# Entrepreneurship, Bequests and the Distribution of Wealth

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**Abstract.** Entrepreneurs are a small fraction of the population, but hold a large share of total wealth. We construct and solve numerically a life cycle optimization model with intergenerational transmission of wealth to study the choice of starting an entrepreneurial activity, and its effect on the distribution of wealth in the population. We examine two forces that determine self selection into an entrepreneurial activity: initial wealth and attitudes to risk. Starting a business requires initial funds or collateral, which may be provided by bequests or parental transfers. Entrepreneurial income has high returns, but is riskier than labor income; more risk averse households may decide not to become entrepreneurs, despite the expected gains from such activity. We calibrate our model to the US economy. Explicitly introducing entrepreneurial choice increases significantly the fraction of wealth held by the right tail of the distribution. Moreover, changes in the coefficient of risk aversion have a large impact on the number of people who become entrepreneurs.

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# 1 Introduction

Entrepreneurs hold a significant fraction of the total wealth of the economy. Gentry and Hubbard [7] report that in the 1989 Survey of Consumer Finances entrepreneurs are 8.6% of the sample, but hold 39% of total net worth; Quadrini [14] documents the concentration of wealth and the upward mobility of entrepreneurs. Most models of wealth accumulation cannot reproduce the inequality in wealth observed in the data[2]. Explicitly modeling the behavior of entrepreneurs and the intergenerational transmission of business assets may help understand the inequality in wealth holdings.

In this paper, we construct and solve numerically a life cycle optimization model with intergenerational transmission of wealth to study the choice of becoming an entrepreneur, and the subsequent savings and consumption choices that determine their wealth accumulation. We study two main mechanisms that determine the entrepreneurial choice: initial funds requirements, and attitudes to risk.

Gentry and Hubbard [7] and Evans and Jovanovic [5] show that external financing to start or expand a business is very costly, and initial wealth plays a role in the choice of becoming an entrepreneur.[3] Part of this initial wealth may be generated by own savings: the possibility of becoming an entrepreneur may induce people to save more to build up the required funds. But this wealth may also come from intergenerational transfers, such as bequests. Holtz-Eakin et al. [9], for instance, show that the decision to become entrepreneurs career is significantly affected by by the receipt and the size of an inheritance.[4]

The income streams and the rate of return for entrepreneurs have higher means, but are much more volatile than those of labor earnings. Therefore, entrepreneurs may be induced to increase their savings for precautionary purposes (see Kennickel and Lusardi [11].) Moreover, people who are more risk averse will prefer to choose different careers, that have safer income streams. Only less risk averse individuals self select into an entrepreneurial career.

Our model features both mechanisms. An individual may choose to become a worker or an entrepreneur; in order to become an entrepreneur, he has to pay an initial startup cost, or hold part of his own wealth as collateral. The

[2] See Quadrini et al [15] for a discussion of the shortcomings of most computable models of wealth dispersion.

[3] For empirical evidence on entrepreneurs, see also Evans and Leighton [6].

[4] A similar result is documented for the UK by Blanchflower et al. [1].

entrepreneurial activity has higher returns, but is both more volatile and there is some risk of defaulting. Even if an individual holds enough initial wealth to become an entrepreneur, he will do so only if his coefficient of risk aversion is low enough. We want to study how the entrepreneurial choice depends on the level of initial startup costs, and how large the difference in the risk aversion parameter needs to be in order to influence such choice.

We calibrate our model to the US economy. We find that the possibility of an entrepreneurial activity increases by 50% the fraction of wealth held by the top 1% of the wealth distribution. We also show that increasing the coefficient of risk aversion from 1.5 to 3 significantly decreases the percentage of entrepreneurs, and even in the absence of initial funding requirements, we cannot match the percentage of 8.6% of entrepreneurs. A decrease in the degree of intergenerational altruism also lowers the fraction of entrepreneurs.

This paper is related to various works that have studied wealth accumulation and entrepreneurial choices. The importance of initial funds was stressed, among others, by Evans and Jovanovic [5]. The idea of the entrepreneur as the individual who is willing to assume risks, dating back at least to Knight, was first incorporated into an explicit model of entrepreneurial choice by Kihlstrom and Laffont [12]. None of these works, however, consider a life cycle framework of individual decision making, whose results can be compared to microeconomic data on wealth dispersion. De Nardi [4] shows that bequests can be quantitatively important in generating wealth dispersion in a life cycle optimization model, but her model does not have entrepreneurial choice. Quadrini [13] constructs a life cycle model of wealth accumulation and entrepreneurial choice, and studies the implications for wealth dispersion. We build on Quadrini's [13] framework, and consider more carefully the importance of bequest, and study the effect of heterogeneity in risk aversion for the entrepreneurial choice.

