

Business Start-ups, The Lock-in Effect, and Capital Gains Taxation

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Abstract

We develop a model of entrepreneurial choice in which some individuals have a comparative advantage in starting new businesses. Efficiency dictates that entrepreneurs should specialize in start-ups and sell successful start-ups to professional managers. We consider the role of capital gains taxation. Capital gains taxes create an incentive for entrepreneurs to manage their own enterprises and avoid paying such taxes rather than sell them to professional managers. With taxation of capital gains, some of the entrepreneurs get inefficiently locked into running their own enterprises. We quantify the role of this effect and argue that it is large. Our model is consistent with a number of key features of the data, including evidence on transitions of entrepreneurs from self-employment to other labor market activities.

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1 Introduction

In this paper, we develop a quantitative model of entrepreneurship and use the model to analyze a classic question in public finance: what are the welfare costs of capital gains taxation? One motivation for developing a model of entrepreneurship is that entrepreneurial activity is widely regarded as central to innovation, growth, and development. We focus on entrepreneurial activity conducted in the business sector of the economy in firms whose equity is not publicly traded. In the United States, such firms consist of corporations as well as unincorporated businesses. We refer to such firms as privately held businesses and their owners as entrepreneurs. They are typically relatively small family owned enterprises, although a few large firms are privately owned. These firms contribute to a sizable fraction of economic activity in the United States so that this sector of the economy is fairly substantial in its own right. To the extent that this sector of the economy contributes disproportionately to innovation, it merits even more attention.

Our model of entrepreneurship is a version of that in the work of Holmes and Schmitz (1990, 1995) and has three key features. First, some individuals have a comparative advantage in starting new business enterprises relative to managing existing enterprises and this comparative advantage varies across individuals. Second, we assume that entrepreneurs can own only one business at a time. Third, markets are incomplete and entrepreneurs smooth consumption by accumulating assets to protect themselves against the risk that new enterprises will fail. The comparative advantage feature implies that specialization is efficient and that the extent of specialization is affected by tax policy. Together with the assumption that entrepreneurs can own only one business at a time, comparative advantage implies that those who are relatively better at starting business enterprises should sell successful startups to others and start new enterprises. In our model, realization-based capital gains taxation introduces a friction which impedes this specialization. Since no capital gains taxes need be paid if an entrepreneur chooses to manage a business rather than sell it, the model raises the possibility that capital gains taxation might lead to inefficient allocation of abilities by leading some entrepreneurs to manage their enterprises rather than transferring them to others.

We call this inefficient allocation of skills the *lock-in effect* induced by capital gains taxation. Our notion of a lock-in effect is closely related to that in the literature (see, for example, Constantinides (1983); Balcer and Judd (1987); and Dammon, Spatt, and Zhang (2001)). In this literature,

individuals hold undiversified portfolios, either as part of unspecified initial conditions or due to changes in the relative prices of assets. In our model, the entrepreneur's portfolio is undiversified because a substantial portion of the entrepreneur's assets are in the business owned by the entrepreneur. Capital gains taxation makes diversification costly. Recent work by Ivkovic, Poterba, and Weisbenner (2003) finds evidence of strong lock-in effect for taxable as compared tax-deferred accounts. For other evidence on effects of capital gains taxes see Poterba (1987).

A key feature of our model is that entrepreneurs must sell their firms if they wish to start a new business enterprise or transition to paid employment. Specifically, we do not allow entrepreneurs to hire managers while maintaining ownership of the business. This feature of the model is driven partly by the data which suggests strongly that few entrepreneurs have substantial passive ownership in privately held businesses. It is also driven indirectly by the substantial evidence that moral hazard and enforcement problems imply that optimal contracts between owners and managers require that managers must hold a large fraction of their wealth as equity in the firm (Bitler, Moskowitz, and Vissing-Jorgensen 2004). When the assets of a firm are relatively small, it may be difficult for managers to hold enough equity to solve incentive problems while leaving owners with a large equity stake as well.

In our quantitative model, we find that the lock-in effect is large. The deadweight cost of raising these revenues through capital gains taxation is 0.14 percent of consumption. That is, in the model all households' consumption can be raised by 0.14 percent and the same revenues of 0.25 percent of total consumption can be raised in a nondistorting manner. To give some perspective, the welfare cost of capital income taxation in a standard one-sector growth model associated with raising revenues of 0.25 percent of consumption is 0.38 percent. We find that a profit tax that is not realization based can reduce the deadweight loss by about 90 percent.

We also show that there is a Laffer Curve associated with capital gains taxation, that is, an inverse U-shaped dependency of tax revenues on the tax rate. The peak of this Laffer Curve occurs at a tax rate of roughly 15 percent. For comparison purposes, the peak of the analogous Laffer Curve associated with taxation of capital income in a one-sector growth model is the labor share of national income, which is roughly 70 percent.

The paper is organized as follows. In section 2, we describe evidence supporting the three key features of our model. In section 3, we set up the model and in section 4 we describe some of the equilibrium dynamics on a simple analytical example. In section 5, we describe how we parameterize

the model. Section 6 contains welfare evaluations and quantitatively compares distortions from the capital gains taxes to the distortions from the tax on capital income in the standard neoclassical growth model. Section 7 concludes.

2 Evidence on Entrepreneurship and Capital Gains Taxation

In this section, we present data which motivates our model of entrepreneurship and evidence that capital gains taxation affects entrepreneurial activity. We first present evidence of comparative advantage in entrepreneurial activity. Second, we provide evidence supporting our assumption that entrepreneurs typically own one business at a time. Third, we argue that the data suggests that entrepreneurial activity is risky and that entrepreneurs insure against risk by holding assets to protect against risk. Finally, we argue that entrepreneurial activity is affected by capital gains taxation.

Entrepreneurs who start more than one business are often called “serial entrepreneurs”. Holmes and Schmitz (1990, 1995) present extensive evidence of serial entrepreneurship. They show that between 40 and 60 percent of entrepreneurs start more than one business and about 10 percent start more than three businesses. Lazear (2001) in a survey of the Stanford Business School graduates finds that the mean number of business started is 1.34 and that some graduates started up to 5 businesses after graduation. There is a substantial literature in entrepreneurship that finds strong evidence of serial entrepreneurship (see, for example, Birley and Westhead 1993; Kolvereid and Bullvag 1993; Ronstadt 1984; Schollhammer 1991).

We draw similar conclusions from our analysis of data from the Panel Study of Income Dynamics (PSID)¹. The PSID includes data on people who report that they own and actively manage a business². In 1993, for example, 12.74 percent of the sample reported that they own and actively manage a business. We refer to these individuals as entrepreneurs. We find that, over time, entrepreneurs experience frequent transitions away from self employment to some other labor force status such as paid employment,

¹The authors are indebted to Gueorgui Kambourov and Iouri Manovskii for providing invaluable assistance with PSID data set.

²Similar results hold for individuals who identify themselves as self-employed. Alternatively, as in Gentry and Hubbard (2002) one can define entrepreneurs as agents with active business assets.

unemployment, or departure from the labor force, and then back to managing their own (presumably new) businesses. We define an entrepreneurship spell as the length of time that a respondent reports continuously that he or she is owning and managing a business. As evidence of frequent transitions from owning and managing their businesses to some other labor force status, consider people who were in the sample continuously for at least 15 years and reported to be managing their own business for at least one year. Of these people, 58 percent have one entrepreneurial spell, 29.5 percent have two entrepreneurial spells, 9 percent have three spells, and about 3 percent have four or more. Figure 1 is a histogram of the number of entrepreneurial spells for such individuals. The average number of spells for these people is 1.55. The average length of an entrepreneurial spell is 9.1 years (see Figure 2). The number of spells is likely to be a lower bound for the number of distinct businesses managed by the individual over a lifetime for two reasons. First, we consider entrepreneurial activity only over a 15 year period, which does not cover the whole life cycle of the person, and any additional entrepreneurial spells are omitted from our sample³. Second, while it is possible that entrepreneurs return to manage the businesses they founded after a spell of nonentrepreneurship, a more likely reading of the data, given the evidence in Holmes and Schmitz (1995), is that each spell of entrepreneurship is associated with sales of an existing business and the relatively immediate start up of a new one.

Our analysis of the PSID also provides empirical support for the second key assumption we make, that each entrepreneur can own only one business at a given time. We find that more than 85 percent of entrepreneurs own only one business, and more than 97 percent own one or two.

Quadrini (2000) documents that entrepreneurs bear substantial income risk. One piece of evidence that they do is that entrepreneurs have substantially higher wealth-income ratios than the population at large. For example, Gentry and Hubbard (2000) use data from the Survey of Consumer Finances to report that the average wealth-income ratios of such owners is 8.1 while the average for the population is 4.6. This data suggests that entrepreneurs accumulate wealth to shield themselves against income fluctuations. Gentry and Hubbard also report that entrepreneurs hold very undiversified portfolios. They find that 41.5 percent of entrepreneurs' wealth consists of the value of businesses they actively manage. It also suggests that moral hazard

³Though the PSID dataset covers 26 years from 1968 to 1993, there are very few individuals who were tracked for all years. Considering only people who would be in the sample continuously for 15 years decreases the number of the entrepreneurial spells but leaves us with a reasonably large sample.

or enforcement problems are significant enough to induce entrepreneurs to hold quite undiversified portfolios.

Next, we present evidence that capital gains revenues from business sales are significant and that they are responsive to changes in capital gains tax rates. Capital gains taxation is an important source of tax revenues in the United States. In 1994, revenues collected from capital gains taxes accounted for about three percent of federal tax revenues and for half of a percent GDP (Department of Treasury, Congressional Budget Office). We estimate that well over 40 percent of all capital gains tax revenues comes from a tax on the businesses sold by entrepreneurs. Figure 3 shows a breakdown of capital gains realizations by types of transaction. This figure shows that 41 percent of realizations are associated with sales of businesses or partnerships. Presumably, some portion of the sales of real estate are also associated with business sales. Part of capital gains on corporate stock is associated with sales by firm founders following initial public offerings and should be considered a business sale.

Some tax practitioners may be able to find ways to sell businesses without generating capital gains taxes. Various schemes may be employed such as “like-kind exchanges” in which one can trade a stock in one company for stock in another or deferred options in which an entrepreneur retains a small amount of risk with regard to the final sale price, but gets most of the sales proceeds immediately. The data on the sales of businesses and partnerships that we present, therefore, may underestimate the actual importance of capital gains in this asset category⁴.

We are primarily interested in how the capital gains tax affects entrepreneurial decisions by decreasing the payoff to an entrepreneur who sells his business. The direct effect is that an entrepreneur may prefer to keep an existing business and manage it, rather than to sell it and start a new one. Capital gains taxes also reduce the return to venture capitalists and may reduce venture capital activity. The available evidence suggests that this effect is strong⁵. Figures 4 and 5 suggest that the number of IPOs and the amount of committed venture capital are negatively correlated with the capital gains tax rate. Figure 6 shows time series for the capital gains realizations and suggest that there is negative correlation between the top capital gains tax rate and revenues. A recent study by Cullen and Gordon (2002) shows theoretically and empirically how taxes can affect the incen-

⁴We thank Jim Poterba for pointing this to us.

⁵See also Poterba (1989) for the evidence on how capital gains taxation affects entrepreneurial and venture capital activity.

tives to be an entrepreneur and document large effects of tax law on actual behavior.

Capital gains tax revenues have varied significantly over the last 50 years. In Figure 7 we plot revenues from capital gains taxes and the top capital gains tax rate. This figure indicates a negative correlation between collected revenues and tax rates and motivates a large body of empirical literature that studies the revenue responses to changes in the capital gains tax rate.⁶

3 Model Economy

We consider a discrete-time infinite-horizon economy populated by a continuum of infinitely lived households of measure one. Each household maximizes expected utility given by $\sum \beta^t u(c_t)$ where c_t denotes the household's consumption in period t , β is a discount factor, and u is strictly concave. Each household has an unobservable type (skill) $\theta \in [0, 1]$. A household's type is an index of comparative advantage in starting a new business. The distribution of types in the economy is given by a pdf $\mu(\theta) > 0$.

The quality of a business is denoted by $q \in [0, \bar{q}]$. The profitability of a business is an increasing function of q , a decreasing function of the wage rate w , and is denoted by $\pi(q, w)$. We assume that profits are generated as follows. Let $R(q, n)$ denote the revenues generated by a firm of quality q which hires n workers. Then, we have:

$$\pi(q, w) = \max_n R(q, n) - wn.$$

Let $n(q, w)$ denote the number of workers hired by a business of quality q . We assume that $\pi(0, w) = 0$.

The quality of a business follows a Markov process with transition probability $G(q'|q) = \Pr(q_{t+1} \leq q' | q_t = q)$. This transition probability is increasing in current quality q in the sense of first order stochastic dominance. We also assume that $q = 0$ is an absorbing state in the sense that $G(0|0) = 1$ and $G(0|q) > 0$ for all q so that any firm has a positive probability of reaching the absorbing state of zero profits. The quality of a new business is drawn from a distribution function $F(q|\theta)$ which is increasing in θ in the sense of first order stochastic dominance. An agent with a higher θ has a higher probability of starting a successful business.

⁶Burman and Randolph (1994) and Bogart and Gentry (1995) are recent papers studying effects of capital gains tax changes on the capital gains revenues. See Auten, Burman and Randolph (1989) for a survey of the literature.

Capital markets are incomplete, and households can save at a gross interest rate R , but cannot borrow. Each household begins with an endowment of capital. Capital held by a household is denoted by k . In the model, entrepreneurs optimally smooth consumption by accumulating adequate assets to self insure against a possibility that their start ups or ongoing business enterprises are unsuccessful. We assume that $R \leq \beta^{-1}$ for all t .⁷ The assumption that the interest rate is less than a discount factor guarantees that the only holdings of capital in the steady state will be due to precautionary motives; households who never become entrepreneurs have no incentive to hold capital.

