepreneurs. More details on these issues are in the following section.

Capital is intermediated by a competitive banking sector. All agents deposit their assets a at the bank which lends capital k to the entrepreneurs at the competitive interest rate r . All loans must be repaid at the end of the period even if the business project fails. We assume that there is a limited commitment problem and that the bank requires entrepreneurs to hold sufficient assets to back up their borrowing (i.e., we assume that loans are fully collateralized). Capital depreciates at a rate $\delta \in (0, 1)$. Labor n is provided by agents that choose not to be entrepreneurs. Each firm employs a pool of workers with the average effective ability \tilde{z} .

If an agent chooses to be a worker, he or she works for a competitive wage rate w and draws an effective ability shock z' from a fixed distribution $\psi(z')$ and receives a wage income $z'w$. Note that workers' effective productivity shock z' is independent of

ability shock z . This is assumed mainly for computational reasons. In the appendix, we consider the case of a persistent productivity process for workers too.

Finally, there is a government in the economy that finances its expenditures G by taxation.

The timing is as follows. In a stationary equilibrium, given taxes and prices (r, w) ,

1. Agent enters a period with (a, z) ;
2. Occupational choice is made, entrepreneurs commit inputs (k, n) ;
3. Effective shock z' is drawn from ψ or Q depending on occupation;
4. Production, labor incomes, profits, consumption, investment take place, taxes are paid;
5. Savings and the effective shock become the next period state variables (a', z') .

Because shocks are idiosyncratic, there is no uncertainty at the aggregate level. Note that there is no uncertainty at the individual level between periods. All information in the economy is observable, agents are rational with perfect foresight. Except for the limited commitment problem all contracts are perfectly enforceable.

2.2 Recursive Description of the Economy

We define value function $v(a, z)$ to be the value of an agent with assets a and ability shock z in the beginning of the period,

$$v(a, z) = \max \left\{ \int v^W(a, z') \psi(dz'), \max_{k, n} \int v^E(a, z') Q(z, dz') \right\}$$

where

$$v^I(a, z') = \max_{c, a'} \{u(c) + \beta v(a', z')\}$$

is the value of being a worker, v^W , or an entrepreneur, v^E , contingent on realizing the effective productivity shock z' .

A worker's budget constraint is

$$c + a' \leq (1 + r)a + z'wl - T^W,$$

where T^W is the amount of taxes paid. An entrepreneur's budget constraint is

$$c + a' \leq (1 + r)a + \pi(k, n, z') - T^E,$$

with entrepreneurial profit defined as

$$\pi(k, n, z') = z'f(k, n) - (r + \delta)k - wn\tilde{z},$$

and T^E as the amount of taxes paid. Finally, we require

$$a \in A, \underline{a} = 0, (k, n) \geq 0, l = 1.$$

That is, we assume that agents work full time in an exclusive occupation.

2.3 Progressive Tax Schedule

In the benchmark, progressive tax system the amount an individual pays depends on tax brackets and corresponding marginal tax rates. For income brackets $\{I_0, I_1, \dots, I_{m-1}\}$, marginal tax rates $\{\tau_1, \dots, \tau_m\}$, and individual income $I > I_{m-1}$, the taxes paid by each occupation are

$$T_P = \tau_1(I_1 - I_0) + \tau_2(I_2 - I_1) + \dots + \tau_m(I - I_{m-1}) + \tau_k r a, \quad (1)$$

where τ_k is a constant tax rate on capital income.

The occupations differ in their definition of taxable income. A worker's and an entrepreneur's gross income is, respectively,

$$\begin{aligned} I^W &= z'w + ra, \\ I^E &= \pi(k, n, z') + ra. \end{aligned}$$

Note that the capital income is taxed twice. The details on tax rates, brackets, and deductions are described in Section 4.

2.4 Flat Tax Reforms

We will analyze four cases of the flat-tax reform. They differ in the amount the agents can exempt from their taxable income. In the model, this amount will be defined as a fraction of the average income in the economy, I^* . We will consider four such fractions, $x \in \{0, 0.2, 0.4, 0.6\}$. For a worker's or an entrepreneur's gross income defined above, the amount of taxes paid under a flat tax rate τ is

$$T_F = \tau \max\{0, I - xI^*\} + \tau_k r a.$$

2.5 Capital Tax Reform

For the progressive tax steady state and for each exemption level of the flat tax reforms, we will also study the effects of elimination of the capital income tax. That is, we will analyze all steady states with $\tau_k = 0.4$ as well as $\tau_k = 0$.

2.6 Financing Constraint

The assumption on the utility function and limited commitment implies that in any tax system no entrepreneur will use more inputs than he would be able to repay for all realizations of effective ability shocks. In particular,

$$(r + \delta)k + wn\tilde{z} < (1 + r)a + \pi(k, n, z') - T^E \quad \text{for all } z' \in Z.$$

Because $Q(z, \underline{z}) > 0$ for all $z \in Z$ and $\underline{z} = 0$, this constraint must be satisfied for the lowest possible shock,

$$(r + \delta)k + wn\tilde{z} < (1 + r)a - T^E.$$

We assume that workers' wages and taxes must be paid in all circumstances.

2.7 Corporate Sector

Small businesses make large contributions to the U.S. economy. Including the self-employed, small businesses account for 58 percent of the private, nonfarm work force, and generate 51 percent of the private gross domestic product.¹

To account for the remaining 42% of employment and capital stock, we model the corporate sector by assigning a fraction $\gamma = 0.42$ of inputs into a representative, zero-profit firm with a constant returns to scale production function

$$Y_C = A_C f(K_C, \tilde{z}N_C) = A_C K_C^\alpha (\tilde{z}N_C)^{1-\alpha},$$

where A_C is the technology parameter that satisfies the zero-profit condition at the same equilibrium prices faced by workers and entrepreneurs. In other words, an exogenous fraction of inputs in the economy is assigned to the corporate sector.

2.8 Stationary Recursive Competitive Equilibrium

In a stationary recursive competitive equilibrium the distribution of agents over their individual states is time invariant. The policy function for the next-period assets $a'(a, z')$ and the laws of motion for the ability shock process generate a law of motion for the endogenous distribution of agents over their individual states,

$$\lambda'(A', Z') = \int_{\{(a, z'): a'(a, z') \in A'\}} \{Q(z, dz')|_E + \psi(dz')|_W\} \lambda(da \times dz)$$

for all A' and Z' , where $Q(z, dz')|_E$ and $\psi(dz')|_W$ is the law of motion for ability shocks of those agents who chose to be entrepreneurs and workers, respectively. According to this law of motion, the fraction of agents that will begin next period with assets in the set A' and a signal of ability in the set Z' is given by all those agents that transit from their current shock z to a shock in Z' and whose optimal decision for assets accumulation belongs to A' .

Definition 1 *A stationary recursive competitive equilibrium for a given taxation system and a corporate sector share γ consists of constant prices (r, w) , value functions $(v(a, z), v^E(a, z'), v^W(a, z'))$, policy functions $(k(a, z), n(a, z), c(a, z'), a'(a, z'))$, tax revenues $(T^W(a, z'), T^E(a, z'))$, a probability measure λ , and aggregate levels (A, K, L, N, T, Y_C) such that*

¹See The Bureau of Labor Statistics, SBA Office of Advocacy Report (1997), U.S. Census Bureau.

1. at prices (r, w) , the policy functions solve the optimization problem of each agent;
2. the probability measure λ is time invariant;
3. the capital and labor markets clear,

$$(1 - \gamma)A = (1 - \gamma) \int a \lambda(da \times dz) = \int k(a, z) \lambda(da \times dz) = K,$$

$$(1 - \gamma)L = (1 - \gamma) \int z' \psi(dz')|_W \lambda(da \times dz) = \int n(a, z) \lambda(da \times dz) = N,$$

4. the government budget constraint holds with equality,

$$\int [T^E(a, z')Q(z, dz')|_E + T^W(a, z')\psi(dz')|_W] \lambda(da \times dz) = G,$$

5. the aggregate feasibility constraint is satisfied,

$$\begin{aligned} & \int \{c(a, z') + a'(a, z')\} [Q(z, dz')|_E + \psi(dz')|_W] \lambda(da \times dz) + G \leq \\ & \int z' f(k(a, z), n(a, z)) Q(z, dz') \lambda(da \times dz) + (1 - \delta)A + Y_C. \end{aligned}$$

3 Characterization of Entrepreneurial Decisions

In order to have positive fractions of both occupations in equilibrium we first need to make two assumptions on the productivity shocks.

First, to guarantee a positive number of entrepreneurs, we require that there exists a level of assets a^s that agents with the highest possible shock \bar{z} and assets $a \geq a^s$ choose to be entrepreneurs, that is

$$\int v^W(a, z')\psi(dz') \leq \int v^E(a, z')Q(\bar{z}, dz') \text{ for all } a \geq a^s.$$

Second, to have a positive fraction of workers, we assume that for the lowest possible realization of ability shock \underline{z} agents choose to be workers. This can be written as

$$\int v^W(a, z')\psi(dz') \geq \int v^E(a, z')Q(\underline{z}, dz') \text{ for all } a \in A.$$

The properties of value functions for each occupation follow the analysis in Stokey et al. (1989) and can be found in greater detail in Bohacek (2006) and Bohacek (2007).

Due to the decreasing returns to scale production function, there is an optimal level of inputs k^* and n^* for a given ability and equilibrium prices. The financing constraint in equation (2) imposes a friction on the allocation of inputs by entrepreneurs. An entrepreneur for whom the financing constraint is binding is constrained in the sense

that he is running a business at a suboptimal level of capital and labor inputs, at $k < k^*$ and $n < n^*$. Figure 1 shows the division of agents in the economy into workers, constrained entrepreneurs and unconstrained entrepreneurs.²

INSERT FIGURE 1 ABOUT HERE

As the problem of occupational choice is a dynamic one, the agent considers the whole present discounted value of each occupation. Because Q is monotone, becoming an entrepreneur has a future value. In other words, some entrepreneurs are willing to sacrifice current consumption for having the opportunity to begin their business career. For such agents the expected current income from business is lower than the expected wage,

$$\int z'w \psi(dz') - T^W > \int \pi(k, n, z')Q(z, dz') - T^E,$$

despite the fact that the value of being an entrepreneur is greater than that of being a worker. This result corresponds to the finding that especially the entrants to entrepreneurial occupation have a lower income than if they continued to be workers.³ This implies that the marginal agent is willing to sacrifice current consumption in order to relax the borrowing constraint and run the business at more efficient level in future periods.

Therefore, the progressiveness of the tax schedule plays an important role in shifting the value of each occupation across different periods of entrepreneurial spell. Both the progressive schedule and the flat tax may influence extensive and intensive margins in both directions. The progressive tax increases the value of small firms (for example, entrants or financially constrained entrepreneurs with high skills). On the other hand, it lowers the after-tax income of large and mature firms. The flat tax influences allocation in the economy in the opposite way. By taking away relatively more funds from low income groups it makes it more difficult for workers or entrepreneurs to accumulate assets as the required collateral. This might decrease entrepreneurial activity on both extensive and intensive margins. On the other hand, flat tax schedule leads to higher after-tax incomes for agents operating large firms. This should lead to larger firms and greater present value of entrepreneurship, and perhaps, more entrants.

At the same time, it is important to consider the other occupation as well. The progressive tax schedule takes away relatively little from low income groups such as workers. This may allow them to accumulate assets as collateral, relax the financial constraint, and make the occupational switch easier in the future. It can increase the entrepreneurial activity on both margins. On the other hand, the flat tax might increase the future value of firms and facilitate entry by lowering the opportunity cost.

²From the first order conditions with respect to committed capital and labor inputs, unconstrained as well as constrained entrepreneurs use the same capital-labor ratio $k^*/n^* = \alpha/(1 - \alpha) \cdot w/(r + \delta)$.

³For a detailed empirical investigation see Hamilton (2000) and for implications in this model see Bohacek (2006).