The paper is structured as follows. Sections 2-5 present the model. Section 6 discusses the algorithm used to solve the model numerically, and the calibration is considered in section 7. Section 8 shows the results, while section 9 concludes and discusses various directions in which to extend our model.

## 2 The setup

We consider a simplified life cycle setup, with two stages of life: working period and retirement. Each worker or entrepreneur has a constant probability $\alpha$ of retiring in the next period. Each retiree has a constant probability $\tilde{\alpha}$ of dying next period. These probabilities may be different between entrepreneurs or groups (entrepreneurs typically do not retire or retire very late).

These probabilities, however, do not depend on how many years individuals have been in the labor force. The model, therefore, is not exactly a life cycle model, in which individuals work for a given number of years. Some will retire very soon, others may go on working for a very long period. We adopt this simplification in order to keep the number of state variables low and the model computationally manageable. With this assumption we only need to keep track of whether an individual works or is retired but not of his age.[5] We calibrate the probability $\alpha$ to match the average length of working age (45 years in our case).

After retiring, individuals have a probability $\tilde{\alpha}$ of dying in the next period. Once again, $\tilde{\alpha}$ is calibrated to match the average lenght of the retirement period (11 years); this also implies that the retired are 20% of the total population.

When the individual dies, he leaves all his assets to his descendant. The ancestor is altruistic and cares about the utility of the offspring. A parameter $\eta$ regulates the degree of altruism.

We assume that the descendant enters the model as a worker when his ancestor dies. When the offspring enters the model, he has to decide whether to become an entrepreneur. We assume that the entrepreneurial decision is made only once, at the beginning of the life cycle. Each period, there is a probability $p$ (that possibly depends on current income) that an entrepreneur defaults (and becomes a worker next period). In reality, there is entry into entrepreneurial activities in all stages of the life cycle, as GH [7] point out; we may introduce this feature in future versions of this paper.

We assume that there is an upfront fixed cost to enter an entrepreneurial activity. Borrowing is not allowed, so to become an entrepreneur, the individual must have resources at least equal to that amount. The fixed cost of entry is lost when the young person becomes an entrepreneurs.[6]

[5]This simplification is often used in models of savings and wealth accumulation to reduce the number of state variables, as for instance, in Castaneda et al. [3] or Quadrini [13].

[6]In the future, we will also consider the case when there is no fixed cost, but a business

After making this choice, the offspring starts working. The income streams are exogenous, and stochastic, and there is no labor choice.

There exists only a single risk-free asset, in which both workers and entrepreneurs can invest. We do not introduce a separate form of investment in the form of business assets. Part of the income of entrepreneurs can be seen as the (risky) return from business assets. It is in fact difficult to distinguish between labor income and returns from business assets for entrepreneurs. For simplicity, in this baseline model we assign all entrepreneurial income to labor income, while the wealth held by entrepreneurs gives a riskless interest rate $r$. One way to think about this is that the labor income for entrepreneur includes all returns to business wealth in excess of the risk-free interest rate.

This is however just a simplification. Later, we will introduce another asset in addition to the riskless asset, a risky business technology in which entrepreneurs can invest.[7] Part, or all, entrepreneurial income may come from the stochastic returns to this technology. This will allow us also to study the portfolio composition of entrepreneurs, who have been shown, for instance by Gentry et al. [7], to hold highly undiversified portfolios.

Note finally that there is no aggregate shock in the economy, since we are not interested in the price of risky securities. There are only idiosyncratic shocks to the income (and the life span) of the individuals. The absence of aggregate shocks allows us to compute an invariant distribution of asset holdings. If aggregate shocks were introduced, the distribution would shift over time and depend on the aggregate shock, thus making the numerical solution of the problem much harder.

# 3 The maximization problem

The period utility from consumption is CRRA with coefficient of relative risk aversion $\gamma$. Each worker receives an exogenous income stream $y$, which follows a first order Markov process. The income stream of entrepreneurs has higher mean but is more volatile than that for workers. Labor income is taxed at

must be started, at least in part, with own funds. Therefore, the initial investment is not lost, as in our current case, but remains as a part of the entrepreneur's business wealth.

[7] This is done also by Quadrini [13]. We think that by relating entrepreneurial income directly to the amount of wealth and allowing the possibility of very high returns to wealth, we will generate more dispersion in income and increase the concentration of wealth in the hands of the very rich.

a constant rate $\tau_l$, while asset income is paid at a rate $\tau_a$. In addition to the interest payments from accumulated assets, the retirees receive a constant pension from the government until they die.

Let us denote by $x = (a, y, occ)$ the set of state variables for the individual decision problem. $a$ denotes the asset level held by the individuals at the beginning of the period, before accruing interest. $y$ is the current realization of the income process, and $occ$ denotes the occupation (young, worker, entreprener, retired). The optimal decision rules are functions for consumption $c(x)$ and next period's asset holding $a'(x)$ that solve the dynamic programming problem described below.