We now describe the decision problems of the households in recursive form in a stationary equilibrium in which the wage rate w is constant. A household begins each period with capital k and a business of quality q . We can think of households which plan to supply labor forever as owning a business of quality zero. A household chooses one of the following three activities: to manage the firm it owns, to sell an existing business and start a new one, or to sell an existing business, become a worker and supply its labor on the labor market for the wage rate w . We denote the values of these three activities by V^m , V^s , and V^w , respectively.

The value function of a household of type θ which owns k units of capital and a business of quality q is given by:

$$V(k, q, \theta) = \max\{V^m(k, q, \theta), V^s(k, q, \theta), V^w(k, q, \theta)\}.$$

The value of the first option, managing his own business is given by:

$$V^m(k, q, \theta) = \max_{c, k' \geq 0} u(c) + \beta \int V(k', q', \theta) dG(q'|q) \quad (1)$$

$$c + k' \leq Rk + \pi(q, w).$$

A household's income consists of savings income Rk and profits from managing the firm $\pi(q, w)$. This income is allocated between consumption, c , and capital accumulated into the next period, k' .

The second option available to a household is to sell the existing business and start a new firm. It takes one period for entrepreneurs to start a new business. We assume that the only cost of starting a new business

⁷In the models with uninsurable shocks and endogenous interest rate, $q < R$ in equilibrium due to precautionary motives such as in Aiyagari (1994). Li (1997) also obtained this relationship in a model of entrepreneurship.

is the opportunity cost of household's time. We assume that financial contracts available to households are limited, and a household cannot hire an outside manager for the firm they own. This assumption is consistent with the findings in Bitler, Moskowitz, and Vissing-Jorgensen (2004) who find that most entrepreneurs hold large ownership in firms they run and argue that this observation can be explained by the moral hazard associated with running small firms. Therefore, an entrepreneur who owns a business and wants to start a new business must sell the currently owned business. The price of a business of quality q is $p(q)$. We discuss the determination of $p(q)$ below. Since households do not incur any out of pocket expenses at the time they started the business, the base for the capital gains tax is equal to the value of the firm they sell, and net receipts from business sales are given by $p(q)(1 - \tau)$, where τ is the capital gains tax rate.

The value of selling an existing business and starting a new business is then given by:

$$V^s(k, q, \theta) = \max_{c, k' \geq 0} u(c) + \beta \int V(k', q, \theta) dF(q|\theta) \quad (2)$$

$$c + k' \leq p(q)(1 - \tau) + Rk.$$

The income of a household consists of savings income Rk and the profit from the sale of the firm $p(q)(1 - \tau)$. The household allocates this income to current consumption and capital accumulation.

An entrepreneur who becomes a worker sells his business and pays capital gains tax. The value function of such an entrepreneur is given by:

$$V^w(k, q, \theta) = \max_{k', c} u(c) + \beta V(k', 0, \theta) \quad (3)$$

$$c + k' \leq p(q)(1 - \tau) + Rk + w.$$

The income of an entrepreneur who sells a business consists of savings income Rk , profits from the sale of the firm $p(q)(1 - \tau)$, and wage income w . This income is used for current consumption and capital accumulation.

We consider a simple way of determining the prices of firms. We assume there are a large number of competitive risk-neutral firms called banks which specialize in buying firms from entrepreneurs, hiring managers at wage w , and running firms. Unlike households, banks are not borrowing-constrained and can borrow and lend at the rate R . We allow the efficiency with which banks operate firms to be different from that of entrepreneurs. Specifically, a firm of quality q , when run by a bank, produces $(\lambda\pi(q, w) - w)$ units of

profit. (In the calibrated version of the model below, we find that $\lambda < 1$.) The price is determined such that expected profits for banks are equal to zero. A recursive representation of the price of a business of quality q is then as follows:

$$p(q) = \text{Max}\{\lambda\pi(q, w) + \frac{1}{R} \int p(q'|q)dG(q'|q), 0\}. \quad (4)$$

An alternative interpretation of the parameter λ is that the profit function $\pi(q, w)$ includes nonpecuniary returns the entrepreneur obtains from running a business and that $\lambda\pi(q, w)$ represents the pecuniary return from owning the business.

In the appendix, we describe an equilibrium for this economy in which the wage rate w is endogenously determined. In the rest of this paper, we focus mainly on results for an economy in which the wage rate is given.

4 Dynamics of the model: a simple example

In this section, we consider a simplified version of the model that allows us to clearly illustrate the dynamics of the model and the lock-in effect of capital gains taxation. We make two principal assumptions: agents are risk-neutral, and markets are complete.

4.1 Environment

We assume that the utility function of agents is $\sum \beta^{t-1} c_t$. The quality of a new business takes on one of two values \bar{q} and 0. The Markov process G for the quality of business is as follows. A firm of quality \bar{q} stays at that quality level in the following period with probability μ and switches to a quality level of 0 with probability $(1 - \mu)$. A firm of quality level 0 stays at that level forever. The probability that a new firm is successful is simply the comparative advantage parameter θ . We assume that $\pi(q, w) = q - w$, $\lambda = 1$, and $R = 1/\beta$. Since $R = 1/\beta$, and entrepreneurs are risk neutral, capital accumulation is indeterminate and the problem of the entrepreneurs is simply to maximize the present value of consumption. Therefore, we can ignore capital accumulation for the purposes of this section.

Let $p(q)$ denote the value of a firm of quality q . From (4), using $\pi(q, w) = q - w$, $\lambda = 1$, $R = 1/\beta$ and the Markov process on business quality q , we have that $p(q) = (q - w) + \beta\mu p(q)$, so that the price of a business is given by

$$p(q) = \frac{q - w}{1 - \mu\beta}. \quad (5)$$

Since entrepreneurs are risk-neutral, $p(q)$ is also the present discounted value of profits for an entrepreneur who chooses to maximize the profits of an existing business until it reaches a quality level of zero.

4.2 Equilibrium without capital gains taxes

In this subsection, we describe the solution to the model without capital gain taxes.

Consider first the decision problem of an agent who always chooses to work and currently does not own a business. The value of such strategy is

$$V^w(0, \theta) = w + \beta V(0, \theta).$$

Simplifying this expression we get

$$V^w(0, \theta) = \frac{w}{1 - \beta}. \quad (6)$$

Next, consider the decision problem of an agent who starts new businesses and sells them immediately if they are successful. The value of such a strategy for an agent who currently does not own a firm is

$$V^s(0, \theta) = 0 + \beta [\theta V^s(\bar{q}, \theta) + (1 - \theta) V^s(0, \theta)]. \quad (7)$$

To understand (7), note that an agent who does not have a firm and starts a new one receives a profit of zero in the first period. In the next period, with probability θ the agent owns a successful business of quality \bar{q} and receives the value of $V(\bar{q}, \theta)$ from selling the business and with probability $(1 - \theta)$ will not have a business and receives a value of $(1 - \theta) V(0, \theta)$.

The value of a strategy of starting and selling firms for an agent who currently owns a firm of quality \bar{q} is equal to the sum of the price $p(\bar{q})$ for which an agent sells this firm and the value of not having a firm $V^s(0, \theta)$ and is given by

$$V^s(\bar{q}, \theta) = p(\bar{q}) + V^s(0, \theta). \quad (8)$$

We solve the system of linear equations (7) and (8) to derive:

$$V^s(0, \theta) = \frac{\beta\theta}{(1 - \beta)(1 - \mu\beta)} \frac{\bar{q} - w}{1 - \mu\beta}$$

$$V^s(\bar{q}, \theta) = \frac{\bar{q} - w}{1 - \mu\beta} \left[1 + \frac{\beta\theta}{(1 - \beta)} \right].$$

Note that both $V^s(0, \theta)$ and $V^s(\bar{q}, \theta)$ are increasing in the comparative advantage parameter θ .

We can also characterize a problem of an agent who chooses to start a firm and, if a firm is successful, to self-manage it. For future use, note that this value is independent of the level of capital gains taxes. The value of not having a firm $V^m(0, \theta)$ for such agents is equal to the sum of zero profits for the start-up period and the discounted sum in the next period of the value of having a successful firm $V^m(\bar{q}, \theta)$ an event that happens with probability θ and the value of not having a firm, an event that happens with probability $(1 - \theta)$:

$$V^m(0, \theta) = 0 + \beta [\theta V^m(\bar{q}, \theta) + (1 - \theta) V^m(0, \theta)]. \quad (9)$$

The value of owning a successful firm $V^m(\bar{q}, \theta)$ is equal to the sum of immediate profits $\bar{q} - w$ and a discounted value of having a successful firm $V^m(\bar{q}, \theta)$ in the period that follows if the firm is not bankrupt, that happens with probability μ , and a value of not owning a firm that happens with probability $(1 - \mu)$:

$$V^m(\bar{q}, \theta) = \bar{q} - w + \beta [\mu V^m(\bar{q}, \theta) + (1 - \mu) V^m(0, \theta)]. \quad (10)$$

We solve the system of linear equations (9) and (10) to derive:

$$V^m(\bar{q}, \theta) = \beta \theta \frac{\bar{q} - w}{1 - \beta \mu} / \left[1 - \frac{\beta^2 \theta (1 - \mu)}{1 - \beta \mu} - \beta (1 - \theta) \right]. \quad (11)$$

Straightforward algebra shows that a strategy of always managing a firm and starting a new firm when the old firm disappears (that is when $q = 0$) is dominated by a strategy of selling an existing firm immediately and starting a new firm.

We can then determine the cutoff level of the comparative advantage parameter $\hat{\theta}$ at which an entrepreneur is indifferent between working and being an entrepreneur who sells firms. This level is given by setting the value $V^s(0)$ equal to $V^w(0, \theta)$:

$$\frac{\beta \hat{\theta}}{(1 - \beta)} \frac{\bar{q} - w}{(1 - \mu \beta)} = \frac{w}{1 - \beta},$$

so that the cutoff level is given by

$$\hat{\theta} = \frac{w(1 - \pi \beta)}{(q - w)\beta}.$$

Since the value of an entrepreneur who starts and then sells a firm $V^s(0, \theta)$ is increasing in the comparative advantage parameter θ , it follows that an entrepreneur with $\theta < \hat{\theta}$ chooses to be a worker and one with $\theta \geq \hat{\theta}$ chooses to start a new business.

In Figure 8 we plot the value functions of the agents who work (solid line), start and sell firms (dashed line), and, for illustrative purposes, the value of self-managing a firm (dash-dotted line). The value of starting and immediately selling a firm is always higher than starting but self-managing a firm. The intersection of the dashed line with the solid line gives us the cutoff level $\hat{\theta}$.

4.3 Equilibrium with capital gains taxes

If the level of capital gains taxes is positive, an agent chooses one of three types of strategies: always work, always start and sell successful businesses, or start new businesses when old ones disappear and then manage successful businesses. Since the problem is stationary, we need to consider only these three strategies.

The value functions are obtained in an analogous fashion to the case without capital gains taxes. For an entrepreneur who manages his business and plans to manage any successful new business, they are given above by (9) and (10); the solution is given by (11).

For an entrepreneur who sells the business and starts a new one and plans to continue doing so in the future, the value function is derived analogously to the previous section and is given by:

$$V^s(0, \theta) = \frac{\beta\theta}{(1-\beta)} \frac{(\bar{q} - w)(1-\tau)}{(1-\mu\beta)}. \quad (12)$$

where τ is the capital gains tax rate.

For an agent who always works, the value function as above is given by (6)

The cutoff level $\hat{\theta}_1$ at which an entrepreneur is indifferent between starting new businesses and then managing them or being a worker is obtained by setting $V^m(0, \theta) = w/(1-\beta)$. Simplifying, we obtain that this cutoff level is given by

$$\hat{\theta}_1 = \frac{1-\beta}{\beta \left[\frac{(\bar{q} - w)(1-\beta)}{(1-\beta\mu)w} + \frac{\beta(1-\mu)}{1-\beta\mu} - 1 \right]}.$$

The cutoff level $\hat{\theta}_2$ at which entrepreneurs are indifferent between always

managing firms and selling them is found by setting their values equal to each other. Straightforward algebra shows that the cutoff level is given by

$$\hat{\theta}_2 = \left[\frac{(1-\beta)}{(1-\tau)} - (1-\beta) \right] / \left[-\frac{\beta^2(1-\pi)}{1-\beta\pi} + \beta \right].$$

We illustrate the effects of the capital gains tax in Figure 9. The value functions for the workers (solid line) and those who start but self-manage firms (dash-dot curve) remains the same as in the case of no taxes. For the entrepreneurs who sell firms, the capital gains tax rotates the value function (dashed line) pivoted at the origin. The higher the tax, the smaller the slope of the dashed line.

We plot the results for an intermediate value of the tax for which all three types of strategies are used in equilibrium. Figure 9 shows that entrepreneurs with comparative advantage parameters $\theta \leq \hat{\theta}_1$ choose to be workers. Entrepreneurs with comparative advantage parameters θ in the interval $[\hat{\theta}_1, \hat{\theta}_2]$ choose to be entrepreneurs who self-manage firms. Entrepreneurs with comparative advantage parameters θ in the interval $[\hat{\theta}_2, 1]$ choose to be entrepreneurs who sell firms.

If the capital gains tax rate is very small then there are only two regions: work or be an entrepreneur who sells firms. If the capital gains tax is very large (the slope of the dashed line is very small) then no entrepreneurs will sell firms. Agents who have skills higher than $\hat{\theta}_1$ choose to self-manage firms.