The capital income tax and its reform influences these decisions in an important way. The abolition of the capital income tax provides strong incentives for accumulation of capital. This extra stock at the aggregate level affects equilibrium prices and the endogenous thresholds of entry and exit into entrepreneurship. As entrepreneurs are usually the more wealthy agents, a zero capital income tax further enables them to relax their financing constraint, invest into their firms which might grow more rapidly to their efficient size. On the other hand, poor agents who rely mostly on labor income (workers) now face relative higher tax burden than before. This might decrease their ability to build up their collateral and entry into entrepreneurship.

It is not possible to analytically determine which of these forces prevails, especially in general equilibrium where prices play crucial role. In the following sections we analyze the economy numerically.

4 Parameters and Taxation

The base for modeling taxation in the benchmark economy is the U.S. 2004 federal income tax schedule. We abstract from all but federal government income taxation. Personal income tax is paid by employees, small businesses and individuals who are self-employed. Individual income taxes paid to federal government accounted for 34.8% of all tax revenues or 7.06% of GDP in 2004. We calibrate the benchmark, progressive tax economy to deliver this fraction of GDP in the steady state. Then we simulate the four flat-tax steady state raising the same amount of resources as the benchmark economy.⁴

INSERT TABLE 1 ABOUT HERE

Personal income tax rates for a single taxpayer are described in Table 1. As in Ventura (1999), we define the income tax brackets I_m as the ratios of total income to average income, I^* . The personal income tax is calculated as percentage of an individual's gross income, which is subject to deductions and exemptions. In the benchmark U.S. economy, we do not specifically model these deductions. Instead, we find such a level of exemption x as a fraction of the average income that clears the government budget constraint. This exemption summarizes the standard, personal and other types of deductions such as mortgage exemption etc. The resulting number $x = 0.547$ is close to one half assumed by Ventura (1999) in a representative firm version of this economy. The capital tax rate $\tau_k = 0.4$ is the value used in the capital tax reform literature (Lucas (1990), Kitao (2008), Chari et al. (2002)) and is close to the value of 0.36 in Mendoza, Razin and Tesar (1994).

⁴Taxation in the United States is a complex system that consist of four basic forms of taxes: corporate income tax, individual income tax, social security tax and other taxes as VAT, estate tax, other customs and tariffs. In 2004, state and local taxes amounted to 32.8% of total tax revenues but only to 19.1% of individual income taxes.

INSERT TABLE 2 ABOUT HERE

All other parameters are presented in Table 2. The production technology is a decreasing returns to scale function

$$y = z'(k^\alpha n^{1-\alpha})^\theta,$$

where the span of managerial control θ set at 0.92, a level close to the one estimated by Burnside (1996). Preferences are of the standard logarithmic utility function,

$$u(c) = \log(c),$$

that satisfies the Inada conditions needed for the financing constraint.

For compatibility with Evans (1987) data on firm dynamics, the modeling period is 2 years. The transition function for ability shocks of entrepreneurs, Q , was calibrated using estimates of firm growth and survival rates in Evans (1987, Table 1). Values of shocks z for workers⁵ and entrepreneurs are chosen such as to represent stylized facts on size and distribution of firms, share of wealth held by entrepreneurs described by Evans (1987), Characteristics of Business Owners (1992), PSID 1993 statistics, SHARE data, Quadrini (1999) and by Chari et al. (2002).

The algorithm for finding the steady state of each tax system is relatively simple. We iterate on interest rate, wage, and the exemption rate (for the flat-tax economy on the flat-tax rate) so that the aggregates from the optimal individual allocations clear the markets and the government budget constraint. We set the maximal level of assets high enough so that the upper bound on the stationary distribution of resources is endogenous.

5 Results

In this section we compare the benchmark economy with nine cases: the progressive tax economy where the capital income tax is eliminated; four economies of the flat-tax reform with $\tau_k = 0.40$, differing in the exemption level $x \in \{0, 0.20, 0.40, 0.60\}$; and finally, the same four flat-tax economies with $\tau_k = 0$.

We analyze their steady states with different equilibrium prices, tax levels and allocations. We also provide results on welfare gains and political support during transition. Taxes are such that all steady states raise the same amount of goods as in the benchmark progressive tax steady state.

In the Appendix we present the results from two alternative specifications of the model: the case of fixed corporate sector and the case of workers having also persistent productivity shocks. These two cases do not alter the main results presented in this Section.

⁵The value of the lowest shock for workers is $z_0^W = 0.5$, otherwise the values are the same for both occupations. The absolute values of shocks do not matter as far as each agent correctly forecasts the future.

5.1 Aggregate Levels

Table 3 shows the aggregate steady state allocations, taxes, and prices. In the benchmark, progressive tax schedule economy with capital income tax $\tau_k = 0.4$ (the first column), an average individual deducts 54.7% of taxable income. When the capital tax is zero, the exemption level has to fall to 35.7% of taxable income in the reformed economy (the second column). At the zero exemption level, a flat tax of 4.7% finances the same government consumption. Naturally, the flat tax rate increases with exemption levels: at the 60% exemption level (relative to the average income of that particular steady state), it is 18.8%. When the capital income tax is eliminated, the flat tax rate has to rise even more (up to 32% at the highest exemption level). In all the following graphs and tables the exemption levels are very important.

INSERT TABLE 3 ABOUT HERE

For all exemption levels the flat-tax reform increases the accumulation of assets and output. In the most radical reform with zero exemption level (with $\tau_k = 0.4$), assets increase by 12.8%, output by 3.7%, consumption by 3.5% and welfare in the steady state by 3.2%.⁶ The flat tax lowers the marginal income tax rate for wealthy households but increases it for the poor. As entrepreneurs are wealthier than workers, the increased business investment leads to a higher demand for labor and, therefore, higher wage and lower interest rate: wage increases by 6.8% while interest rate falls from 4.26% to 3.47%. These changes are similar but a little bit smaller in the 0.2-exemption level reform.⁷ The 0.4-exemption reform is similar to the progressive tax system while the 0.6-exemption reform is far the worst in terms of welfare comparison.

When the capital income tax is eliminated (columns 7-10), the aggregate levels increase by around twice as much: at the zero exemption level, the capital stock increases by 24%, output by 7.4%, consumption by 4.5%, and welfare by 3.8%. These changes are comparable to the capital tax literature (see Lucas (1990), Cooley and Hansen (1992), Imrohoroglu (1998) or Atkeson et al. (1999)).

Welfare gains during transition are lower than those in the steady state.⁸ As usual, the transition costs are due to increased savings during the initial periods of transition

⁶Welfare is measured in consumption units from agents' utility weighted by the stationary distribution in each steady state. It is lower than the average consumption due to the concave utility function and high consumption levels of entrepreneurs.

⁷Gorodnichenko et al. (2010) estimate the efficiency and tax evasion effects of a flat tax reform in Russia in 2001. There the tax rate was set 13% with an exemption level equal to 24% of taxable income. They find that the gain to productivity is 4.4% while the tax evasion effect is stronger, at 10.5%. Our closest case is the economy with the 0.2-exemption level: there the output increases by 3.7%.

⁸Welfare in transition is calculated as per period consumption units given to each agent that would make the average discounted expected value from transition equal to that in the benchmark steady state, weighted by the stationary distribution in the benchmark steady state. The transitions take around 40 periods and are calculated at guessed equilibrium prices and lump-sum transfers needed to balance the government budget in each period.

when agents need to accumulate assets to reach the levels of the final steady state. Thus the transition losses are larger for the low exemption levels. All but the highest exemption level flat-tax reforms are welfare improving with a large majority of population supporting the reform. This is also the case of the capital tax reform of the progressive tax system. When the capital income tax is eliminated, the steady state gains are larger while the transition gains are lower than in the corresponding cases of the flat-tax reform with $\tau_k = 0.4$. This is again due to increased savings during the initial periods of transition. We will analyze the gains to each occupation below.

Note that the fraction of population in entrepreneurship is always lower under the flat tax. Higher wage rates lower entrepreneurial profits as much as they increase the opportunity cost of being a worker. This, together with the higher marginal tax rate for low incomes, reduces the entry into entrepreneurship. Similar results were found in Meh (2005) and Meh (2007). We will analyze the entry and exit decisions below.

The model was parameterized in a way as to have good fit with the data. The capital-output ratio in the benchmark economy is 2.72 and the fraction of entrepreneurs is 8.8%, matching the data for the U.S. economy. We will see later that all measures of inequality, shares of wealth and income, or distribution of firms fit very well.

5.2 Average Levels in Occupations

Average levels for workers and entrepreneurs are shown in Table 4. Entrepreneurs have much higher average assets, income, consumption, and taxation levels. Gentry and Hubbard (2004) report that the median net worth of entrepreneurs is 8 times as large as that of non-entrepreneurs. In our model, the average entrepreneur holds 7.7 times more assets, receives 3.8 times higher income, pays 16 times higher taxes, and has 3.4 times after-tax income than average worker. This results in 1.7 times higher consumption and 1.5 times higher welfare. These premia are required for choosing the riskier occupation.

INSERT TABLE 4 ABOUT HERE

Flat tax reforms increase these ratios in all categories except for taxes paid. The zero exemption case sees the asset ratio increased to 8.9, that of income to 4.0, after-tax income to 3.9, and consumption to 1.8. This is mainly because the taxes paid by the average entrepreneur are now only around five times higher than that by the average worker.

As entrepreneurs hold so much more assets, the elimination of the capital tax shifts the tax burden to workers by lowering the exemption level in the progressive steady state and raising the flat-tax rate in the flat tax reforms. Thus in the progressive steady state with $\tau_k = 0$, the ratio for taxes paid by entrepreneurs relative to workers now falls to 3.4, in the zero exemption flat tax reform to 3.0. However, at new equilibrium prices both occupations adjust to the capital tax reform in such a way that the other ratios fall only slightly compared to the steady states with $\tau_k = 0.4$.

Importantly, the flat-tax reform is welfare improving for *both* occupations at low levels of exemption: in the zero exemption rate and $\tau_k = 0.4$, steady state welfare increases by 2.6% for workers and by 11.6% for entrepreneurs. Workers' assets increase by 10.3%, income by 6.3% (due to higher wages), after-tax income by 4.6%, and consumption by 2.9%. These increases are important especially after workers paying 67% more taxes than in the progressive tax steady state. Median worker pays 2.6 times more taxes than he paid in the progressive tax system. In transition, the gains are smaller but the reform has a full support of workers.

Entrepreneurs' gains are even larger: their asset holdings grow by 28.2%, income by 11.1% (mostly due to larger size of the firms, see below), after-tax income 22.3%, and consumption 11.8%. Their tax burden falls by 51.7%. Median entrepreneur pays only 60% of taxes he paid in progressive tax system. The steady state welfare gains are huge, above ten percent. The transition gains are smaller but always positive on average. A large fraction of entrepreneurs supports the reform including the transition costs (see below for a more detailed discussion of welfare gains by initial assets).

However, when the government offers a too high exemption level at either capital tax rate (in our simulations above 60% of the average income), workers become worse off and the economy becomes more inefficient and unequal. The number of entrepreneurs increases in the exemption level and the size of firms falls. Entrepreneurs borrow less frequently, and if they borrow, they borrow smaller amounts. Assets become more concentrated among entrepreneurs and inequality of income and wealth increase. High exemption levels display the highest tax-to-profit ratio.

The same conclusions hold for the capital tax reform too, only at higher levels of capital accumulation, output and consumption. When the capital tax is abolished at the zero exemption level, the tax burden of wealthy entrepreneurs is much lower (by 64% relative to the benchmark steady state and by 30% relative the flat tax reform with $\tau_k = 0.4$) while that of workers increases. On the other hand, workers benefit from large equilibrium wage increases (10.2% in the zero exemption reform) and their steady state welfare is greater than in economies with capital income tax. This is consistent with the Ramsey optimal taxation theory that the tax rate on capital income should be zero in the long run.⁹ However, the gains from transition are lower as they pay higher taxes and need to accumulate more assets. For entrepreneurs, both steady state and transition welfare gains are larger: they are the wealth holders in the economy and the reduction of capital income tax is beneficial for them.