Comparing Figure 8 and Figure 9 we see that the capital gains tax introduces two distortions. First, fewer entrepreneurs choose to start businesses and instead choose to become workers. Second, some entrepreneurs who choose to start businesses manage the businesses themselves rather than sell them. We call this second distortion the lock-in effect. To see the sense in which this lock in effect introduces a pure distortion, consider the following policy in the environment with capital gains taxes. Suppose that it is possible to make the capital gains tax rate type-specific. Then consider a policy under which all entrepreneurs with types below $\hat{\theta}_2$ face a tax rate of zero and all entrepreneurs with types above $\hat{\theta}_2$ face a capital gains tax rate of τ . Under this new policy it is easy to see that the entrepreneurs who sell firms make exactly the same choices as in the environment without capital gains taxes. All other agents behave as if there are no taxes. Those who start new businesses and have types below $\hat{\theta}_2$ are better off and the welfare of those with types above $\hat{\theta}_2$ is unchanged. Government revenue is exactly the same with the new policy as it is with a uniform capital gains tax rate. The welfare loss due to the lock-in effect is the area of the shaded region in Figure 9.

We turn now to analyzing welfare in the general model with risk averse entrepreneurs and capital accumulation.

5 Parameterization

In this section we describe how we choose the parameters of the general model with risk averse agents and incomplete markets. Suppose that the quality of a business takes on one of three values: a high value q_h , intermediate value q_m , or a value of 0. We define θ to be the probability that startup is successful, that is, has quality $q = q_m$.

We further assume that $u(c) = \log c$. The parameters to be chosen are then β , R , $\pi(q|w)$, $F(q|\theta)$, $\mu(\theta)$, w , $G(q'|q)$, and λ .

We set a period of the model to be equal to two years. This time interval is consistent with the data from Holmes and Schmitz (1995), who show that there is a significant decrease in the failure rate of firms after two years in operation. We set the discount factor β be equal 0.9, (an annual rate of time preference of 5 percent), the interest rate R equal to 1.08, and the capital gains tax rate to be equal to 20 percent. The interest rate of R is chosen so that non-entrepreneurs do not hold wealth in a steady state and so that βR is close to 1.

We adopt a particularly simple formulation of $\pi(q|w)$. We assume that $\pi(q|w) = q - qw$. We use the number of employees as an index of firm quality. We assume that successful firms can be of two sizes, q_m and q_h . We use data from Table 1 in Evans (1987) to choose parameters for the evolution of firms. Evans considers dynamics of firms over a 6-year period from 1976 to 1982 and provides data for firms of a range of ages and sizes. The information on firm sizes is partitioned in seven groups: firms with (1–19), (20–49), (50–99), (100–249), (250–499), (500–999), and with more than 1000 employees. For each group of firm sizes, the information on the growth rate, exit rate, and number of firms in the sample is further grouped by the age of firms. There are five groups of firm ages: (0–6), (7–20), (21–45), (45–95), and over 96 years old.

According to Evans, more than 70 percent of young firms with an age of less than 6 years employ between 1 and 19 workers. This observation suggests that a good approximation to the c.d.f. F which describes the formation of new firms is to assume that $F(q_h|\theta) = 0$ and $F(q_m|\theta) > 0$ and $F(0|\theta) > 0$. We assume that firms in this group correspond to the size q_m of a successful business in our model. Assuming that firms are log normally distributed on the interval between 1 and 19 employees, we calculate that

a start-up employs on average 7 workers and set q_m to be equal to this number. We assume that the rest of the firms in the sample correspond to firms of size q_h in our model. Assuming that employment is log normally distributed for each size group in Evans, we find that the average size of the firms with employment of more than 20 people to be equal to 89 and set q_h to be equal to this number.

We assume that the probability of success $f(\theta)$ is linear, $f(\theta) = \theta$, and $\mu(\theta)$ is log-normally distributed with mean μ and variance σ^2 . We then choose μ to be equal to the initial failure rate of firms, and σ to match the share of income of entrepreneurs in total income⁸. We target the share of income of entrepreneurs to be 16–22 percent as in Quadrini (2000).

Next, we describe our choice of the transition function $G(q'|q)$. Though most firms start small, they eventually grow. In the sample, only 45 percent of the firms employ fewer than 19 workers. An average annual logarithmic growth rate of employment for a small firm is equal to 3.73 percent. An average growth rate for a firm with more than 20 workers is negative, equal to -1.62 percent. Evans (1987) also reports that small and young firms are more likely to fail. Small mature firms with an age of more than 6 years have a 21 percent probability of exiting in the following 6 years. Only 11 percent of large firms exited his sample of the same period. Irrespective of their size, young firms face a much higher probability of exiting the market, with an exit rate of almost 40 percent. In our model this number will correspond to the firms that were started but turned out to be unsuccessful, and we will call this number an *initial exit rate*. We convert the statistics on firms failure reported by Evans from a six-year to a two-year interval and present the results in Table 1.

Table 1: Firm Dynamics

Exit rate (small firm)	7.63%
Exit rate (large firm)	3.83%
Growth rate (small firm)	7.4%
Growth rate (large firm)	-3.2%
Initial exit rate	15.5%

We choose a transition probability matrix (Table 2) of firm sizes $G(q'|q)$ such that exit and growth rates for small and large firms correspond to the ones found in Evans.

⁸Alternatively, we could have chosen σ to match the distribution of spells of entrepreneurship in the PSID data.

Table 2: Transition Probabilities

	0	q_m	q_h
0	1	0	0
q_m	0.0763	0.90	0.0237
q_h	0.0383	0.0177	0.95

We choose the wage rate w to match the number of entrepreneurs to be in the range of 9–14 percent of the population (Quadrini (2000) and Gentry and Hubbard (2000)). We choose λ so that 9 percent of all surviving firms are sold biannually (Holmes and Schmitz (1995)). We collect the parameters in Table 3.

Table 3: Parameters of the model

Parameter	μ	σ	w	λ	R	β
Value	1.2	0.5	0.875	0.93	1.08	0.9

The reason that the share of entrepreneurial income in the model is higher than in the data is that the assumption $R < \beta^{-1}$ eliminates any incentive to save, except for savings for precautionary motives. As a result, workers in the model do not hold capital, while a substantial part of entrepreneurial income comes from capital holdings.

6 Equilibrium Dynamics: General Model

In this section we present a numerical characterization of equilibrium dynamics for the parameterized model and compare the results to those from a model with no capital gains tax. We denote by $h(k, q, \theta)$ the policy function of an agent, which can start a new firm, manage the existing one or sell and become a worker.

We start by describing dynamics of our model for individuals who do not own a firm ($q = 0$) for the capital gains tax equal to 20 percent and 0 percent. In Figure 10 we present the computed value of $h(k, 0, \theta)$ for an economy where the capital gains tax is 20 percent. When an entrepreneur does not own a firm, he can either work and receive a wage (this decision corresponds to $h(k, 0, \theta) = work$), or start a new firm (this decision corresponds to $h(k, 0, \theta) = start$). The solid line in this figure represents combinations of individual’s capital k and his ability θ that makes him indifferent between starting a firm and working. For (k, θ) that are located to the right

of this line, an entrepreneur chooses to start a new firm, and for (k, θ) that are located to the left of the line he chooses to work. Households with low comparative advantage (low θ) work, while households with high comparative advantage and sufficient wealth start a new firm. Entrepreneurs with a higher comparative advantage start a new firm when they have lower wealth relative to entrepreneurs with lower θ . In Figure 11, we present the computed value of the policy function for an entrepreneur of type $\theta = 0.9$ who does not own a firm: $k'(k, 0, 0.9)$. For low values of current capital holdings $k \in [0, 0.3]$, an entrepreneur saves capital to start a new firm. Above capital holdings of 0.3, entrepreneurs start firms. An entrepreneur who starts a new firm consumes capital income to finance consumption and $k' = 0$ for $k \in [0.3, 0.9]$. If an entrepreneur starts a series of successful firms his capital holdings grow, and his savings are close to being a linear function of capital. A decrease in the capital gains tax rate from 20 percent to 0 percent, changes the values of $h(k, 0, \theta)$ and $k'(k, 0, \theta)$ (Figures 12 and 13) only insignificantly. In particular, entrepreneurs start firms for slightly lower levels of capital at the tax rate of zero percent than with a 20 percent tax.

We proceed to describe policy functions for an entrepreneur who owns a firm q_m (Figures 14 and 15) for an economy with the capital gains tax equal to 20 percent. Most of the entrepreneurs choose to manage a firm. For relatively small levels of capital, only entrepreneurs with high comparative advantage start a new firm. If an entrepreneur has significant wealth he becomes more similar to risk-neutral financial intermediaries and, faced with the capital gains tax, has less incentive to sell a firm. When the capital gains tax is decreased from 20 percent to 0 percent the policy functions change significantly (Figures 16 and 17). Entrepreneurs sell existing firms and start new firms for lower levels of comparative advantage and for significantly higher levels of capital. The policy functions for entrepreneurs who own a firm q_h are very simple: all entrepreneurs manage a firm.

We compare the predictions of the model regarding the number and duration of entrepreneurial spells to those of the PSID data we described earlier (Figures 1–2). In Figures 18–21 we plot the number of entrepreneurial spells from our model over a 15-year span and the duration of these spells. We compute these spells in two ways. First, we compute each spell as the length of time an entrepreneur is between periods when an entrepreneur works for a wage in the labor market. Second, we compute a spell length as lasting from the period an entrepreneur starts a business up to the time the business is sold or goes out of business. Our model predicts that an average duration of an entrepreneurial spell is 10.1 years using the first method and 5.1 years using the second method, which is very close to the duration of 9.1

years in the PSID data. The distribution of the duration and the number of entrepreneurial spells also matches well with the data. The only difference is since the period in the model is two years, the model slightly overpredicts the number of individuals who have only one unemployment spell.

7 Welfare experiments

In this section, we determine the welfare loss due to capital gains taxation and compare the welfare loss to that of capital taxation in a neoclassical model. We then show that a profit tax eliminates a part of the welfare loss of capital gains taxation. Finally, we determine the peak of the Laffer Curve in our model.

7.1 Welfare losses of capital gains taxes

Capital gains taxes in the model affect a small group of people, since only entrepreneurs who sell firms (about 1 percent of population) are subject to the tax in each period. In our model, only the most productive entrepreneurs have incentives to sell businesses. Most entrepreneurs hold their businesses and avoid paying capital gains taxes. As a result, the amount of revenues collected from the capital gains tax is small and equal to about 0.25 percent of total consumption in the economy.

We use the following measure of welfare changes. Define γ to be the ratio by which consumption of each household in the benchmark economy can be increased in each period such that the total welfare (measured as an average of utilities of all households) is equal to the welfare under a new policy along the transition path of the economy.

First, we consider the effect of a decrease in a capital gains tax from 20 percent to 0 percent. Elimination of capital gains taxes creates a loss in revenues for government which in present value terms is equal to 6.6 percent of current consumption (assuming a 4 percent annual interest rate). We find that this reduction of taxes results in a 0.48 percent welfare gain in the economy.

This welfare gain comes from two sources. First, entrepreneurs who sell firms are better off since they do not have to pay capital gains taxes. They have a windfall in revenues which increases their welfare. The second effect comes from a more efficient allocation of time of individuals as more households specialize in starting new businesses rather than self-managing a business. In a benchmark economy where the capital gains tax is equal

to 20 percent, only 10 percent of the entrepreneurs sell businesses they just started, while the rest of the entrepreneurs manage businesses until they become bankrupt. When the capital gains tax is decreased to zero, the number of individuals specializing in start-ups increases to 29 percent.

To evaluate the size of the lock-in effect we construct a system of type-specific capital gains taxes. We retain capital gains taxes only on those individuals who, in the benchmark economy with taxes, start and immediately sell businesses. In our model, these entrepreneurs have a comparative advantage parameter of $\theta = 0.9$ or greater. We exempt all other individuals from this tax. Notice that this policy change is a possible Pareto improvement. The highest type entrepreneurs continue to make the same decisions and pay the same taxes. Lower type entrepreneurs never paid capital gains taxes in equilibrium since they chose to manage their businesses. With such a tax system, the lock-in effect is completely removed, and the same amount of revenues is collected, since the same household are subject to the tax as in the benchmark economy. This tax changes the behavior of 2 percent of the households in the economy who switch from holding firms to selling them. The welfare gain is quite large at 0.14 percent. Alternatively, the deadweight loss is $0.14/0.25=56$ cents of loss for each dollar collected.

7.2 Comparison with welfare losses of capital taxation in the neoclassical growth model

A tax on capital is usually considered to be one of the most distorting taxes. Lucas (1990) finds that substituting capital income taxation with less distorting taxes would produce a welfare gain equivalent to 0.75–1.25% of consumption. We compare the welfare effect of a decrease in the capital tax in a standard neoclassical growth model with inelastic labor supply to a decrease in the capital gain tax in our model. Since the amount of revenues collected under capital taxes is disproportionately larger than the amount collected by the capital gain tax, we will decrease the capital income tax rate in the one sector growth model so that the losses in the revenues for the government are exactly equal to the losses in revenues with abolishment of capital gain tax.

We compare this gain to the equivalent reduction in taxes in a standard one sector growth model described as follows. Households maximize a discounted utility function $\sum \beta^t \ln(c_t)$. The consumer's budget constraint is as follows:

$$c_t + k_{t+1} \leq (1 - \tau)(r_t - \delta)k_t + k_t + w_t.$$

The production function is Cobb-Douglas $Y_t = K_t^\alpha$. We assume that taxes on capital are equal to 40 percent, α is 1/3, and capital-output ratio in the steady state is equal to 3.

With this parametrization, in the steady state $R = \alpha K^{\alpha-1} = 1/9 = 11$ percent. We choose the depreciation parameter δ to be equal to 7.1% such that an annual net interest rate $R_t - \delta$ is equal to 4 percent as in the benchmark model. From the Euler equation, we choose $\beta = 0.977$.

The present value of tax revenues in this model is $\tau(r_{ss} - \delta)K_{ss}/(1 - \frac{1}{1 + r_{ss} - \delta})$ and equal to 169 percent of total consumption in a steady state. To reduce the amount of the collected revenues by 6.6 percent of the initial consumption, tax rate should be decreased by 3.5 percent to 36.5 percent. This reduction in taxes will lead to an increase in the welfare equivalent to 0.82 percent of consumption.

As in the discussion of the capital gains taxes, the welfare gain reflects effects from an increase in the income of the households and a decrease in investment distortions. To single out the distortionary effect of capital taxes, we introduce a lump sum tax in addition to the 36.5 percent tax on capital such that the amount of tax revenues is equal to the revenues with 40 percent capital tax. This experiment is similar to the type-specific capital gains tax considered in the previous section. We find that this tax leads to the welfare increase equal to 0.38 percent of consumption. Alternatively, the deadweight loss is $0.38/0.25 = 1$ dollar 52 cents of loss for each dollar collected.

Thus the distortion from capital taxes is of the same order of magnitude as the distortion from capital gains taxes. (See Table 4)

Table 4: Welfare and Distortions

	Change in welfare	Distortion
Capital tax	0.82%	0.38%
Capital gains tax	0.48%	0.14%

Welfare losses in both our model and in the model of Lucas are significantly higher than those found in public finance literature (for example in Ballard et.al 1985) that range about 10-15 cents of loss per dollar collected. We conjecture that the main reason is that we have a dynamic model rather than either static model or a model with myopic households considered in public economics literature.

7.3 Profit taxes

The type-specific tax discussed above is not a satisfactory alternative for the capital gains tax. The skills of the entrepreneurs are not observable, and the government cannot tax only high-skilled individuals while exempting all others. Alternatively, a government that wants to collect the same amount of revenues while alleviating the lock-in effect can switch to taxation of profits of companies. A tax on profits eliminates the lock-in effect since it is not paid at the time when the company is sold. However, there are two other effects that such a tax would create. Similar to an accrual tax, it creates disincentives for some households who would start and keep the firms. When these entrepreneurs pay taxes on firm profits, their revenues from running businesses are lower and they may decide to join the labor force instead. The second effect is distributional. In the benchmark model, only 10 percent of entrepreneurs paid capital gains tax. Business income tax is paid by all the entrepreneurs, including the ones who sell firms in the very first period. Those entrepreneurs incur tax indirectly, through the lower price at which they can sell businesses. This effect can be expected, in general, to be positive through the more even distribution of the tax burden. Thus, the welfare gain may exceed gain from the elimination of the lock-in effect.

We find that an income tax as small as 0.75 percent is sufficient to collect the same amount of revenues as with 20 percent capital gains tax. The results of computations for an economy with a profit tax are presented in Table 5. These results are consistent with the intuition outlined above. Though the number of entrepreneurs decreases slightly, there is a much higher business turnover in the economy. The total income of entrepreneurs falls, since individuals who specialize in starting businesses tend to have lower levels of precautionary savings than those holding businesses. Welfare with income taxes increases by 0.4 percent of consumption.

Table 5: Statistics of the Model

Statistics	Model: 0.75% income tax
Percentage of entrepreneurs	11%
Income of entrepreneurs	35%
Initial exit rate	19%
Percent of firms sold	43%

7.3.1 Laffer curve

The empirical literature has estimated effects of changes in capital tax rates on the amount of the collected revenues. One of the most active debates is whether a small decrease in the tax rate would provide an incentive to increase realization of the capital gains so that total collected revenues from the tax do not decrease. Burman and Randolph (1994) and Bogart and Gentry (1995) contain reviews of this literature. In our model, capital gains realizations are very sensitive to the tax rate. Figure 22 plots revenues against the capital gains tax rate. Revenues peak at a relatively low tax rate of 15 percent. This finding suggests that, unlike other taxes such as tax on capital income, the "Laffer curve" effect is very strong for the capital gains. Even a moderate tax rate of 20 percent locks a significant number of entrepreneurs in their business, and cutting this rate may significantly increase revenues and increase welfare.

For comparison purposes, the peak of the analogous Laffer Curve associated with taxation of capital income in a one-sector growth model is the labor share of national income, which is roughly 70 per cent.

8 Conclusion

In this paper we study the effect of capital gains taxes on entrepreneurial activity. These taxes create an incentive for entrepreneurs to manage their own businesses rather than to sell them and start new businesses. We quantitatively estimate this lock-in effect and find that the welfare distortions of the current level of capital gains taxes is large. We also find that the amount of collected revenues rises rapidly at low levels of taxes but peak at 15 percent and then quickly decline.

We have abstracted from general equilibrium effects whereby reducing capital gains tax rates could raise revenue from taxes on other kinds of income. Incorporating such effects is likely to raise the welfare gains from reducing capital gains tax rates.

Appendix

The Model Economy in General Equilibrium

In this appendix we describe a general equilibrium version of our model economy. The environment and the decision problems are described in the text. Here we define an equilibrium in which the labor market clears. The state of the economy is given by a distribution $\Psi_t(k, q, \theta)$ which gives the measure of households of each type θ who hold capital k and own a firm of quality q . In this paper, we will concentrate only on stationary equilibria where $\Psi_t(k, q, \theta) = \Psi(k, q, \theta)$ for all t so that wages and return on capital are constant.

Let $h(k, q, \theta) \in \{manage, start, work\}$ be the decision of the worker to become manager, entrepreneur or workers. Analogously define

$$M = \{(k, q, \theta) | h(k, q, \theta) = manage\}$$

$$S = \{(k, q, \theta) | h(k, q, \theta) = start\}$$

$$W = \{(k, q, \theta) | h(k, q, \theta) = work\}$$

Let $I = \{(k, y, \theta) | S \cup W, y > 0\}$ be the set of all the agents who sell their firms to a financial intermediary in the current period.

The dynamics of the distribution of firms $\phi(q)$ in the stationary equilibrium are described by the equation

$$\phi(q) = \int_{x>0} [\int_0^q dG(y|x)] d\phi(x) + \int_I d\Psi(k, y, \theta)$$

The first part of this expression is the transition dynamics of the firms which are already owned by the intermediary. The second part captures the newly purchased firms.

The number of workers in equilibrium is equal to the number of the available vacancies. Then the feasibility condition is

$$(6) \quad \int_M n(q, w) d\Psi(k, q, \theta) + \int n(q, w) d\phi + \int_{S \cup M} d\Psi(k, q, \theta) = 1$$

The first expression is the number of workers which are hired by the managers who own their businesses. The second part is the number of workers employed by the intermediaries. Finally the last term is total number of the entrepreneurs, both those who start new businesses and manage their own. Now we can define an equilibrium of this economy.

Definition 1 *A stationary equilibrium in this model economy is the distribution of households in the economy $\Psi(k, q, \theta)$, value functions $V(k, q, \theta)$ and policy functions $h(k, q, \theta)$ and $k'(k, q, \theta)$ so that V, h, k' are the solution to the household's maximization problem (1)-(4), price functions $p(q)$ given in (5), feasibility (6) holds and*

$$\Psi(k, q, \theta) = \int_{\substack{(x,y,\theta) \in M \\ h^k(x,y,\theta)=k}} d\Psi(x, y, \theta)g(q|y) + \int_{\substack{(x,y,\theta) \in S \\ h^k(x,y,\theta)=k}} d\Psi(x, y, \theta)f(q|\theta) + \\ + \int_{\substack{(x,y,\theta) \in W \\ h^k(x,y,\theta)=k}} d\Psi(x, y, \theta)I_q = 1$$

where $I_q = 1$, if $q = 0$ and 0 otherwise.

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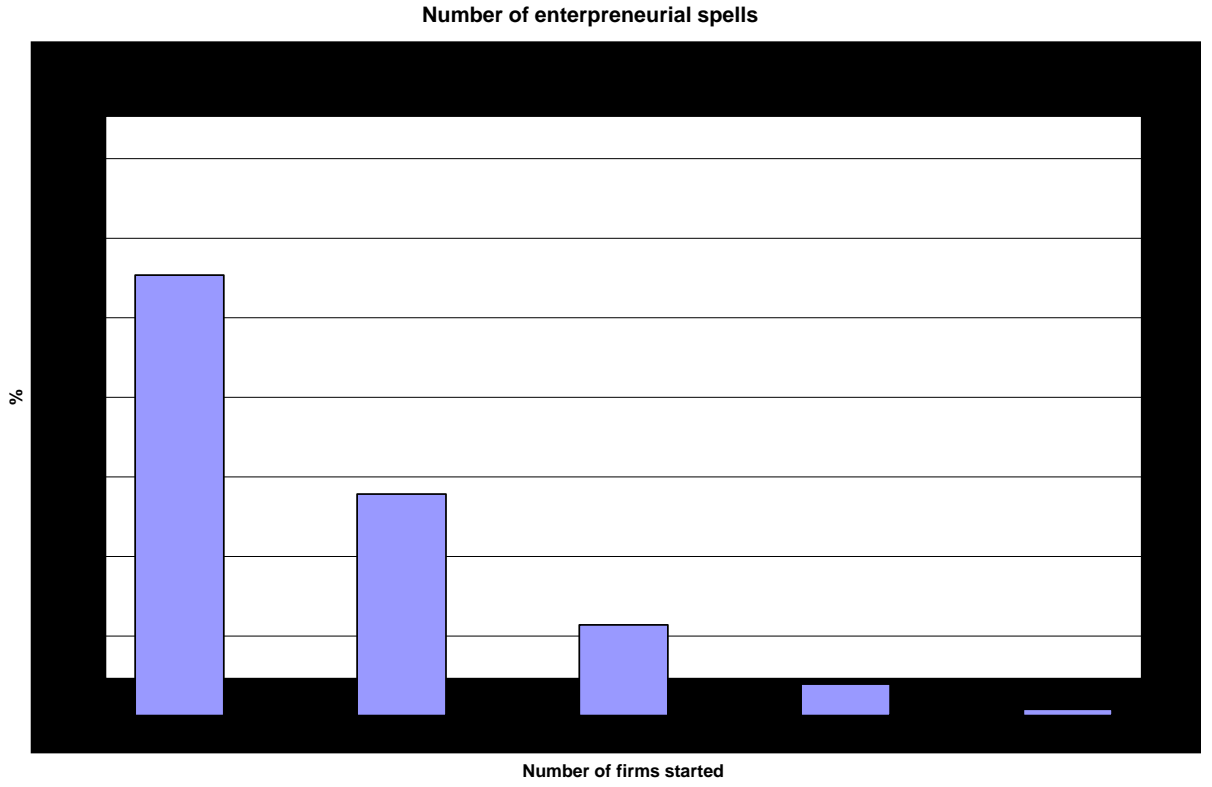


Figure 1: Number of entrepreneurial spells

Duration of entrepreneurial spells in the data

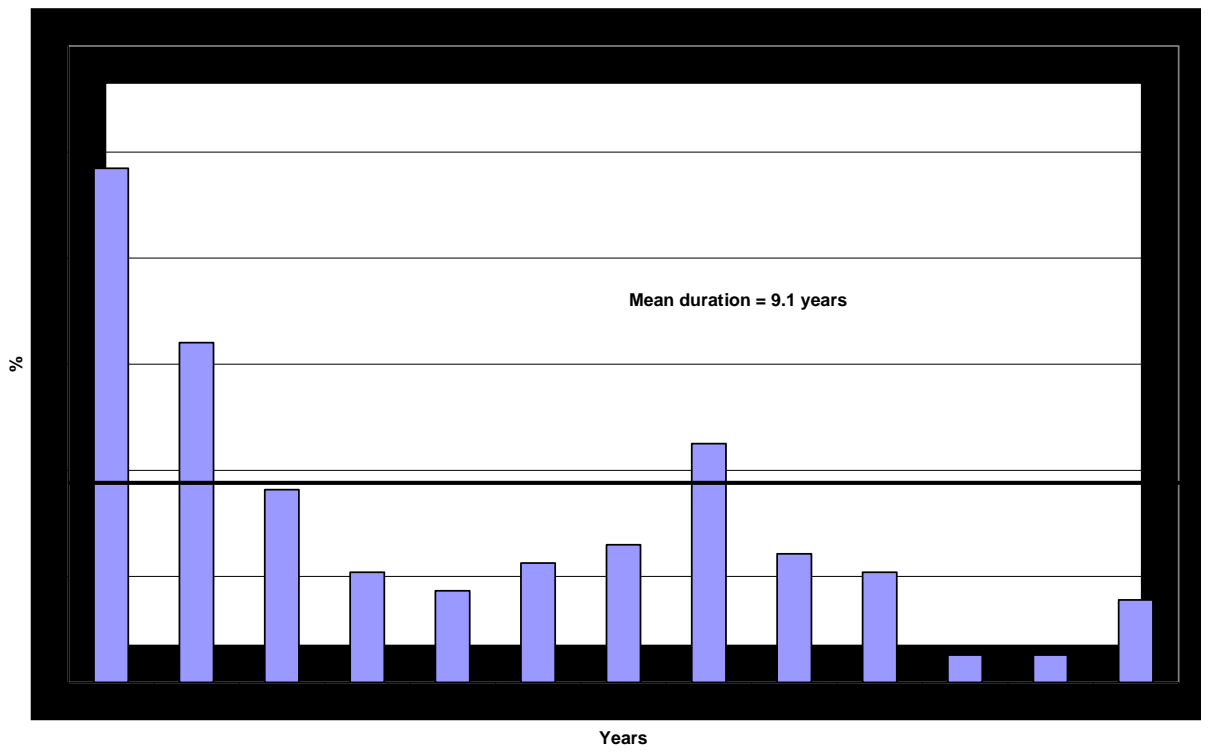


Figure 2: Duration of spells

Capital Gains Realizations (by asset types)

Source: Burman (1999)