As in Hamilton (2000), the future value of entrepreneurial career is significant. The average entrant in the benchmark economy consumes only 58% of average worker's consumption. It takes three periods to consume at least as the average worker. The flat-tax reform with zero exemption lowers the entering entrepreneur's consumption to

⁹In Conesa et al. (2009), the optimal capital income tax is positive due to the life-cycle structure of the economy. Capital income tax rates are positive (but zero in expectation) in economies with private information (see Kocherlakota (2005), Golosov et al. (2003) or Albanesi and Sleet (2006)).

55% and adds one more period. The reason seem to be the larger firm size and greater accumulation of assets in the flat-tax economies. The elimination of the capital income tax improves the situation of the average entrant by reducing the tax burden related to investment and increasing his profits.

5.3 Welfare Gains

In Tables 3 and 4 we have seen that entrepreneurs are on average always better off while workers gain in all but the highest exemption level flat-tax reform, regardless of the capital tax.

INSERT FIGURE 2 ABOUT HERE

Figure 2 shows welfare gains during transition for both occupations by initial assets for the economies with 40% capital income tax.¹⁰ Welfare gains are increasing in assets for all entrepreneurs while they are almost flat or decreasing for workers. All wealthy entrepreneurs at low exemption levels benefit from the low flat-tax rates. Poorer entrepreneurs are hurt by the reform at high exemption levels because they face high taxes when their firms and profits are low. In the 40% and 60% exemption level reforms, the majority of entrepreneurs suffers welfare losses.

INSERT FIGURE 3 ABOUT HERE

Figure 3 shows transition gains by initial assets when the capital income tax is eliminated. Now for both occupations the welfare gains are increasing in assets. The capital tax reform with a preserved progressive tax schedule is supported by all workers and the largest majority of entrepreneurs (94 percent). Again, the majority of entrepreneurs at high exemption levels do not support the reform.

We have also analyzed those entrepreneurs who leave their occupation after the flat-tax reform is unexpectedly introduced. Because the equilibrium prices to some extent mitigate the initial impact of the reforms, only around 2% of entrepreneurs become workers in the first period of transition. At the 0% and 20% exemption levels, even these former entrepreneurs are better off (by around 1.5%), regardless of the capital income tax. Again, only when the exemption levels are too high, these switching agents are the agents who suffer the highest welfare losses during transition (around -1.4%).

Contrary what is often claimed, these results show that majority of workers is more often better off than that of entrepreneurs (see Table 4). Except for the highest exemption level of flat tax reform, their political support is overwhelming. Although workers pay higher taxes than in the benchmark economy, the general equilibrium effects are stronger and increase their after-tax income. In general, all flat-tax reforms receive a

¹⁰Welfare gains (weighted by productivity shocks z at each asset level) are displayed at deciles of the wealth distribution for each occupation in the initial period of the transition.

very similar share of political support in transition. This is true for both occupations as long as the exemption levels are low.¹¹

5.4 Inequality and Distribution

Importantly, this model with of occupational choice replicates the more concentrated distribution of wealth (see Table 5). In the 1989 PSID data, Gini coefficient for wealth is 0.77 and 0.45 for income. Although there is a small and monotone increase of income and wealth inequality, it is remarkable that the flat tax reforms do not increase inequality (compared to most models with a representative firm), regardless of the capital income tax rate.

INSERT TABLE 5 ABOUT HERE

The top percent of the agents own 19.2% of the total wealth and receive 9.3% of the total income (29% and 8% in data, respectively). The top 5% own almost one half of the total wealth and receive one quarter of the total income (in data it is 50% and 20%). Finally, the top decile owns around 66% of the wealth and receives 34% of the income (60% and 31% in data). These shares in all percentiles increase with the flat-tax reform by about 5% for wealth and 1% for income. As in the data analyzed by Quadrini (1999), the entrepreneurs are heavily over-represented in the top wealth decile, with 52%, as well as in the second top decile, with 21%. These shares are almost the same in both capital income tax cases.

The bottom half of Table 5 shows that in all steady states, entrepreneurs receive around 20% of income and hold around 43% of assets, as in the data by Gentry and Hubbard (2004) who report 0.22 and 0.408, respectively (these shares are lower in European data from the SHARE survey). In the benchmark progressive tax system, entrepreneurs have high incomes and fall into the high tax brackets: they pay 61.3% of all personal income taxes. This is no longer true for the flat tax where their share falls to around 30% in the case of $\tau_k = 0.4$ and even to 20% in the zero capital income tax. Note that the Gini coefficient of inequality for taxes falls as well: when the capital income tax is eliminated, the coefficient of tax inequality is only 0.16. However, at the high 0.60-exemption level, it is the entrepreneurs again who pay most taxes as all lower income agents (workers) can exempt almost all their gross incomes. Finally, the case of progressive taxation with no capital income tax, the share of taxes paid by entrepreneurs falls to 49%.

Recall that the flat tax reform lowers the fraction of entrepreneurs in the population by around 10%. The flat tax reform makes entrepreneurs better off on average but their shares of wealth, income and consumption do not change.

¹¹In this paper, we do not study the optimal way how to initiate the reforms in order to attain a Pareto-improving allocation. Given the large fraction of wealth held by a small fraction of agents and the large welfare and efficiency gains in transition, redistribution of initial wealth by taxation seems a plausible candidate for this goal. See Floden (2009) for details.

INSERT FIGURE 4 ABOUT HERE

These effects are also apparent from Figure 4. It displays the share of tax burden by top percentiles for the zero exemption reform with $\tau_k = 0.4$. The top 1% of tax payers pays almost 28% in the benchmark steady state, the top 5% almost 60%, the top 50% pays almost 93%. The reform shifts the burden to the poorer percentiles. The largest difference is for the top 10-30% percentiles, at around 25%. A very similar results apply to the flat tax reform with the capital tax eliminated.

The after-tax incomes do not change so dramatically. This is mostly because of the general equilibrium effects. For almost all reforms, the after-tax incomes are higher, most for the average entrepreneur.

5.5 Entrepreneurial Decisions

In the U.S. data, the average spell is 9.1 years and the average exit rate is 12.4% (over 2 years). In the flat-tax steady states, higher wage rates lower entrepreneurial profits as much as they increase the opportunity cost of not being a worker. This, together with the higher marginal tax rate for poor agents, reduce the entry into entrepreneurship (the fraction of entrepreneurs falls by around 10%). However, lower marginal tax rates, and therefore, relaxed financing constraints, imply that more entrepreneurs run larger projects. In Table 6 the firms are bigger, with a shorter spell and a higher exit rate. This is even more pronounced when the capital tax is eliminated.

INSERT TABLE 6 ABOUT HERE

In order to better illustrate these changes, we compute the distribution of firms by size and employment. We choose three categories of firms by employment size: below 5 employees, between 5 and 20, and above 20. In the benchmark economy, 60% of firms are the smallest firms, 36% have the medium size, and only 4% employ more than 20 workers. This corresponds to 27% of workers employed in the smallest, 54% in the medium size, and 19% in the large firms.

The flat-tax reforms with preserved capital income tax increase the average firm size away from the first category in both margins. There are now only 56% of small firms, 37% of medium firms, but 6% of the large firms. They employ 22%, 49% and 29% of workers in the non-corporate sector, respectively. The share of workers in the large firms increases by 10%. When the capital income tax is eliminated, the firm size distribution is almost identical, with slightly fewer smaller firms.

The size of the average entering firm in the progressive tax steady state is only 34.3% of the average firm. It receives only 47.9% of average profits and the entering entrepreneur has 30.7% of assets owned by the average entrepreneur. While these relative results do not change dramatically with the flat tax reforms, the average entering firm is different. The average entrant's size grows by 3.4% and its owner has 19.3%

more assets. At the 20%-exemption level, the average entrant is 6% larger and its owner 24.1% wealthier. When the capital income tax is also eliminated, the average entering entrepreneur is even wealthier but there is no effect on the size of the firm (except for the top exemption rate when the large income tax burden falls even on the smallest firms).

These entry changes are mostly due to the general equilibrium effects. As the equilibrium wage increases with flat-tax reforms (and capital income tax reform), the entering entrepreneur opportunity cost increases too and he requires greater profits. These come from running firms at more efficient, i.e., bigger, size. In order to start a bigger firm, the agent needs more assets as collateral.

5.6 Growth and Rates of Return

The growth rate of firms declines in the length of entrepreneurial spell, as in the data. Under the progressive tax, on average firms grow at 23% during the first two years, around 2 percent faster than under the flat tax. The fastest growth occurs for newborn firms faced with the flat tax and 60% exemption level. However, this difference reverses at later stages: after 5 years of existence, firms under the flat tax grow at around 19%, which is 5% more than in the progressive tax steady state. The elimination of the capital income tax increases growth of firms in their first five years by 0.9% annually but has no effect on firm growth in later years. The main forces of the zero capital tax is thus mainly reflected in the asset position of entrepreneurs and general equilibrium effects.

Thus the flat tax promotes growth of firms and accumulation of assets in the long run. After 10 years in operation, entrepreneurs under the flat tax hold around 15-20% more assets than those under the progressive tax. Again, those under the flat tax with 60% exemption level accumulate the lowest stock of assets. Similarly, the after-tax incomes of entrants are highest under the progressive tax (by around 15%) but are overtaken after the firm grows for 10 periods. For mature firms, the flat tax with low exemption levels have 15-20% higher after-tax incomes than those under the progressive tax.

Finally, Table 6 also shows rates of return on the average firm and on the average entrant. These returns are calculated as annual rates of pre-tax and after-tax profit per unit of capital invested in the firm. These returns are high in the progressive tax economy with capital taxation (see the first column) and fall with the capital tax reform. The flat-tax returns are generally lower and increase in the exemption level (the highest rate of returns are in the 60% exemption level flat tax economy with capital income tax $\tau_k = 0.4$). Differences between the pre-tax and the after-tax returns are greater in the progressive steady states (by 1.5-2%) than in the flat-tax steady states (usually less than 1%).

As in the U.S. data, rates of return of surviving firms decrease in the firm size and in the age of the firm: the bottom decile of firms (by employment) have 5-6% higher return than those in the top decile in pre-tax returns and 6-8% in after-tax returns. Thus the

returns of a median surviving firm in all steady states are slightly higher (by 0.1 to 0.2 percent) than those of the average firm. The average entrant has much higher return than the average firm in all steady states. This again suggests that the long-run values of entrepreneurial career are much more important than the instantaneous profits.

These rates correspond to those found in Moskowitz and Vissing-Jorgensen (2002). They estimate the average after-tax return on private equity as 8.2 percent per year (from 1990 to 1992), as 13.0% (from 1993 to 1995), and as 19.4% (from 1996 to 1998), adjusted for retained earnings, own income, firm births, IPOs, mergers and acquisitions and tax evasion. These results confirm that flat-tax and capital-tax reforms increase competition to enter and reduce rents to entrepreneurs.¹²

The tax-to-profit ratios over the spell have diverging paths for the progressive and flat tax economies. For the progressive tax, the ratio grows from 13% for an average entrant to 28% for a mature firm (it includes tax on capital income). For the zero exemption flat tax, it is constant at under 12%. For the 60% exemption level, it grows from 17% to 28%. Figure 5 shows total taxes paid by entrepreneurs during their spell in the economy with $\tau_k = 0.4$. In the 0-exemption reform, tax burden is more than 50% lower than in the benchmark economy. These results are very similar in the steady states without the capital income tax.