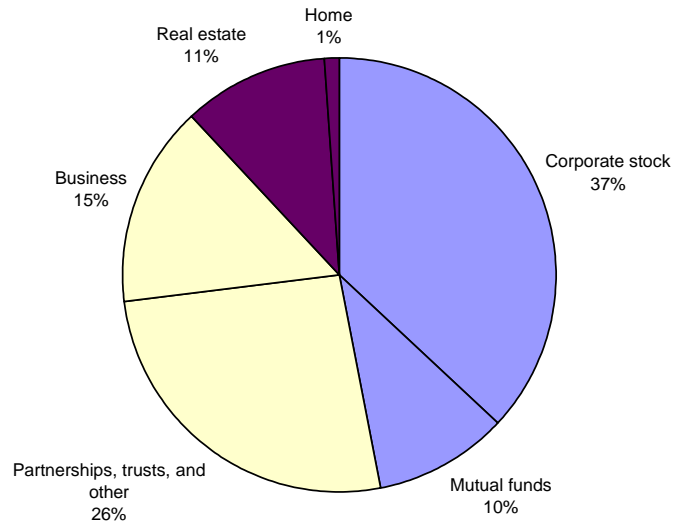


Figure 3: Capital Gains Realizations

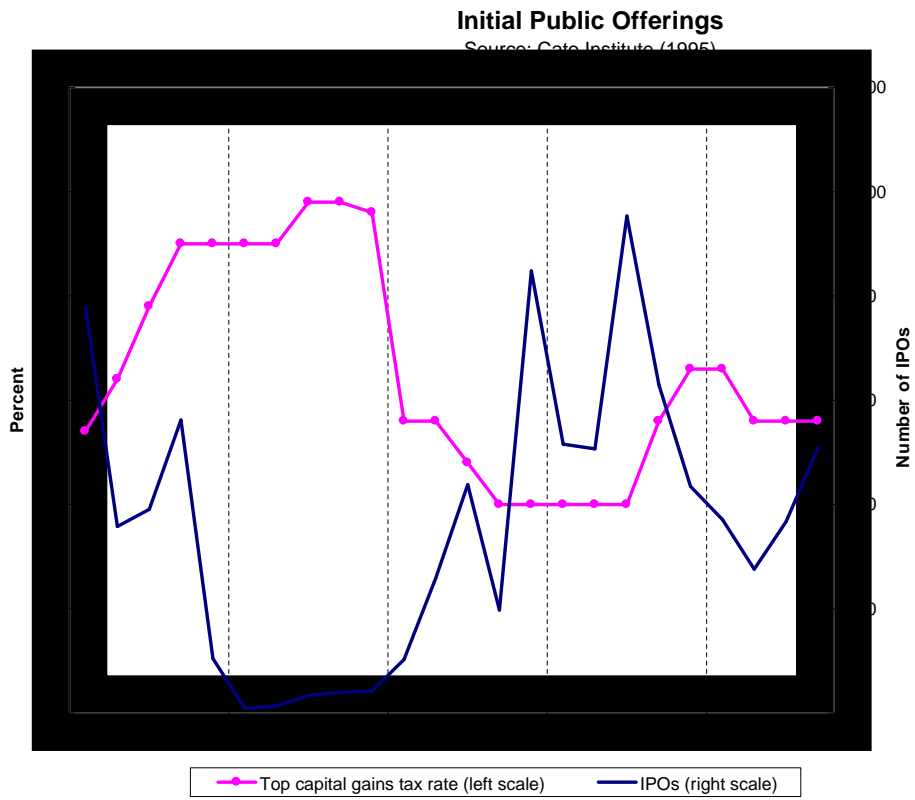


Figure 4: IPOs

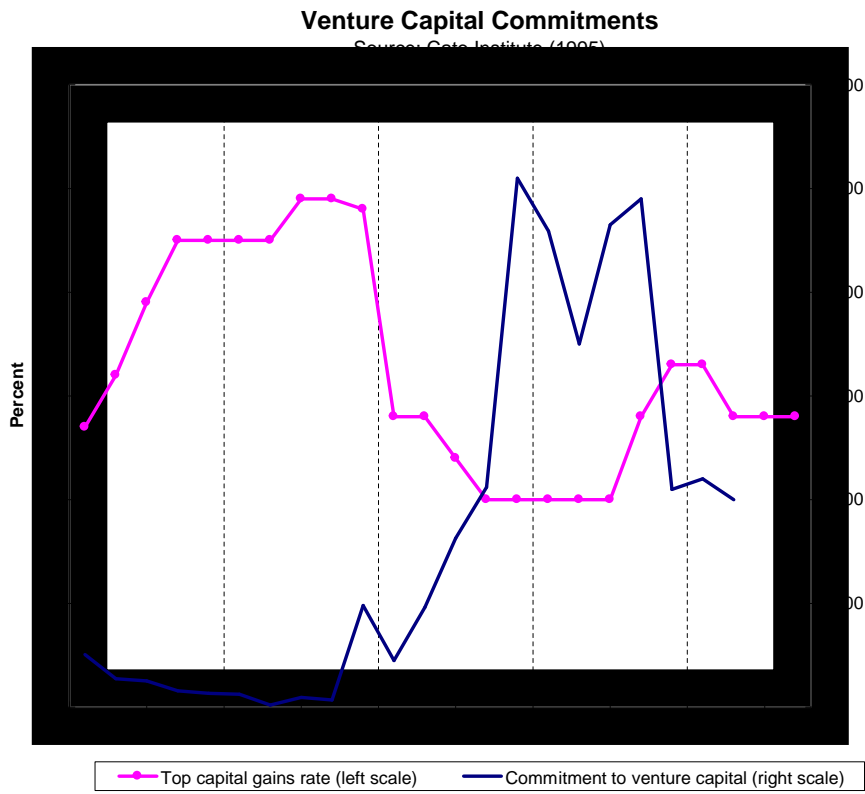


Figure 5: VC Commitments

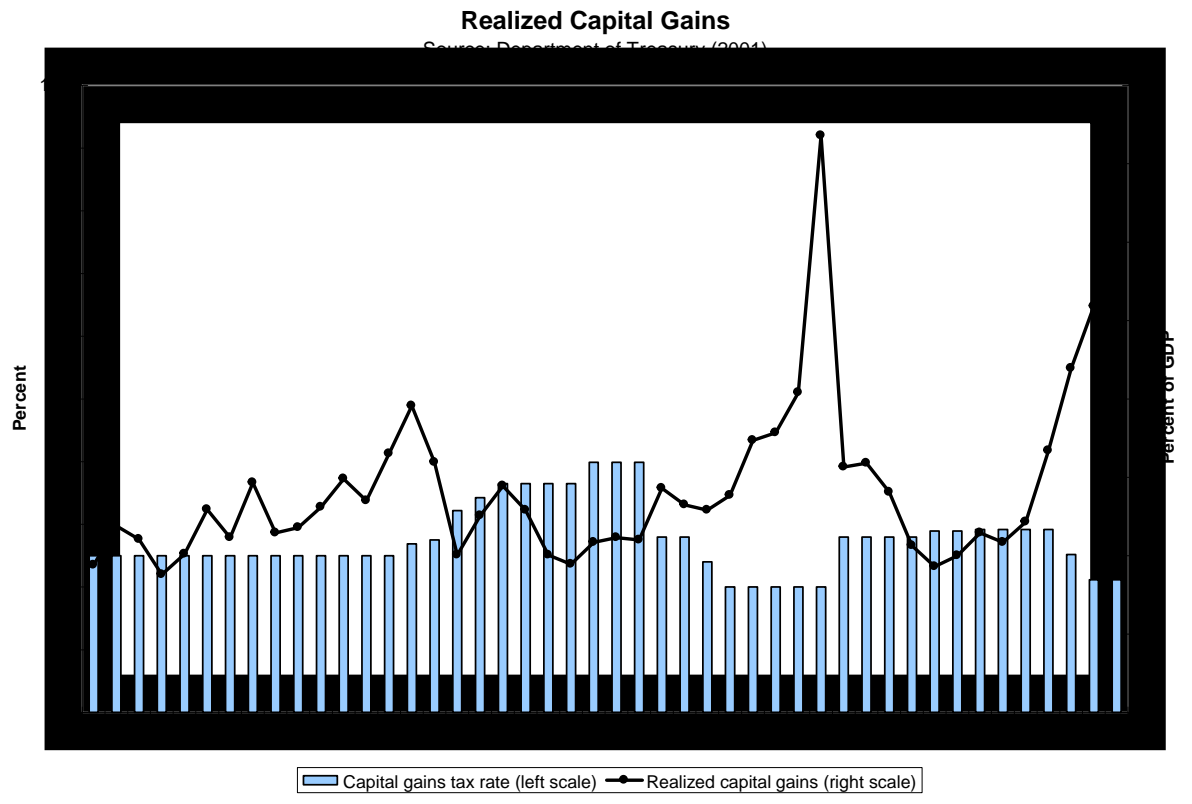


Figure 6: Realized Capital Gains

Capital Gains Tax Revenues

Source: Department of Treasury (2001)

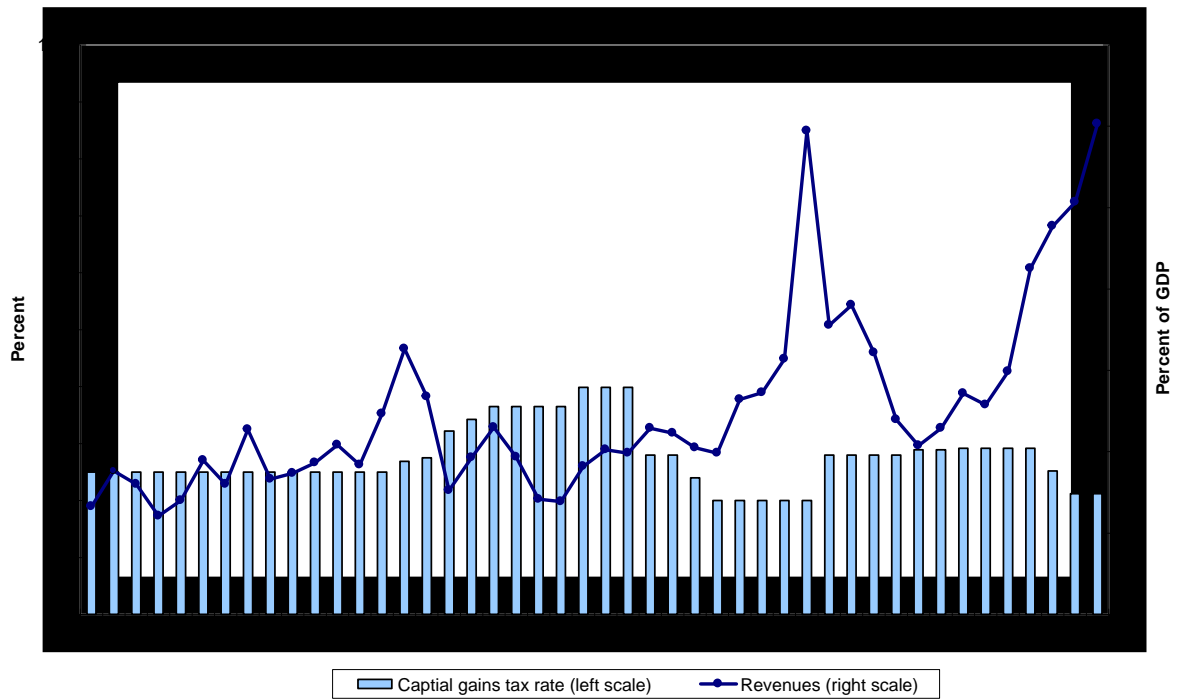


Figure 7: Capital Gains Tax Revenues

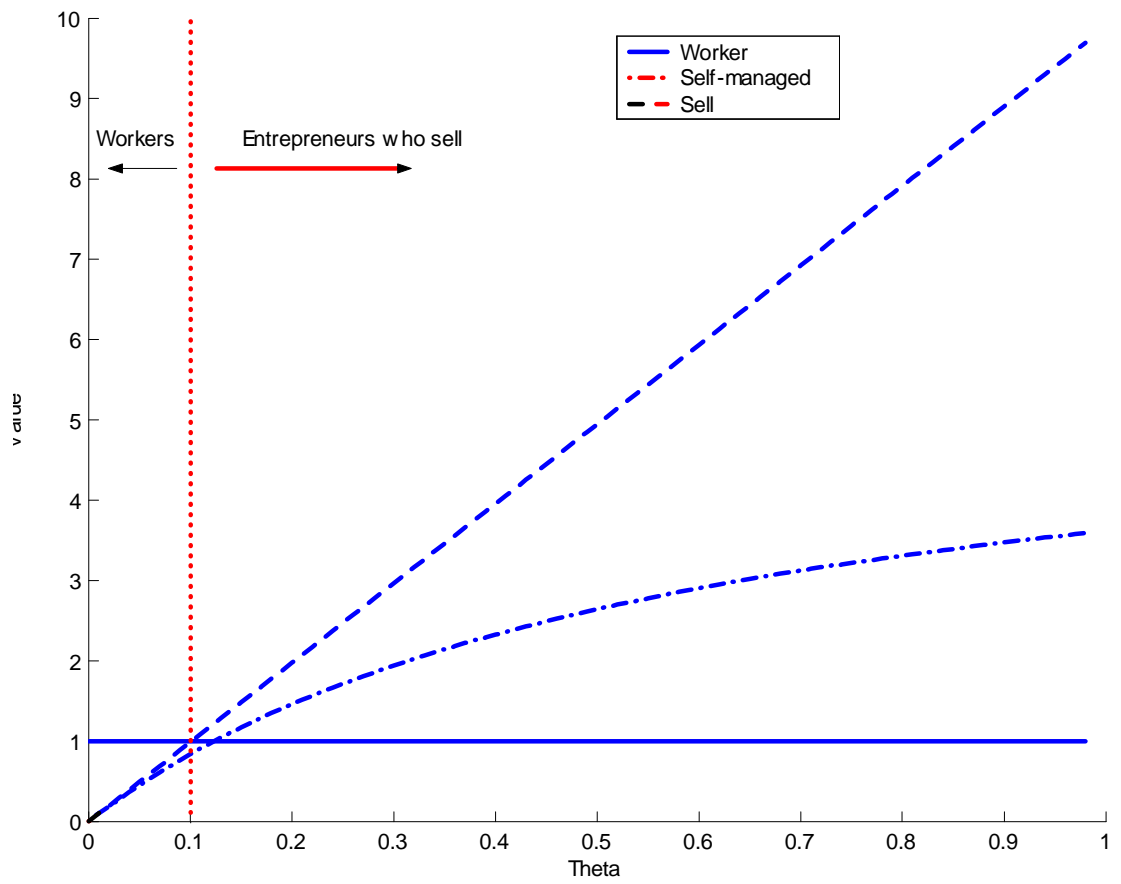


Figure 8: Value functions without tax $V^s(0, \theta)$, $V^m(0, \theta)$, $V^w(0, \theta)$