INSERT FIGURE 5 ABOUT HERE

Thus, over time successful entrepreneurs accumulate a significant amount of savings, become unconstrained and operate firms at a more efficient scale of production. Correspondingly, Quadrini (1999) uses the PSID data to observe that while worker families tend to stay in or move to lower positions of wealth, business households tend to stay in or move to higher positions. He also finds that the longer the business life, the higher the wealth accumulated by business families. Undertaking of entrepreneurial activity is an important way for households to switch to higher classes of wealth.

Importantly, despite all these changes in allocations, the average profit of firms remains approximately the same in all steady states. This is consistent with general equilibrium and the no arbitrage principle.

5.7 Financing Frictions

How much are the entrepreneurs financially constrained? We define the optimal size of a firm as the unconstrained allocation of inputs at the equilibrium prices. On average, firms start at around 8% of the optimal size. The average firm with a spell longer than 20 years operates at 58.8% of the optimal size in the progressive tax system and at 67% in the 0.20-exemption reform. It seems that the flat-tax reforms offer better incentives for the development of firms in the long-run: Except for the 0.60-exemption reform,

¹²The risk premium for bearing idiosyncratic risk might be overstated due to the absence of aggregate risk.

production is more efficient under the flat tax system. Production is at a more optimal level when the capital income tax is eliminated. In this case, the average older firms at the zero and 0.20-exemption reforms operate at 71% and 72% of the optimal size, respectively.

In all steady states, almost all entrepreneurs (above 95%) of all types borrow from the banking sector (that is, they choose $k > a$). As successful entrepreneurs accumulate assets over time, the fraction of borrowers in Figure 6 decreases in the entrepreneurial spell.¹³

INSERT FIGURE 6 ABOUT HERE

Evans and Leighton (1989) estimate that entrepreneurs can borrow up to 50% of their current assets. Small firms pay fewer dividends, take on more debt, and invest more. Evans and Leighton (1989) also provide evidence that almost half of the entrepreneurs use their own family's savings to start up their business. We obtain similar results. In our model, entrants in the progressive tax system have on average the largest leverage ratio, 56%, but the low exemption reforms have the highest ratio over time, up to 63%. Note that the progressive tax system provides an almost constant 56-58% loan to asset ratio over the whole spell. Importantly, the flat tax steady states with high exemption levels have the lowest leverage ratios, especially in the first years of the spell: although the entrepreneurs do not pay taxes at their low levels of income, expensive inputs and high taxes in the future seem to discourage investment. Borrowing declines in later periods of the spell, mostly due to self-financing by larger firms. When the capital income tax is eliminated, the shape of these ratios remain very similar but at higher loan-to-asset levels: with the peak for the zero exemption economy at 69% and for the progressive tax economy at 68%. Importantly, even the highest exemption level economy has this ratio always above that of the benchmark economy.

It seems that firms operate at very low efficiency levels despite a good access to banks: Around 70% of smallest firms (under five employees) borrow at the bank in the progressive tax steady state (which is 2% more than under the flat tax). We therefore look at the ability to borrow at the margin, i.e., the fraction of entrepreneurs that would be constrained with respect to borrowing additional assets. Results are very similar across all steady states, slightly improving with the flat-tax reform. At the 2% margin, only 0-2% of entrepreneurs are constrained (that is, they are unable to add more than 2% of extra inputs because their assets are not sufficient to cover potential losses). Around 25% of entrepreneurs are constrained in adding 10% more inputs. Adding greater amounts is impossible for a large majority of entrepreneurs: 82-85% cannot add 25% more inputs, and 95% of entrepreneurs cannot increase the size of their firms by 50% or more. These numbers decrease over the length of the entrepreneurial spell. Also,

¹³The CBO 1992 shows that three-quarters of small firms use credit, almost 60% use traditional as well as non-traditional sources. Around 90% of credit comes from traditional sources, mostly from lines of credit and loans. Almost half of the entrepreneurs use their own or family's savings.

the least constrained are entrepreneurs under the flat tax with the high 60% exemption level. The elimination of the capital income tax shows the same financing constraints at low margins but allows around 5% more entrepreneurs who would like to add more than 25% of more inputs.

These results suggest that although firms are undercapitalized, their owners could increase their size at the margin but they *choose* not to. In other words, for most firms the financing constraint is not binding at the margin (for small additions of inputs). The reason why the entrepreneurs do not want to increase the size of their firms is the risk of a larger project's failure. Therefore, more developed financial markets can lead to a substantial improvement in allocation of resources. For example, contracts contingent on realization of profits may lead to large efficiency and welfare gains. We will investigate this phenomenon in our future research.

6 Conclusion

This model shows that introducing occupational choice into the literature of optimal taxation provides important results for understanding the effects of flat tax and capital tax reforms on business firms, their size, entry and exit, distribution and development over time. We find that the standard models without occupational choice overestimate the effects of these reforms. Also, modeling occupational choice of heterogeneous agents and the investment decisions of wealth-constrained entrepreneurs is important for matching U.S. distributional data. In particular, saving and investment decisions under limited enforceability of contracts are capable of generating very unequal distribution of wealth. The main factor behind the high levels of savings of business families is the incentive to overcome the financing constraint that prevents them from operating their firms at the optimal size.

We find large efficiency and welfare gains from transition for flat-tax and capital tax reforms with low exemption levels. This result seems to be a strong policy recommendation for government policy. Importantly, the welfare gains apply to both occupations. If the government tries to protect workers and small entrepreneurs by high exemption levels, both occupations are worse off and the economy becomes less efficient and more unequal.

We also find that the average firm size increases while the fraction of entrepreneurs decreases as only the most efficient as well as wealthy ones enter. This could be important for the crucial role small firms play in innovation, technological change and productivity growth. In the 1990s, small businesses employed more than half of the workforce and created three-fourths of the new jobs. A lower number of these small firms could be costly in terms of technology innovation. Jermann and Quadrini (2003) analyze the impact of technology innovations in a similar model with heterogeneous firms and limited enforceability of financial contracts. Government policies targeting the entry of financially constrained and skilled entrepreneurs can have significant im-

pact on occupational choice, efficiency, aggregate levels and the distribution of resources (see Kiyotaki and Moore (2001)).

There are many important issues the paper does not address. Asymmetric information, taxation and financial intermediation can be studied in a greater detail. The banks could provide optimally designed loan contracts (multiperiod loans, break even only in expectation, or require collateral contingent on individual characteristics of entrepreneurs). Consequently, financial contracts could be optimally designed to provide not only capital for an entrepreneurial project but also some insurance against its failure.

We did not consider the wide variety of existing tax incentives, deductions or supplements. For example, we might include deduction of investment or tax-free periods at the beginning of entrepreneurial spell. These issues are left for future research.

Appendix A

In this Appendix we present the results from two alternative specifications of the model: the case of fixed corporate sector and the case of workers having also persistent productivity shocks.

A.1 Fixed Corporate Sector

In this experiment, we keep the levels of capital and labor inputs used in the corporate sector fixed across all steady states. We impose the amount of assets K_C and labor N_C used in the corporate sector in the benchmark progressive tax steady state on all flat tax and capital tax reform steady states (and transition paths).

This implies two changes in the model: first, in the definition of stationary equilibrium, the market clearing conditions are

$$\begin{aligned} A - K_C &= \int a \lambda(da \times dz) - K_C = \int k(a, z) \lambda(da \times dz) = K, \\ L - N_C &= \int z' \psi(dz')|_W \lambda(da \times dz) - N_C = \int n(a, z) \lambda(da \times dz) = N, \end{aligned}$$

and second, the zero-profit condition for the corporate sector must be preserved. Because equilibrium prices are determined in the non-corporate sector (see the two equations above), a technology parameter for the corporate sector A_C has to be found in each steady state for the representative corporate firm to attain zero profits.

A.1.1 Results

The technology parameter for the corporate sector that guarantees zero profit in the benchmark progressive steady state economy is $A_C = 1.3271$. All other steady states have this parameter in the interval $A_C \in [1.32, 1.35]$.

INSERT TABLE 7 ABOUT HERE

Overall, the results of this experiment are close to the benchmark model. Keeping fixed the inputs in the corporate sector, its share falls approximately to 0.35 in the flat tax reforms with $\tau_k = 0.4$ and to around 0.36 in the steady states with the capital tax abolished. This implies that more accumulated capital and more labor input is available for the entrepreneurial sector. Interest rates fall by 20-30 basis points, there is slightly more entrepreneurs. As the corporate sector does not crowd out additional resources, there is no need to accumulate as much assets as in the benchmark model (the aggregate capital stock increases by 5-6% less). Welfare gains are very similar to the benchmark model too.

INSERT TABLE 8 ABOUT HERE

A.2 Workers with Persistent Productivity Shocks

In order to test whether the assumption of iid shocks for workers affects the aggregate results and especially the welfare analysis, we simulate the benchmark progressive tax steady state as well as all the flat tax and capital tax reforms with a persistent transition function for workers.

Similarly to entrepreneurs, workers now draw z' from a first-order Markov process $Q_W(z, z')$, approximated by the method of Tauchen and Hussey (1991). We set the AR(1) coefficient $\rho = 0.94$ and the residual variance $\sigma^2 = 0.02$, which is in the range of estimates in the literature (see Hubbard et al. (1994) and Storesletten et al. (2004)). This transition matrix satisfies the assumptions required for the existence of equilibrium described in Section 3.

All equations are the same except for the replacement of ψ by $Q_W(z, z')$ and the corresponding definition of \tilde{z} , the average ability of workers hired by each entrepreneur. During numerical simulations, this average is not known beforehand and must be guessed and verified in computations of all equilibria and transition paths. At the cost of a worse fit for some simulation results but for the sake of the most straightforward comparison with the benchmark economy, we keep fixed all the other parameters of the model. In evaluating the results, we focus mostly on changes with respect to the benchmark model rather than levels of aggregate variables.

A.2.1 Results

In the benchmark, progressive taxation steady state with $\tau_k = 0.4$ (the first column in Table 9), the capital stock increases by 51% relative to the steady state with workers having iid shocks; output increases by 47% and consumption by 41%. The average skill of workers in the benchmark steady state is $\tilde{z}=1.575$ (with very small changes in the other steady states) which increases the effective equilibrium wages by 34%. In

equilibrium, the tax exemption level is at 72% of the average income. Entrepreneurs now constitute only 4.6% of the workforce (this is less than in the U.S. data and less than in the benchmark model).

INSERT TABLE 9 ABOUT HERE

The second column shows the allocations in the progressive steady state without the capital income tax. Relative to the first column, assets increase by 8.2%, output by 2.5%, and consumption by 1.9%. That is, these increases are about one half of those in the iid specification.

In the following columns, we see that aggregate stock of capital increases with the flat-tax reform and in elimination of the capital income tax. In the economy with a zero exemption level and $\tau_k = 0.4$, capital increases by 12.9%, output by 3.1%, and consumption by 1.6%. These changes are very similar to the iid case. The equilibrium interest rate falls to 2.54% while effective wage increases by 7.6%. However, the welfare gains are lower than in the iid case, turning negative already for the 0.4-exemption economy (with only 37% support for the reform). In general, the steady state gains are around one half and the transition gains are about one third of those found in the iid specification. Similar results apply to the elimination of the capital income tax.

INSERT TABLE 10 ABOUT HERE

These aggregate results are also reflected in proportional changes for each occupation in Table 10. Compared to the iid case, entrepreneurs accumulate relatively more assets than workers. In the benchmark steady state, the ratio of assets held by entrepreneurs relative to workers is now 10.9, that of income 7.4, and that of after-tax income 6.1.¹⁴ The Gini coefficients of wealth and income increase to around 0.89 and 0.44, respectively, in all steady states. Because the lower number of entrepreneurs, their share of assets falls to 34% and that of income to 26%. On the other hand, entrepreneurial tax burden increases to 72% (due to higher tax exemption level).

Firms with 20 and more employees now constitute around 20% of all firms and employ a majority of workers (52% in the progressive tax and around 65% in the flat-tax economies with zero exemption level). Also, due to greater entrepreneurial wealth, the leverage ratio of small firms falls (for firms under 5 employees to around 0.4) but increases for the larger firms (to around 0.25). Overall, the firm dynamics remain very similar albeit at higher levels of employment and capital. This is understandable as the shock process of entrepreneurs is the same as in the benchmark specification and general equilibrium effects take care of the supply and demand forces in labor and capital markets.

¹⁴These ratios increase even more with the flat tax reform: In the 0-exemption case with $\tau_k = 0.4$, they become 13.2, 8.0, and 7.9, respectively. This is almost twice as much as in the iid specification.

On the other hand, the persistence of workers' shocks leads to different welfare gains in steady states and transitions. In general, compared to the iid economies, workers' steady state gains are now around one half and transition gains are now around one quarter of those in the benchmark model (consequently, the 0.4-exemption levels are no longer welfare improving). Entrepreneurs' gains are two thirds in the steady states but double during the transitions. These transition gain differences come from the high levels of entrepreneurial savings before the reform starts and from a more persistent occupational division in the economy. When shocks were iid, a worker had a greater chance of becoming an entrepreneur and reach the benefits of that occupation in a transition.

Otherwise, the patterns observed in the iid economies remain preserved. The flat-tax reform and the elimination of the capital income tax increase accumulation of assets and increase output with a lower fraction of population in entrepreneurship. Increasing the flat-tax exemption level leads to allocations similar to those of the progressive steady state, lowers the welfare gains in the steady state and especially those during the transitions. There are two main differences from the iid case: First, the average welfare gains in transition are negative already at the 0.4-exemption level of the flat-tax reform. Second, the persistent shock process for workers lowers occupational mobility and increases inequality.

CERGE-EI, Prague, Czech Republic

Submitted: July 9, 2010

Accepted:

References

- [1] Albanesi, Stefania and Sleet, Christopher (2006) "Dynamic Optimal Taxation with Private Information." *Review of Economic Studies* 73: pp. 1-30
- [2] Altig D., A.J. Auerbach, L.J. Kotlikoff, K.A. Smetters, J. Walliser (2001) "Simulating Fundamental Tax Reform in the United States." *American Economic Review* 91: pp. 574-595
- [3] Alvarez F., M. Veracierto (1999) "Labor Market Policies in an Equilibrium Search Model." *NBER Macroeconomic Annual* 14: pp. 265-304
- [4] Atkeson, A., Chari V. V. and Kehoe P. (1999) "Taxing capital income: A bad idea." *Federal Reserve Bank of Minneapolis Quarterly Review*: pp. 3-17
- [5] Bohacek R. (2006) "Financial Constraints and Entrepreneurial Investment." *Journal of Monetary Economics* 53: pp. 2195-2212

- [6] Bohacek R. (2007) "Financial Intermediation with Credit Constrained Agents" *Journal of Macroeconomics* 29: pp. 741-759
- [7] Bohacek R., H. Mendizabal (2007) "Credit Markets and the Propagation of Monetary Policy Shocks." *Journal of Money, Credit and Banking* 39: pp. 1429-1456
- [8] Buera F. (2004) "A Dynamic Model of Entrepreneurship with Borrowing Constraints." *Working Paper*
- [9] Burnside C. (1996) "Production Function Regressions, Returns to Scale, and Externalities." *Journal of Monetary Economics* 37: pp. 177-201
- [10] Cagetti M., M. De Nardi (2006) "Entrepreneurship, Frictions and Wealth." *Journal of Political Economy* 114: pp. 835-870
- [11] Chari V., M. Golosov, A. Tsyvinski (2002) "Business Start-ups, The Lock-in Effect, and Capital Gains Taxation." *Federal Reserve Bank of Minnesota Working Paper*
- [12] Chari V., P.J. Kehoe (1990) "Sustainable Plans" *Journal of Political Economy* 98: pp. 784-802
- [13] Conesa, J.C., Kitao S., and Krueger D. (2009) "Taxing Capital? Not a Bad Idea After All!" *American Economic Review* 99(1): pp. 25-48
- [14] Cooley T. and Hansen G. (1992) "Tax distortions in a neoclassical monetary economy." *Journal of Economic Theory* 58: pp. 290-316
- [15] Cooley T., E. Prescott (1995) "Economic Growth and Business Cycles" *Frontiers of Business Cycle Research* Princeton University Press
- [16] Engen E., Gale W (1996) "The Effects of Fundamental Tax Reform. *Economics Effects of Fundamental Tax Reform* Brookings Institution Press
- [17] Erosa A. (2001) "Financial Intermediation and Occupational Choice in Development." *Review of Economic Dynamics* 4: pp. 303-334
- [18] Evans D.S. (1987) "Tests of Alternative Theories of Firm Growth." *Journal of Political Economy* 95: pp. 657-674
- [19] Evans D.S., B. Jovanovic (1989) "An Estimated Model of Entrepreneurial Choice under Liquidity Constraints." *Journal of Political Economy* 97: pp. 808-827
- [20] Evans D.S., L.S. Leighton (1989) "Some Empirical Aspects of Entrepreneurship." *American Economic Review* 79: pp. 519-535
- [21] Floden, M (2009) "Why are capital income taxes so high?" *Macroeconomic Dynamics* 13: pp. 279-304
- [22] Gentry W., G. Hubbard (1997) "Distributional Implications of Introducing a Broad Based Consumption Tax." *Tax Policy and the Economy* 11: pp. 1-48
- [23] Gentry W., R. Hubbard (2000) "Entrepreneurship and Household Saving." *Advances in Economic Analysis Policy* 4: pp. 1050-1053.

- [24] Gentry W., R. Hubbard (2004) "Tax Policy and Entrepreneurial Entry." *American Economic Review* 90: pp. 283-287.
- [25] Gine X., R. M. Townsend (2004) "Evaluation of Financial Liberalization: pp. A General Equilibrium Model With Constrained Occupational Choice." *Journal of Development Economics* 74: pp. 269-307
- [26] Golosov, A., Kocherlakota, N. and Tsyvinski, O. (2003) "Optimal Indirect and Capital Taxation." *Review of Economic Studies* 70: pp. 569-587
- [27] Gordonichenko, Y., Martinez-Vazquez, Jorge and Sabirianova, Klara (2010) "Myth and reality of flat tax reform: Micro estimates of tax evasion and productivity response in Russia." *Journal of Political Economy* 117(3): pp. 504-554
- [28] Greenwood J., B. Jovanovic (1990) "Financial Development, Growth and the Distribution of Income." *Journal of Political Economy* 98: 1076-1107
- [29] Hall R., A. Rabushka (1995) *The Flat Tax*. 2nd edition. Hoover Institution Press
- [30] Hamilton, Barton H. (2000) "Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment." *Journal of Political Economy* 108: pp. 604-631
- [31] Hubbard, R.G., Skinner, J., and Zeldes, S.P. (1994). "The importance of precautionary motives in explaining individual and aggregate savings". *Carnegie-Rochester Conference Series on Public Policy* 40: pp. 59-125
- [32] Imrohoroglu, S. (1998). "A Quantitative Analysis of Capital Income Taxation" *International Economic Review* 39 (2): pp. 307-328
- [33] Kitao, Sagiri (2008) "Entrepreneurship, taxation and capital investment." *Review of Economic Dynamics* 11(1): pp. 44-69
- [34] Klein P., J.V. Rios-Rull (2003) "Time-Consistent Optimal Fiscal Policy." *International Economic Review* 44: pp. 1217-1245
- [35] Kocherlakota, Narayana R. (2005) "Zero Expected Wealth Taxes: A Mirrless Approach to Dynamic Optimal Taxation." *Econometrica* 73(5): pp. 1587-1621
- [36] Krusell P., V. Quadrini, J.V. Rios-Rull (1997) "Politico-economic Equilibrium and Economic Growth." *Journal of Economic Dynamics and Control* 21: pp. 243-272
- [37] Lucas R., Jr. (1978) "On the Size Distribution of Business Firms." *Bell Journal of Economics* 9: pp. 508-523
- [38] Lucas R., Jr. (1990) "Supply-Side Economics: An Analytical Review." *Oxford Economic Papers* 42: pp. 293-316
- [39] Lucas R., Jr., E.C. Prescott (1974) "Equilibrium Search and Unemployment." *Journal of Economic Theory* 7: pp. 188-209
- [40] Meh, Cesaire (2005) "Entrepreneurship, Wealth Inequality, and Taxation." *Review of Economic Dynamics* 8 (3): pp. 688-719.

- [41] Meh, Cesaire (2007) "Business Risk, Credit Constraints, and Corporate Taxation." *Journal of Economic Dynamics and Control* 32 (9): pp. 2971-3008
- [42] Mirrlees, James (1971) "An Exploration in the Theory of Optimum Income Taxation." *Review of Economic Studies* 38: pp. 175-208
- [43] Mendoza, E. G., A. Razin, and L. L. Tesar (1994) "Effective tax rates in macroeconomics: Cross-country estimates of tax rates on factor incomes and consumption." *Journal of Monetary Economics* 34 (3): pp. 297-323
- [44] Moskowitz, T.J., Vissing-Jorgensen, A. (2002) "The returns to entrepreneurial investment: A private equity premium puzzle?" *American Economic Review* 92 (4): pp. 745-778
- [45] Quadrini V. (1999) "The Importance of Entrepreneurship for Wealth Concentration and Mobility." *Review of Income and Wealth* 45: pp. 1-19
- [46] Quadrini V., J.V. Rios-Rull (1997) "Understanding the U.S. Distribution of Wealth" *Federal Reserve Bank of Minneapolis Quarterly Review* 21: pp. 22-36
- [47] Stokey, Nancy L. and Lucas, Jr., Robert E. and Prescott, Edward C. (1989) *Recursive Methods in Economic Dynamics*. Cambridge: Harvard University Press
- [48] Stokey N.L., S. Rebelo (1995) "Growth Effects of Flat-rate Taxes." *Journal of Political Economy* 103: pp. 519-550
- [49] Storesletten, K., Telmer, C.I., and Yaron, A. (2004) "Cyclical dynamics in idiosyncratic labor market risk". *Journal of Political Economy* 112(3): pp. 695-717
- [50] Tauchen, G. and Hussey, R. (1991) "Quadrature-based methods for obtaining approximate solutions to nonlinear asset pricing models". *Econometrica* 59(2): pp. 371-396
- [51] Ventura A. (1999) "Flat Tax Reform: A Quantitative Exploration". *Journal of Economic Dynamics and Control* 23: pp. 1425-1458

Marginal Tax Rates				
Tax Rate τ_m	U.S. Tax System		Model	
	Taxable Income		Fraction of Average Income	
	$>$	\leq	$>$	\leq
.10	\$0	\$ 7,300	$I_0 = 0$	$I_1 = 0.2I^*$
.15	\$7,300	\$29,700	$I_1 = 0.2I^*$	$I_2 = 0.81I^*$
.25	\$29,700	\$71,950	$I_2 = 0.81I^*$	$I_3 = 1.97I^*$
.28	\$71,950	\$150,150	$I_3 = 1.97I^*$	$I_4 = 4.11I^*$
.33	\$150,150	\$326,450	$I_4 = 4.11I^*$	$I_5 = 8.93I^*$
.35	\$326,450	∞	$I_5 = 8.93I^*$	∞

Notes: I_0, I_1, \dots, I_5 are tax brackets, I^* is the average income.

Table 1: U.S. and Model Marginal Tax Rates.

Technology and Preferences							
α	θ	δ	β	γ	A_C	G/Y	
0.36	0.92	0.07	0.978	0.42	1.3271	0.0706	
Ability Shocks Z							
0	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Distribution ψ of Workers' Ability Shocks							
0.10	0.70	0.08	0.06	0.03	0.02	0.01	0
Transition Matrix Q for Entrepreneurs' Ability Shocks							
1	0	0	0	0	0	0	0
0.109	0.698	0.192	0.001	0	0	0	0
0.059	0.095	0.713	0.131	0.002	0	0	0
0.053	0.001	0.111	0.736	0.098	0.001	0	0
0.044	0.004	0.015	0.107	0.755	0.074	0.001	0
0.039	0	0	0.001	0.162	0.756	0.041	0.001
0.025	0	0	0	0.008	0.172	0.758	0.037
0.018	0	0	0	0	0.001	0.339	0.642

Table 2: Parameters of the model.