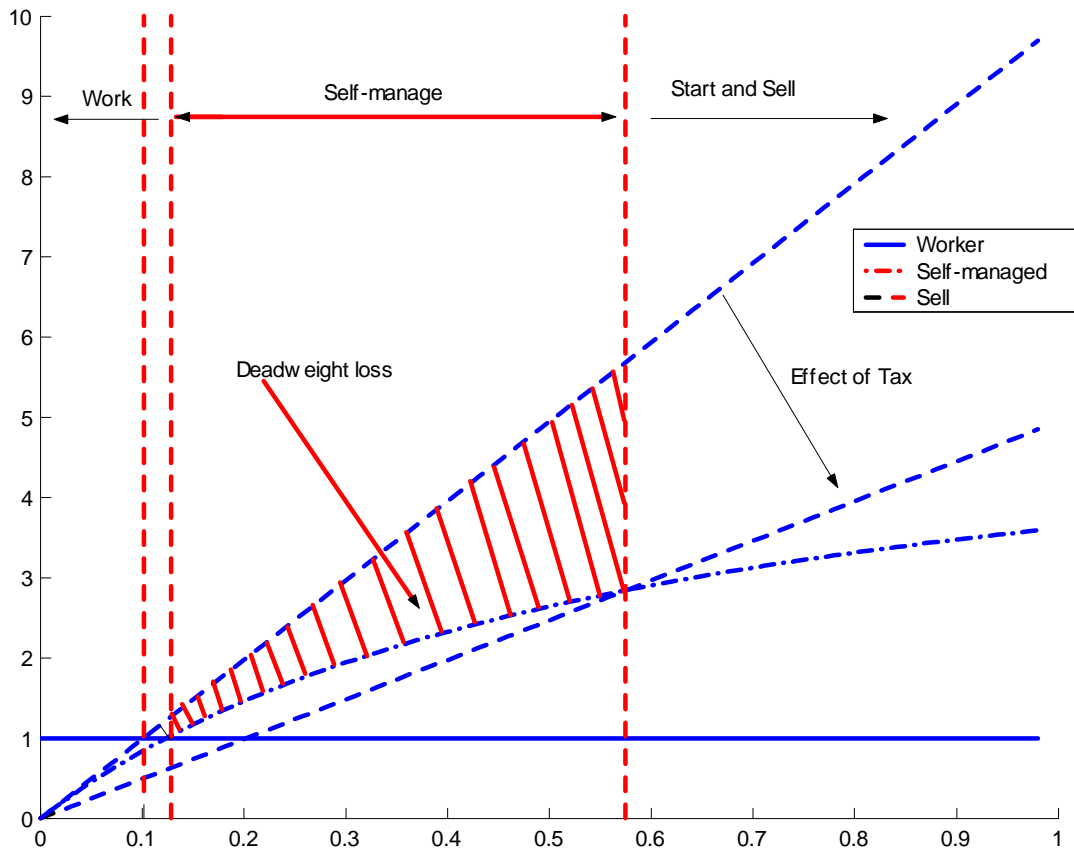


Figure 9: Deadweight loss of capital gains tax

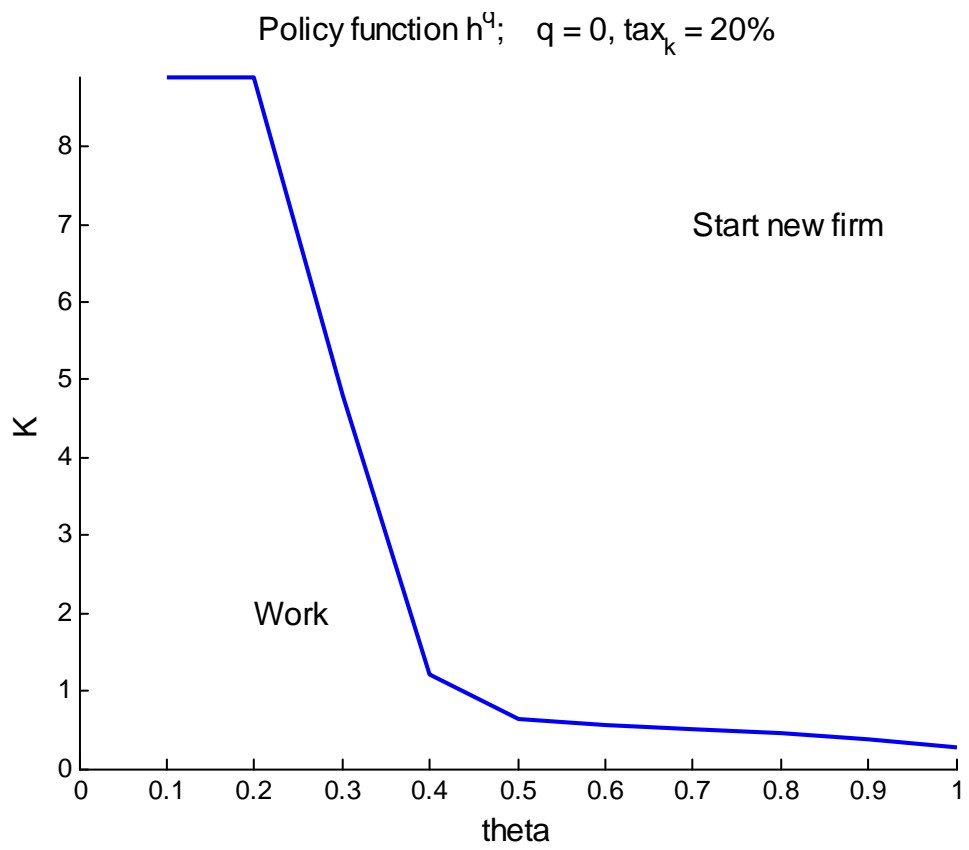


Figure 10: $h^q(k, 0, \theta)$

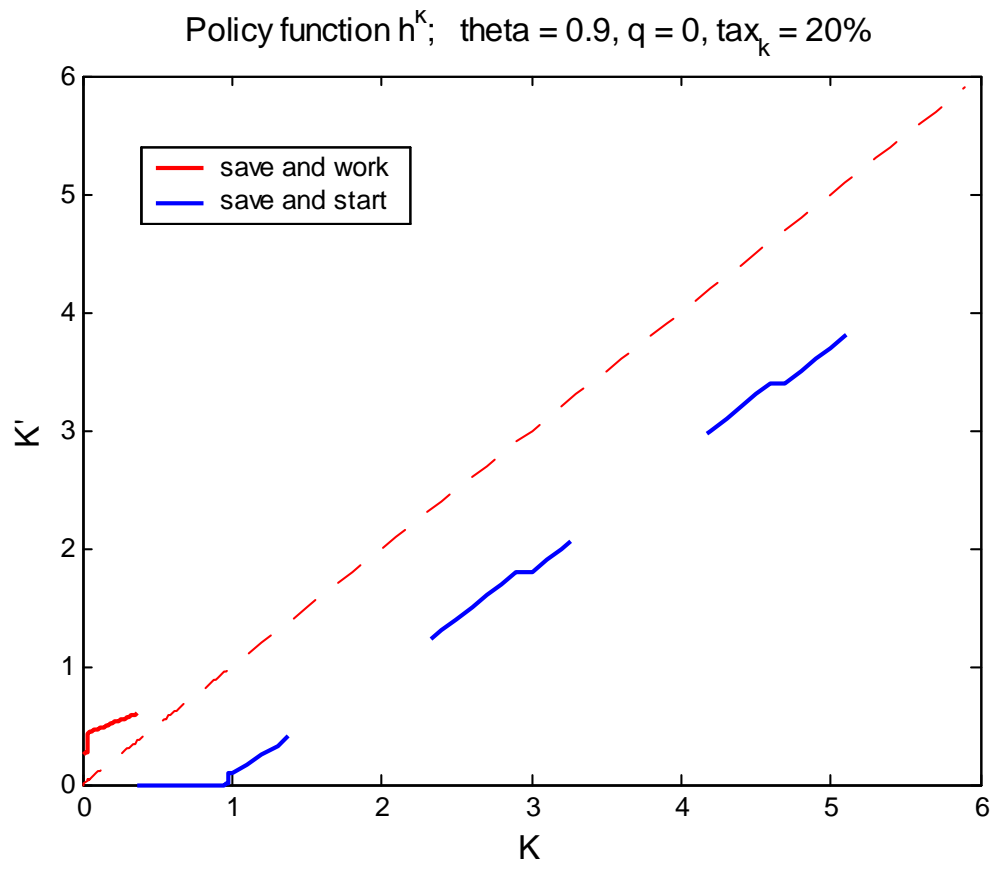


Figure 11: $k'(k, 0, 0.9)$

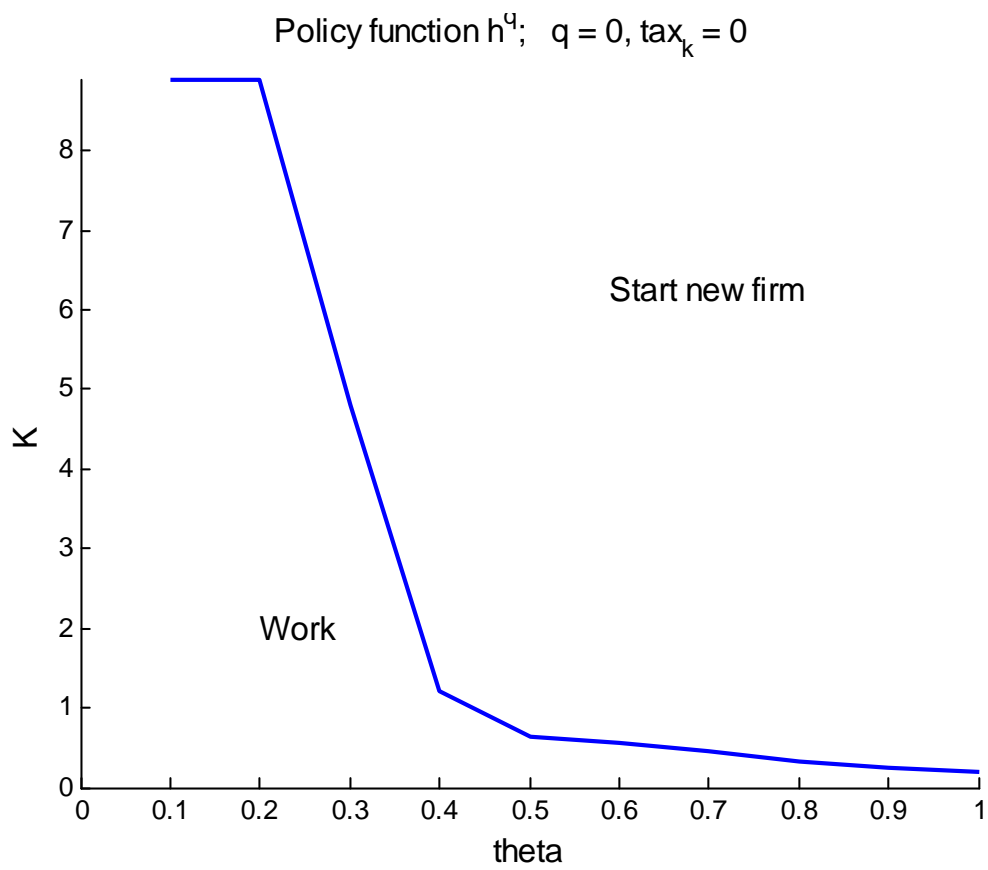


Figure 12: $h^q(k, q^m, \theta)$

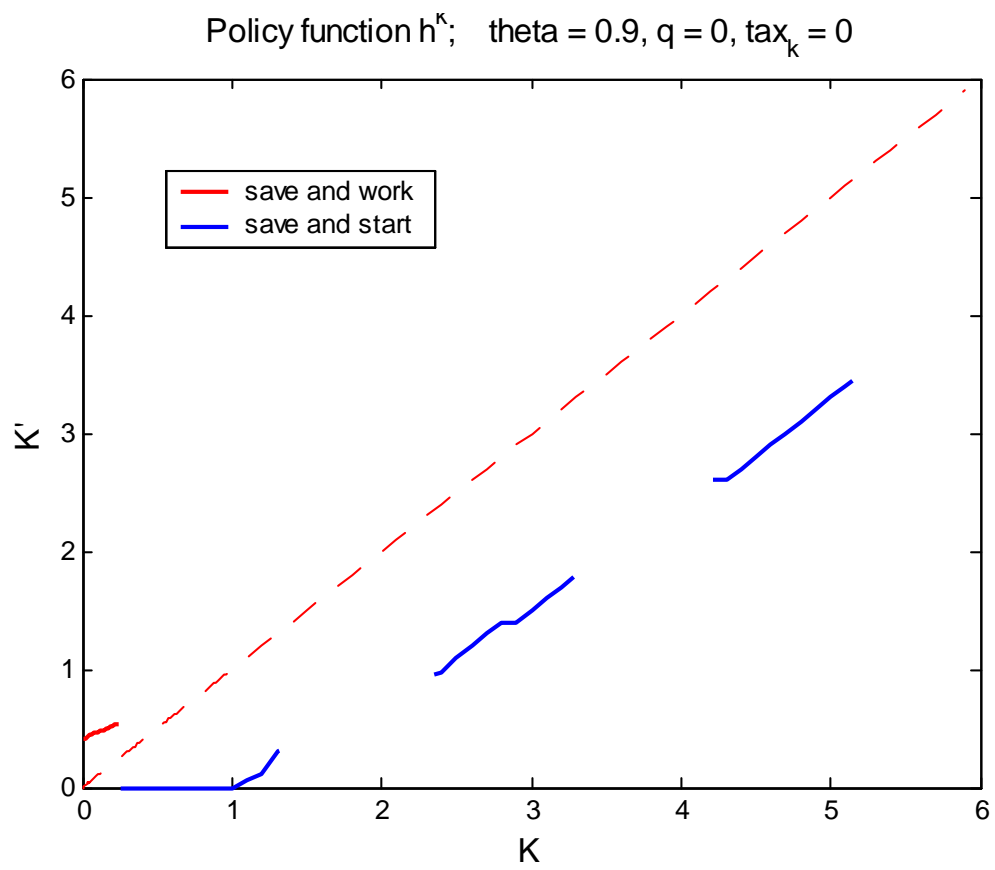


Figure 13: $k'(k, q^m, 0.9)$

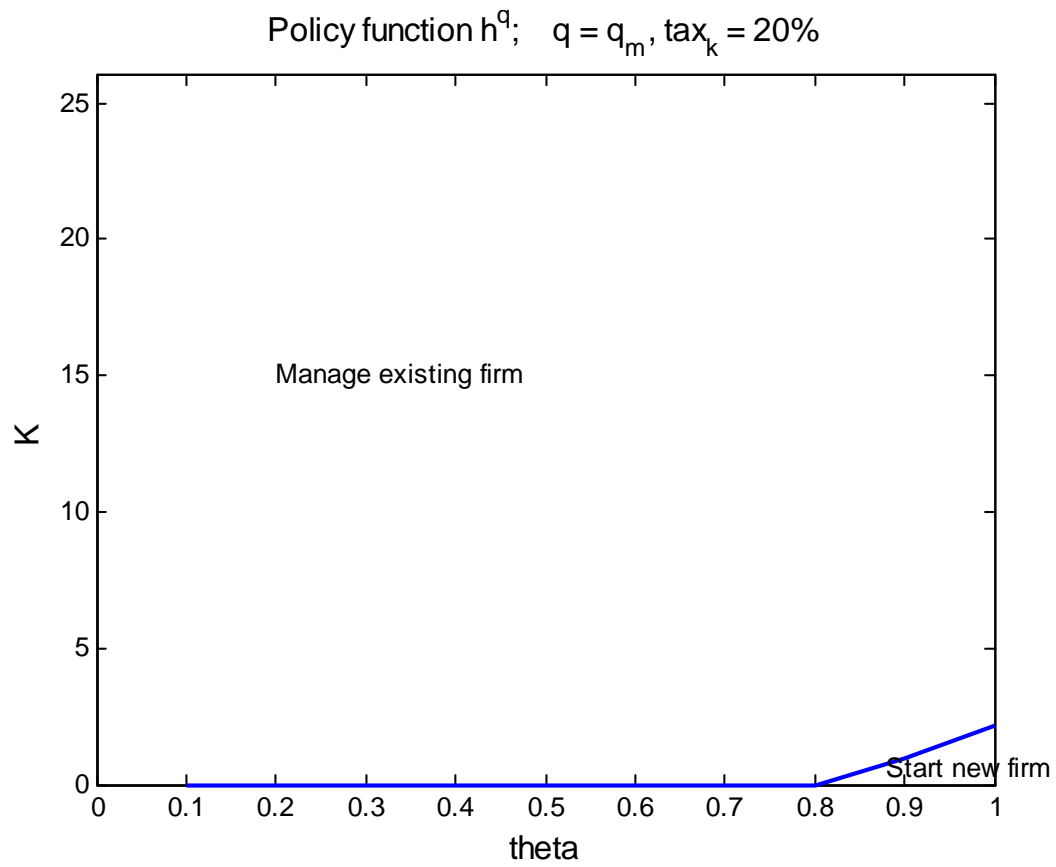


Figure 14: $h^q(k, q^m, \theta)$

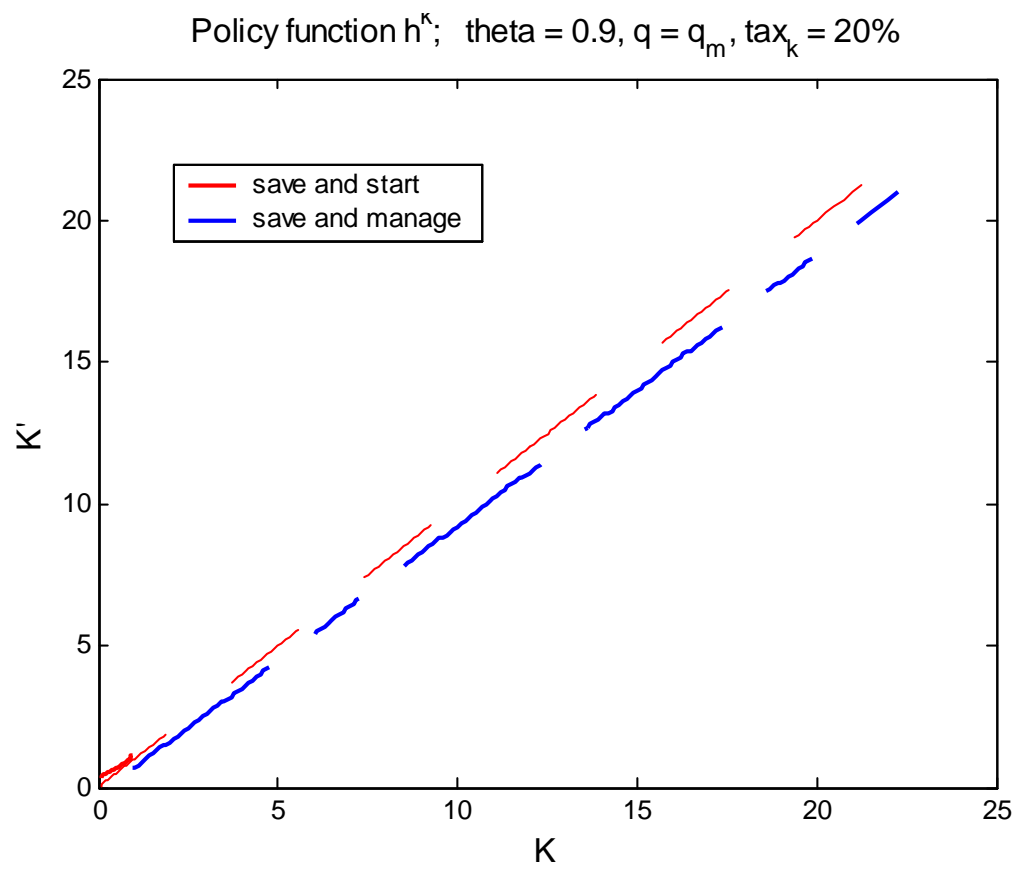


Figure 15: $k'(k, q^m, 0.9)$

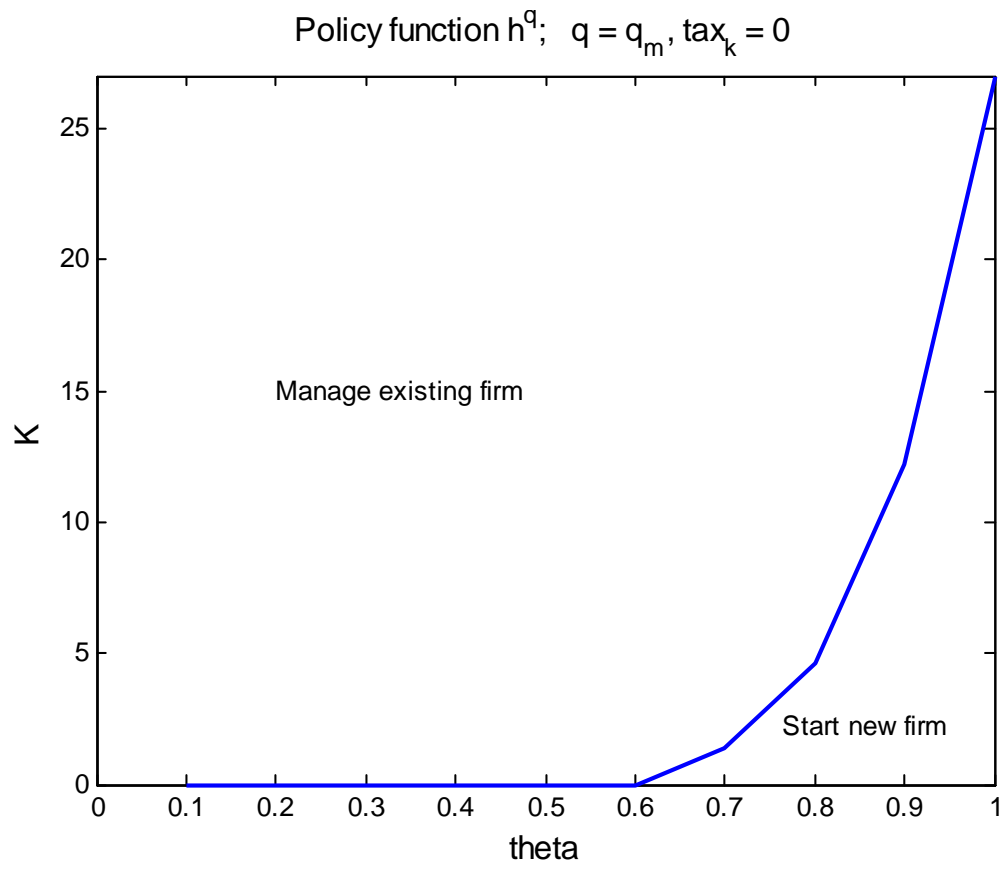


Figure 16: $h^q(k, q^m, \theta)$

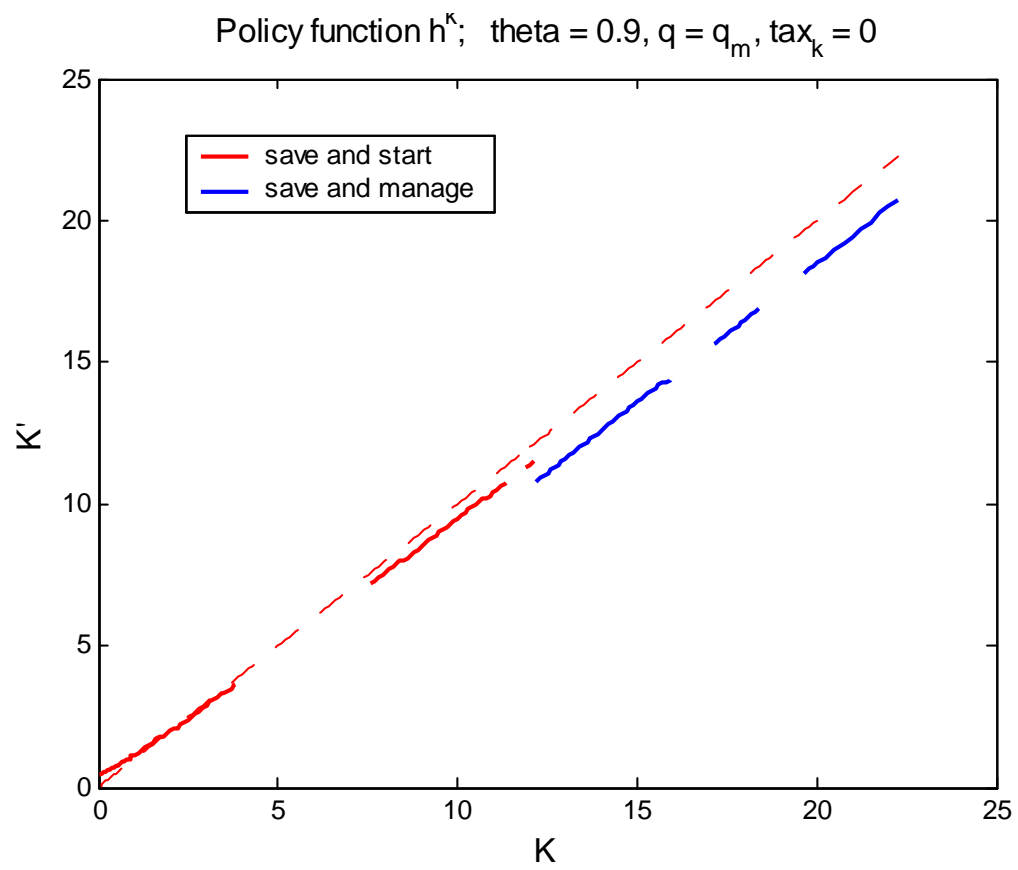


Figure 17: $k'(k, q^m, 0.9)$

Number of Entrepreneurial Spells over 15 Years (Model)