Aggregate Levels										
	Progressive		Flat Tax Reform: Exemption Level							
	Tax		$\tau_k=.4$				$\tau_k=0$			
	$\tau_k=.4$	$\tau_k=0$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$
Average										
Assets	4.45	5.14	5.02	4.98	4.81	4.51	5.52	5.43	5.21	4.83
Output	1.63	1.72	1.69	1.69	1.67	1.63	1.75	1.73	1.71	1.68
Consumption	1.79	1.85	1.86	1.86	1.82	1.79	1.87	1.86	1.83	1.79
Entrepreneurs (%)	8.82	8.66	7.91	7.93	8.13	8.20	8.01	8.03	8.07	8.48
Flat Tax τ	0.55*	0.36*	0.05	0.06	0.11	0.19	0.08	0.11	0.19	0.32
Interest Rate (%)	4.26	2.81	3.47	3.60	3.90	4.42	2.43	2.53	2.78	3.28
Wage	1.47	1.55	1.57	1.56	1.53	1.47	1.62	1.60	1.56	1.48
Welfare Gains (in %)										
Steady State	—	2.96	3.18	2.97	0.97	-0.70	3.80	3.60	1.71	-0.08
Transition	—	1.48	2.22	2.12	0.50	-0.52	1.72	1.61	0.38	-0.62
Political Support	—	99	98	98	87	3	97	96	90	5

Notes: Output represents the production of goods in the entrepreneurial sector. *In the progressive tax steady states, 0.55 and 0.36 are the exemption levels (fractions of average income).

Table 3: Steady State Aggregate Levels.

Average Levels in Occupations										
Average	Progressive		Flat Tax Reform: Exemption Level							
	Tax		$\tau_k=.4$				$\tau_k=0$			
	$\tau_k=.4$	$\tau_k=0$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$
Workers										
Assets	2.79	3.34	3.08	3.05	2.93	2.73	3.51	3.46	3.31	3.07
Income	2.04	2.18	2.17	2.16	2.12	2.04	2.27	2.25	2.19	2.08
Taxes Paid	0.07	0.09	0.12	0.12	0.12	0.09	0.15	0.14	0.13	0.08
After-Tax Income	1.97	2.09	2.05	2.04	1.99	1.94	2.12	2.11	2.06	2.00
Consumption	1.69	1.75	1.74	1.74	1.71	1.68	1.76	1.76	1.73	1.70
Welfare Gains (in %)										
Steady State	—	2.60	2.63	2.45	0.50	-0.98	2.98	2.86	1.08	-0.40
Transition	—	1.34	2.04	1.96	0.33	-0.63	1.42	1.36	0.06	-0.86
Political Support	—	100	100	100	92	1	100	100	93	2
Entrepreneurs										
Assets	21.48	24.16	27.56	27.31	25.96	24.40	28.67	28.23	26.89	23.85
Income	7.83	8.10	8.69	8.69	8.52	8.45	8.67	8.65	8.59	8.30
Taxes Paid	1.24	0.94	0.64	0.71	0.91	1.21	0.45	0.54	0.82	1.27
After-Tax Income	6.58	7.16	8.05	7.98	7.61	7.24	8.22	8.13	7.77	7.03
Consumption	2.87	2.97	3.21	3.18	3.05	2.94	3.19	3.16	3.04	2.81
Welfare Gains (in %)										
Steady State	—	6.03	11.60	11.08	7.50	4.11	13.63	13.00	9.74	3.61
Transition	—	2.49	2.91	2.72	1.40	0.26	3.45	3.26	2.35	0.87
Political Support	—	94	81	79	44	30	67	64	49	35

Table 4: Steady State Average Levels in Occupations.

Inequality and Distribution										
Average	Progressive		Flat Tax Reform: Exemption Level							
	Tax		$\tau_k=.4$				$\tau_k=0$			
	$\tau_k=.4$	$\tau_k=0$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$
Gini Coefficients										
Assets	0.75	0.76	0.79	0.79	0.80	0.80	0.79	0.79	0.80	0.80
Income	0.31	0.31	0.32	0.32	0.32	0.33	0.32	0.32	0.33	0.33
Consumption	0.16	0.16	0.17	0.17	0.17	0.16	0.18	0.17	0.17	0.16
Taxes	0.77	0.49	0.43	0.47	0.54	0.72	0.16	0.22	0.36	0.67
Share of Entrepreneurs										
Assets	0.43	0.41	0.43	0.43	0.44	0.44	0.41	0.41	0.42	0.42
Income	0.22	0.21	0.19	0.20	0.21	0.22	0.19	0.19	0.20	0.22
Consumption	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13
Taxes	0.61	0.49	0.30	0.33	0.39	0.53	0.20	0.25	0.36	0.61

Table 5: Steady State Inequality and Distribution.

Average Firm and Average Entrant										
Average	Progressive		Flat Tax Reform: Exemption Level							
	Tax		$\tau_k=.4$				$\tau_k=0$			
	$\tau_k=.4$	$\tau_k=0$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$
Average Firm										
Assets	21.48	24.16	27.56	27.31	25.96	24.40	28.67	28.23	26.89	23.85
Size	5.98	6.14	6.73	6.72	6.58	6.51	6.67	6.65	6.58	6.28
Profit	4.01	4.15	4.02	4.02	4.01	4.08	4.10	4.14	4.21	4.29
Taxes Paid	1.24	0.94	0.64	0.71	0.91	1.21	0.45	0.54	0.82	1.28
Return (in %)										
Pre-tax	13.3	11.7	11.8	12.0	12.3	13.3	10.8	11.0	11.5	12.6
After-tax	11.2	10.3	10.9	11.0	11.5	11.4	10.2	10.3	10.4	10.7
Spell	8.49	8.27	8.11	8.12	8.16	8.21	7.83	7.86	7.97	8.16
Exit Rate (%)	12.79	13.02	13.54	13.52	13.26	13.24	13.60	13.54	13.36	13.15
Average Entrant										
Assets	6.59	7.42	7.86	8.18	7.63	7.55	8.28	8.38	8.53	6.57
Size	2.05	2.10	2.12	2.17	2.10	2.11	2.12	2.18	2.19	1.95
Profit	1.92	1.98	1.87	1.91	1.84	1.84	1.96	1.95	1.93	1.91
Taxes Paid	0.25	0.19	0.21	0.23	0.26	0.30	0.19	0.20	0.24	0.26
Return (in %)										
Pre-tax	16.4	14.6	15.7	15.7	15.9	17.4	14.0	14.8	14.9	14.9
After-tax	16.2	13.9	14.9	15.0	15.3	17.2	12.9	13.8	13.9	14.4

Table 6: Steady State Average Firm and Average Entrant.

Aggregate Levels: Fixed Corporate Sector										
Average	Progressive		Flat Tax Reform: Exemption Level							
	Tax		$\tau_k=.4$				$\tau_k=0$			
	$\tau_k=.4$	$\tau_k=0$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$
Assets	4.45	4.89	4.85	4.78	4.69	4.51	5.17	5.13	4.98	4.69
Output	1.63	1.73	1.71	1.70	1.68	1.64	1.77	1.77	1.74	1.67
Consumption	1.79	1.84	1.84	1.83	1.82	1.79	1.86	1.86	1.82	1.79
Entrepreneurs (%)	8.82	8.71	7.96	7.99	8.18	8.27	8.03	8.06	8.24	8.47
Flat Tax τ	0.55*	0.37*	0.06	0.07	0.11	0.19	0.08	0.11	0.19	0.32
Interest Rate (%)	4.26	2.61	3.23	3.38	3.66	4.34	2.07	2.19	2.51	3.11
Wage	1.47	1.54	1.56	1.55	1.53	1.47	1.62	1.60	1.56	1.48
Welfare Gains (in %)										
Steady State	—	2.87	3.14	2.93	0.97	-0.71	3.79	3.59	1.69	-0.08
Transition	—	1.41	2.20	2.10	0.49	-0.52	1.74	1.60	0.37	-0.63
Political Support	—	98	97	97	88	3	96	96	88	5

Notes: Output represents the production of goods in the entrepreneurial sector. *In the progressive tax steady states, 0.55 and 0.37 are the exemption levels (fractions of average income). Fixed inputs in the corporate sector: $K_C = 1.87$, $L_C=0.38$.

Table 7: Steady State Aggregate Levels with Fixed Corporate Sector.

Average Levels in Occupations: Fixed Corporate Sector										
Average	Progressive		Flat Tax Reform: Exemption Level							
	Tax		$\tau_k=.4$				$\tau_k=0$			
	$\tau_k=.4$	$\tau_k=0$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$
Workers										
Assets	2.79	3.09	2.91	2.87	2.81	2.72	3.16	3.16	3.08	2.94
Income	2.04	2.13	2.14	2.13	2.10	2.04	2.20	2.19	2.14	2.05
Taxes Paid	0.07	0.09	0.14	0.13	0.12	0.10	0.15	0.14	0.13	0.07
After-Tax Income	1.97	2.04	2.00	2.00	1.98	1.94	2.05	2.05	2.01	1.98
Consumption	1.69	1.73	1.72	1.72	1.71	1.68	1.74	1.74	1.71	1.69
Welfare Gains (in %)										
Steady State	—	2.57	2.60	2.42	0.50	-0.98	2.95	2.83	1.07	-0.40
Transition	—	1.32	2.02	1.94	0.33	-0.63	1.40	1.34	0.06	-0.85
Political Support	—	99	99	99	92	1	99	99	92	2
Entrepreneurs										
Assets	21.48	23.79	27.31	26.86	26.20	24.26	28.26	27.67	26.18	23.61
Income	7.83	8.05	8.67	8.62	8.61	8.41	8.67	8.61	8.46	8.27
Taxes Paid	1.24	0.95	0.66	0.73	0.89	1.19	0.45	0.54	0.82	1.29
After-Tax Income	6.59	7.10	8.01	7.89	7.72	7.22	8.22	8.07	7.64	6.98
Consumption	2.87	2.96	3.19	3.16	3.09	2.94	3.23	3.19	3.02	2.81
Welfare Gains (in %)										
Steady State	—	6.01	11.53	11.01	7.60	4.11	13.80	13.12	9.68	3.61
Transition	—	2.48	2.89	2.70	1.42	0.26	3.49	3.29	2.33	0.87
Political Support	—	94	80	79	45	30	68	65	50	35

Notes: Fixed inputs in the corporate sector: $K_C = 1.87$, $L_C=0.38$.

Table 8: Steady State Average Levels in Occupations with Fixed Corporate Sector.

Aggregate Levels: Workers with Persistent Productivity Shocks										
	Progressive		Flat Tax Reform: Exemption Level							
	Tax		$\tau_k=.4$				$\tau_k=0$			
	$\tau_k=.4$	$\tau_k=0$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$
Average										
Assets	6.71	7.26	7.58	7.43	7.10	6.84	8.15	8.07	7.72	7.00
Output	2.39	2.45	2.47	2.43	2.39	2.32	2.53	2.52	2.46	2.38
Consumption	2.52	2.56	2.56	2.54	2.51	2.50	2.58	2.57	2.56	2.51
Entrepreneurs (%)	4.59	4.45	3.75	3.76	3.79	3.88	3.76	3.86	3.76	4.04
Flat Tax τ	0.72*	0.37*	0.07	0.10	0.15	0.17	0.10	0.14	0.17	0.29
Interest Rate (%)	3.35	2.47	2.54	2.72	2.98	3.45	1.84	2.02	2.03	2.73
Wage	1.32	1.37	1.42	1.40	1.36	1.28	1.45	1.43	1.42	1.34
Welfare Gains (in %)										
Steady State	—	1.45	1.65	1.46	0.34	-0.78	1.78	1.56	0.99	-0.21
Transition	—	0.56	0.72	0.57	-0.02	-0.45	0.84	0.64	-0.04	-0.85
Political Support	—	85	88	85	37	8	92	87	42	10

Notes: Output represents the production of goods in the entrepreneurial sector. *In the progressive tax steady states, 0.72 and 0.37 are the exemption levels (fractions of average income).

Table 9: Steady State Aggregate Levels: Workers with Persistent Productivity Shocks

Average Levels in Occupations: Workers with Persistent Productivity Shocks										
Average	Progressive		Flat Tax Reform: Exemption Level							
	Tax		$\tau_k=.4$				$\tau_k=0$			
	$\tau_k=.4$	$\tau_k=0$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$	0	$0.2I^*$	$0.4I^*$	$0.6I^*$
Workers										
Assets	4.61	5.04	5.19	5.09	4.85	4.69	5.69	5.65	5.38	4.76
Income	2.86	2.96	3.07	3.04	2.96	2.84	3.21	3.15	3.08	2.88
Taxes Paid	0.08	0.08	0.22	0.21	0.18	0.11	0.23	0.21	0.14	0.09
After-Tax Income	2.78	2.88	2.85	2.83	2.78	2.73	2.98	2.96	2.94	2.80
Consumption	2.36	2.41	2.39	2.38	2.35	2.32	2.42	2.40	2.39	2.36
Welfare Gains (in %)										
Steady State	—	1.29	1.34	1.26	0.15	-0.86	1.38	1.32	0.79	-0.37
Transition	—	0.43	0.57	0.42	-0.12	-0.67	0.55	0.36	-0.19	-0.96
Political Support	—	85	88	85	36	7	92	87	41	9
Entrepreneurs										
Assets	50.36	54.93	68.42	67.32	64.22	60.10	71.12	68.34	67.61	60.21
Income	21.08	21.73	24.44	24.41	24.31	24.30	24.69	24.37	23.82	23.18
Taxes Paid	4.02	3.66	1.87	2.28	3.06	3.19	1.61	2.09	2.50	4.14
After-Tax Income	17.06	18.07	22.57	22.13	21.25	21.11	23.08	22.28	21.32	19.04
Consumption	5.85	6.01	6.89	6.64	6.57	6.48	6.83	6.61	6.51	6.07
Welfare Gains (in %)										
Steady State	—	4.89	9.54	6.58	5.07	1.20	12.02	7.54	14.09	3.59
Transition	—	3.35	4.54	4.28	2.52	0.50	8.26	7.61	3.53	1.49
Political Support	—	96	98	98	62	32	98	96	67	33

Table 10: Steady State Average Levels in Occupations: Workers with Persistent Productivity Shocks.

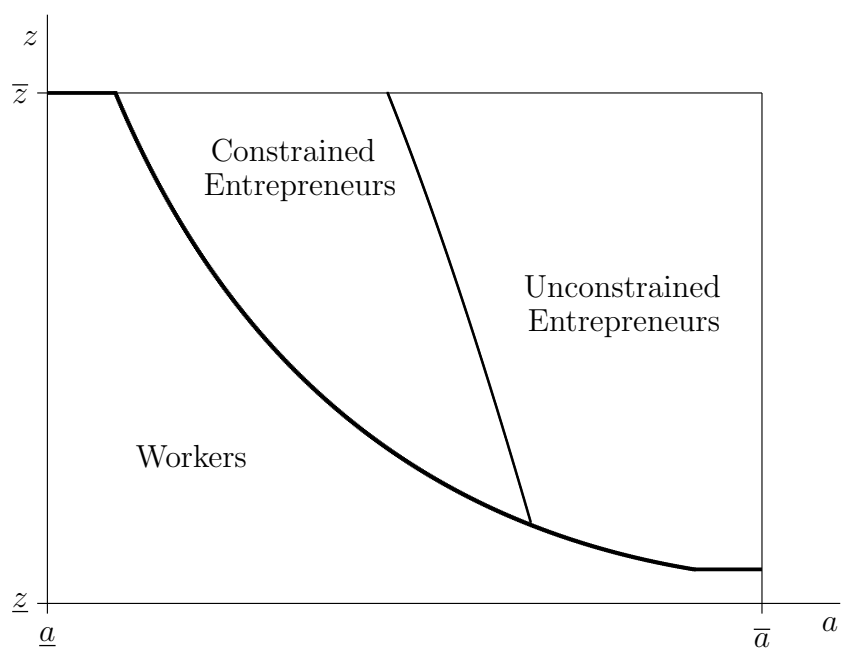


Figure 1: Occupation Choice by Assets and Skill

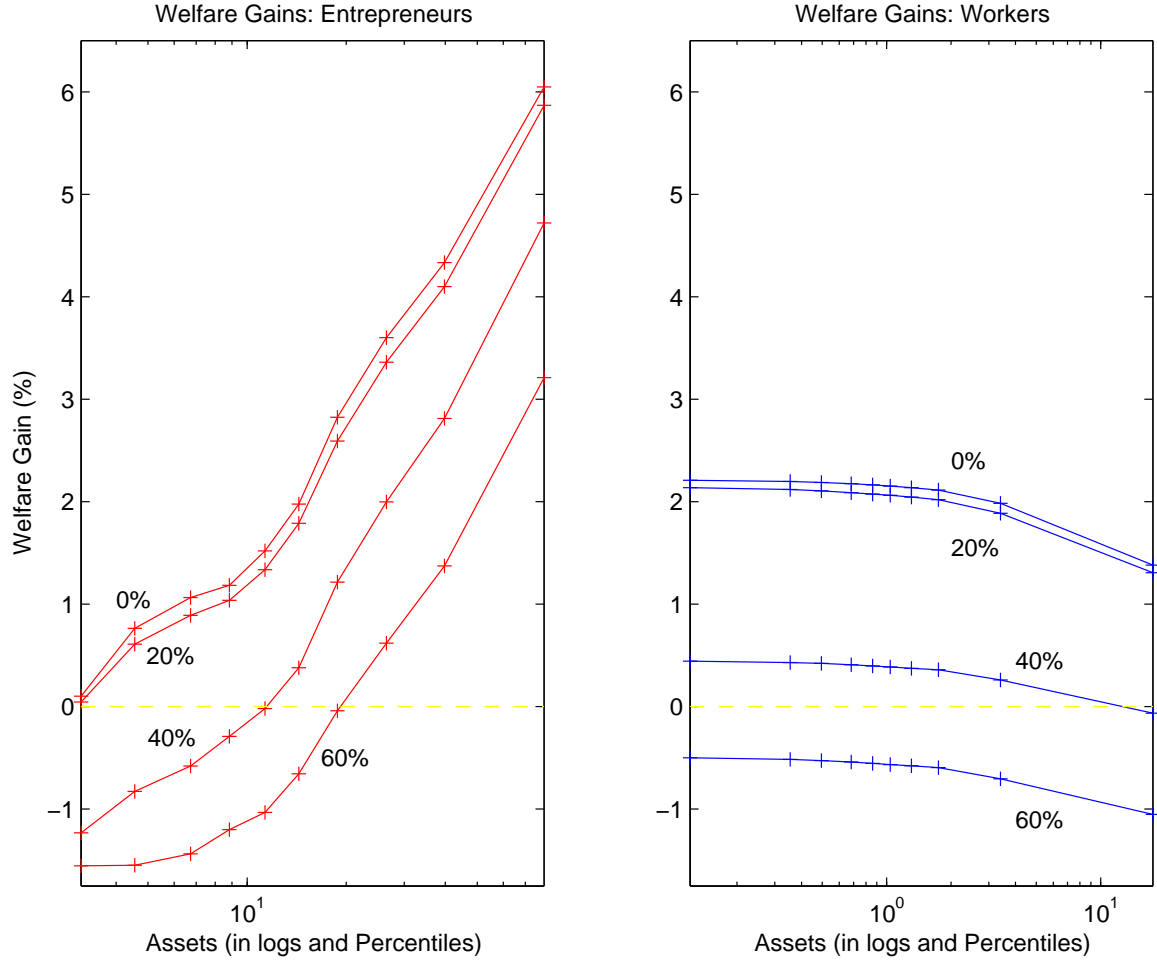


Figure 2: Welfare gains from transition with $\tau_k = .4$ for the flat-tax reforms with 0%, 20%, 40% and 60% exemption rates. Marks represent deciles of the distribution of wealth in each occupation.

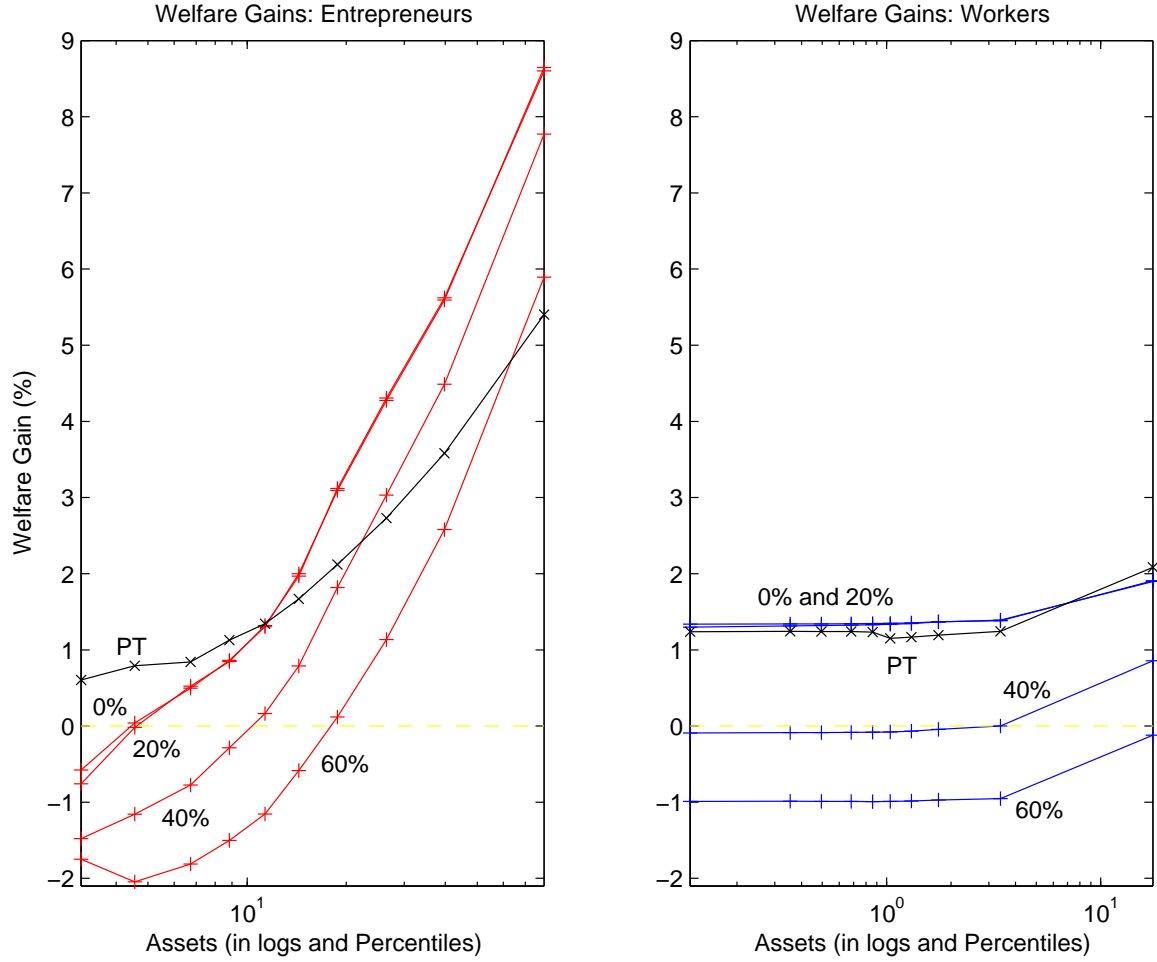


Figure 3: Welfare gains from transition with $\tau_k = 0$ for the progressive taxation (PT) and flat-tax reforms with 0%, 20%, 40% and 60% exemption rates. Marks represent deciles of the distribution of wealth in each occupation.