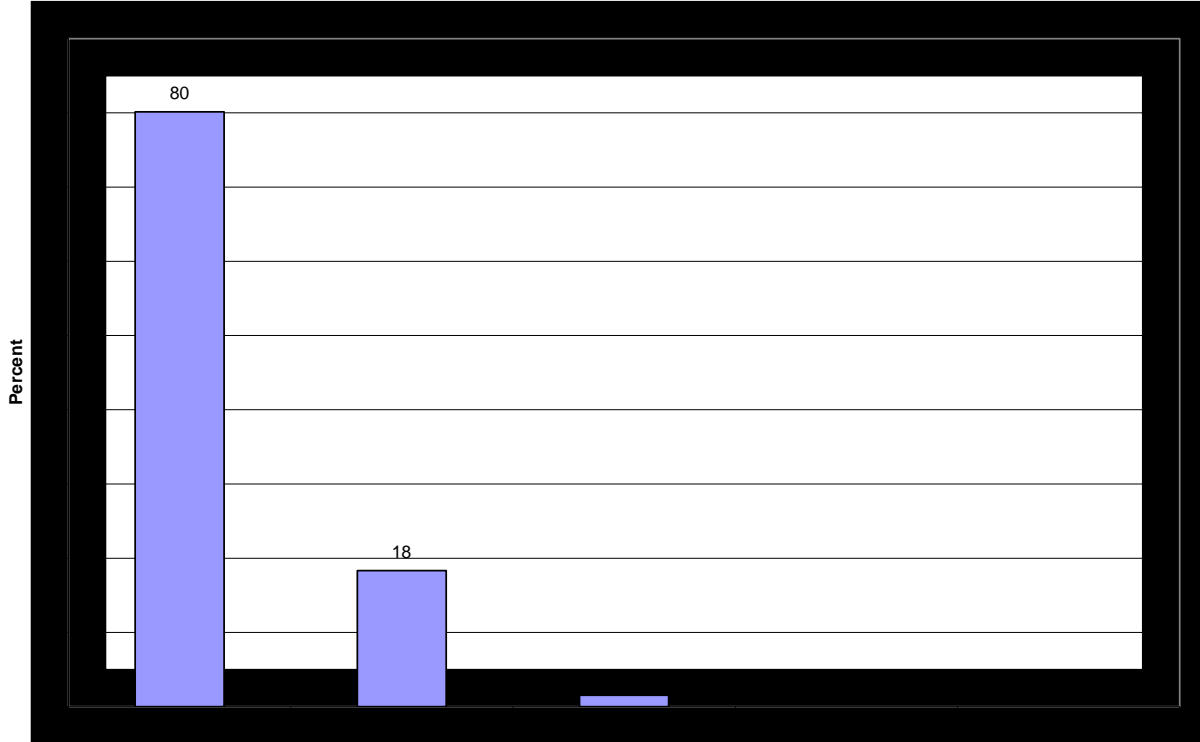


Figure 18: Number of Spells

Number of Businesses Started over 15 Years (Model)

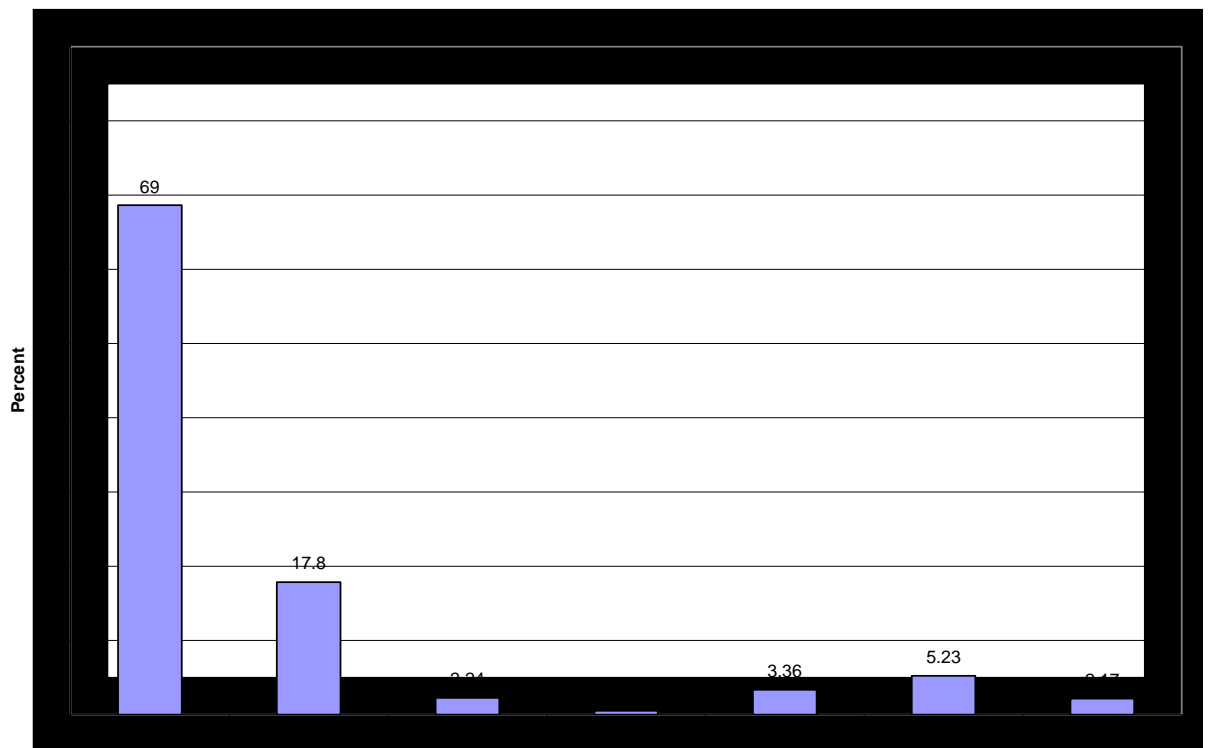


Figure 19: Number of businesses started

Duration of Entrepreneurial Spells (Model)

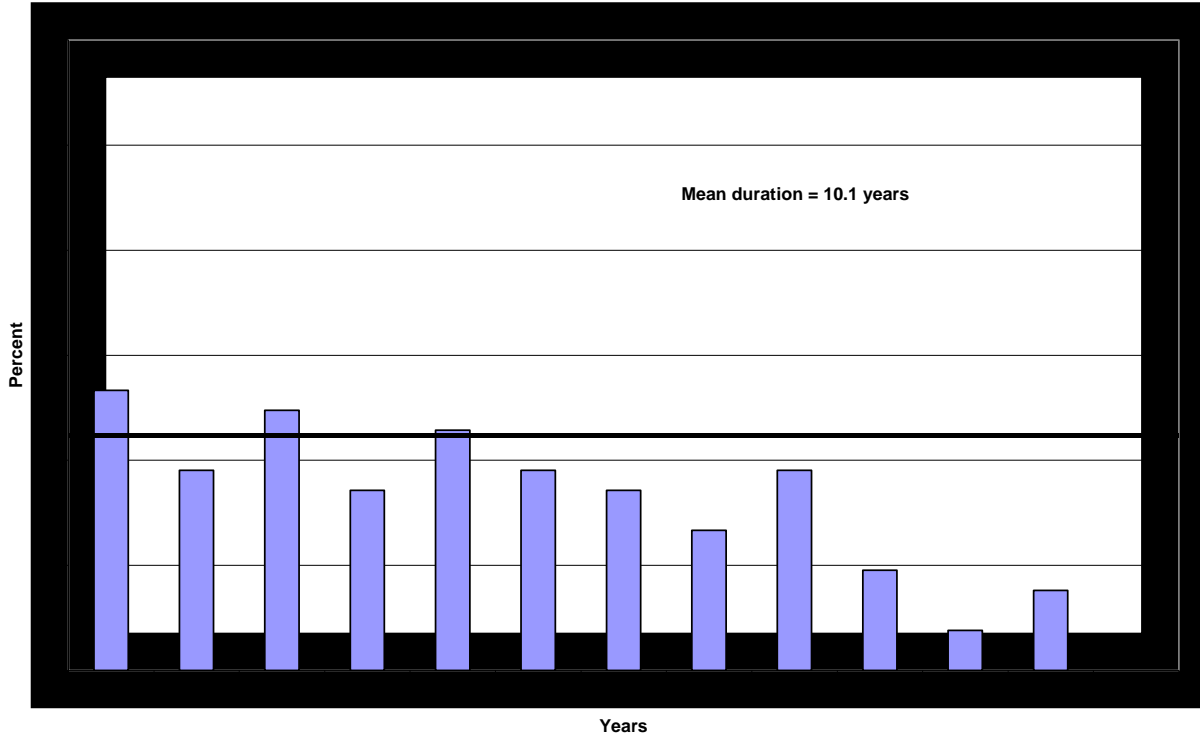


Figure 20: Duration of Spells

Duration of Business Ownership (Model)

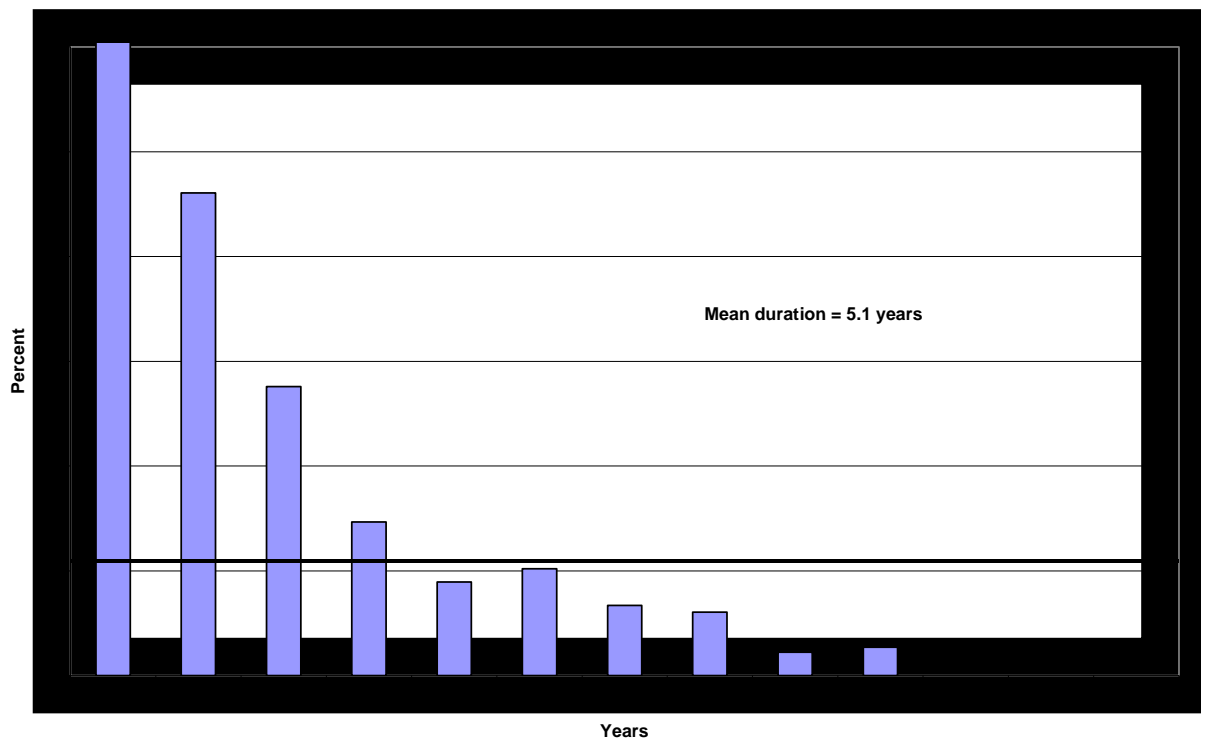


Figure 21: Duration of Business Ownership

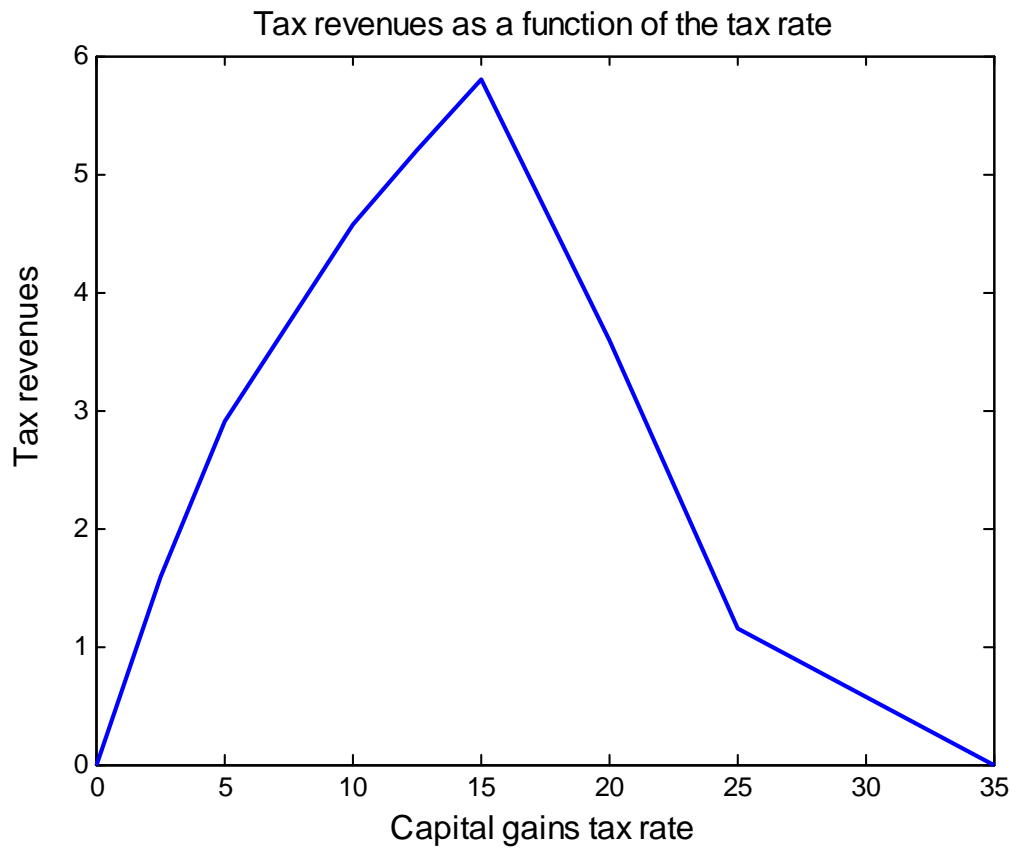


Figure 22: Laffer Curve