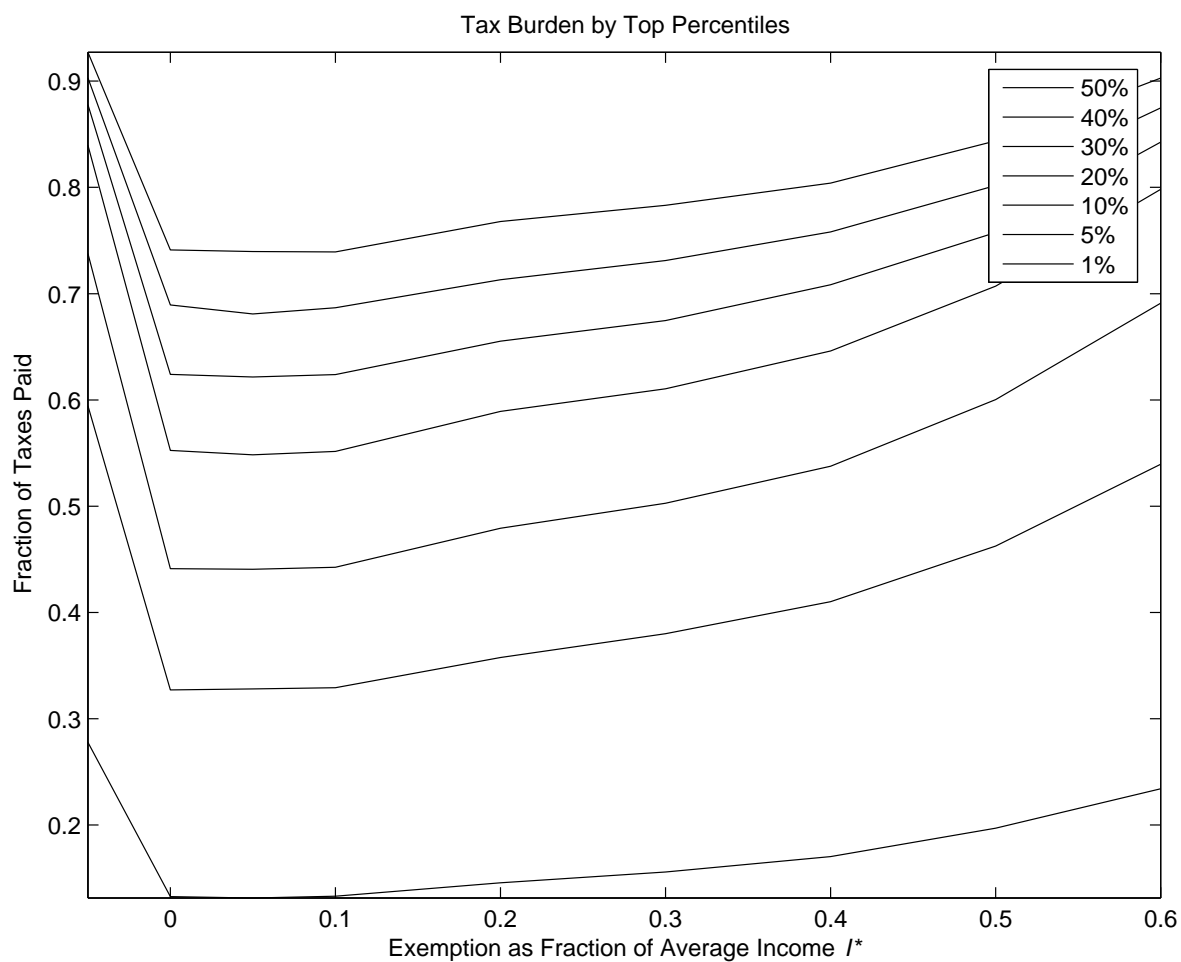


Figure 4: Tax Burden by Top Percentiles. Steady States with $\tau_k = 0.4$.

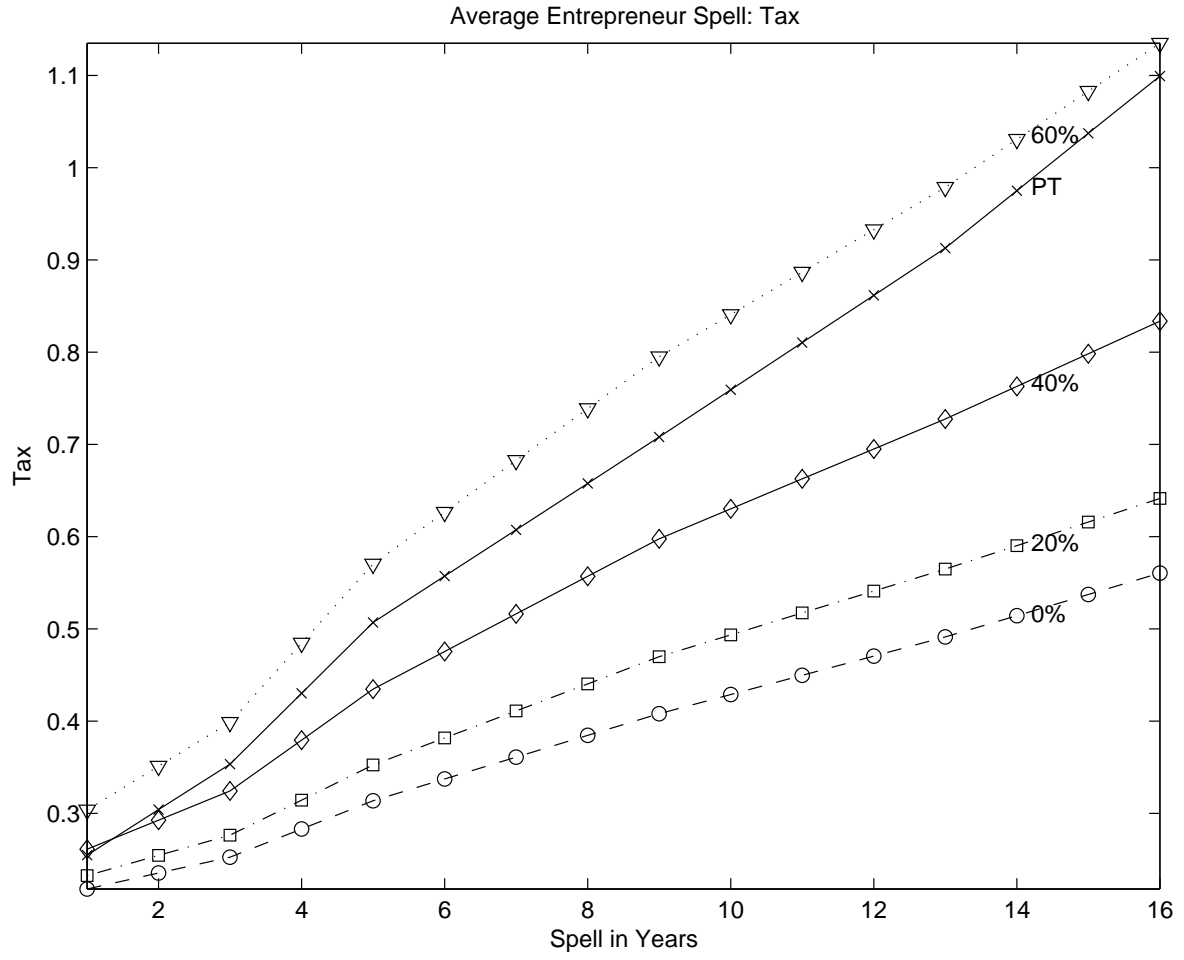


Figure 5: Average Entrepreneur Spell: Taxes Paid. Steady States with $\tau_k = 0.4$.

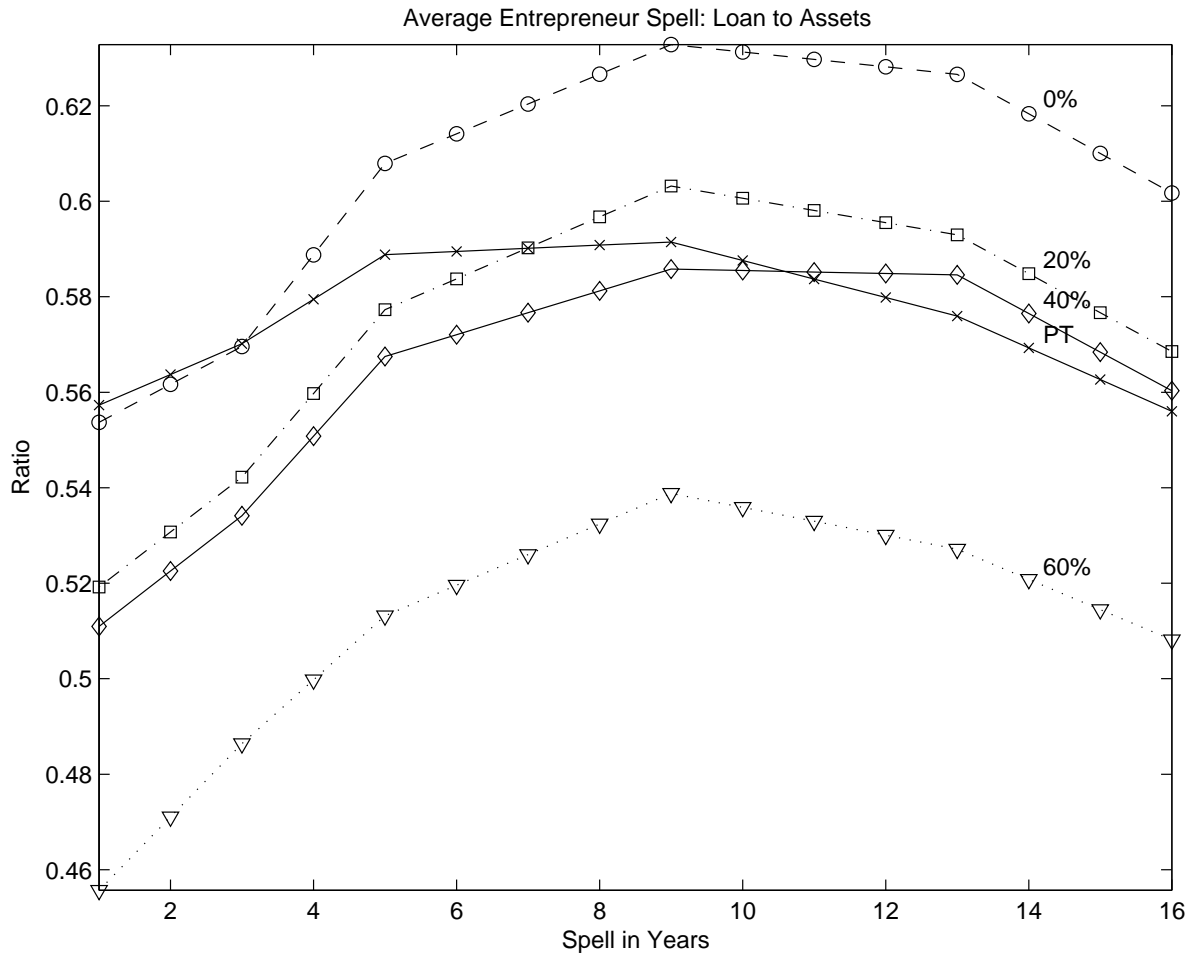


Figure 6: Average Entrepreneur Spell: Loan to Assets. Steady States with $\tau_k = 0.4$.