The value function for the old, who are retired:

$$V(a,o) = \max_{c,a'} \{U(c) + \beta\tilde{\alpha}V(a',o) + \eta\beta(1-\tilde{\alpha})E(V(a,n))\} \tag{1}$$

$$\begin{aligned} \text{s.t.} \quad c + a' &\leq a(1 + r(1-\tau_a)) + p && (2) \\ a' &\geq \underline{a} && (3) \end{aligned}$$

$\eta$ represents the degree of altruism towards the offspring. $\eta = 1$ is full altruism, while $\eta = 0$ corresponds to absence of altruism.

The value function for the young who must make their career choice:

$$V(a,n) = \max\{EV(a'_w, y', w), EV(a'_e, y', e)\} \tag{4}$$

The assets at the start of the working life are:

$$a'_w = \begin{cases} a & \text{if} \quad a \leq \text{ex} \\ (1-\tau_b)\max(0, a - \text{ex}) + \text{ex} & \text{otherwise} \end{cases} \tag{5}$$

$$a'_e = \begin{cases} a - c_f & \text{if} \quad a \leq \text{ex} \\ (1-\tau_b)\max(0, a - \text{ex}) + \text{ex} - c_f & \text{otherwise} \end{cases} \tag{6}$$

The newborn pays a constant tax rate $\tau_b$ on all the bequest exceeding a given exemption level ex.

The value function for the worker is:

$$V(a,y,w,\zeta) = \max_{c,a'} \{u(c) + \beta\alpha EV(a',y',w) + \beta(1-\alpha)V(a',o)\} \tag{7}$$

$$\text{s.t.} \quad c + a' \leq a(1 + r(1 - \tau_a)) + y(1 - \tau_l) \tag{8}$$
$$a' \geq \underline{a} \tag{9}$$

There is an exogenous probability $p(y)$ that the entrepreneur defaults. In this case, he becomes a worker next period. The probability depends on current income, the lower the income realization, the greater the risk of defaulting. The entrepreneur who has defaulted becomes a worker, with an initial income realization drawn from the invariant distribution of $y$ for workers.

The value function for the entrepreneur is:

$$V(a, y, e, \zeta) = \max_{c,a'} \{U(c) + \beta\alpha(p(y)E(V(a', y', e)) + (1 - p(y))E(V(a', y', w, \zeta)) + \beta(1 - \alpha)V(a', o)\} \tag{10}$$

$$\text{s.t.} \quad c + a' \leq a(1 + r(1 - \tau_a)) + y(1 - \tau_l) \tag{11}$$
$$a' \geq \underline{a} \tag{12}$$

# 4 The government

The government is infinitely lived and taxes labor earnings, capital income and estates to finance the exogenous public expenditure $g$ and to provide pensions to the retired agents. We assume that the government budget must be balanced in every period.

# 5 The equilibrium

From the policy rules and the exogenous Markov process for income we can derive a transition function $M(x, \cdot)$, which is the probability distribution of $x'$ (the state next period) conditional on $x$ for a person that behaves according to the policy rules $c(x)$ and $a'(x)$.

A stationary equilibrium is given by

- an interest rate $r$,
- allocations $c(x), a(x)$,
- government tax rates and transfers,$(\tau_a, \tau_l, \tau_b, ex, p)$,
- and a constant distribution of people over the state variables $x$: $m^*(x)$

such that, given the interest rate and the government policy:

- the functions $c$ and $a$ solve the maximization problem described above, taking as given the interest rate and the government tax rates and transfers.

- given a per capita exogenous government expenditure $g$ and the structure of the social security system, the government policy is such that the government budget constraint balances at every period:

$$g = \int \Big[\tau_a \, r \, a + \tau_l \, y I_{occ=w,e} - p \, I_{occ=o} + \tilde{\alpha} I_{occ=o} \tau_b \max(0, a' - ex)\Big] dm^*(x);$$

- $m^*$ is the invariant distribution for the economy.

# 6 The algorithm

Since there is no aggregate shock, the solution of the model is given by the invariant distribution of wealth. We need to find the wealth distribution associated with each tax rate, and then find the tax rate for which the government budget is balanced. The numerical algorithm is given by the following steps:

- we construct a grid for the state variables, asset holdings at the beginning of the period and current income. In order to have a good approximation, we need a very fine grid for assets (currently we use 200 gridpoints), as well as a relatively extended grid, to make sure that the decision rules do not go out of the bounds (we use 40 times average yearly income).

- for a given tax rate, we solve for the value functions described in section 3 by value function iteration. We start from a guess $\hat{V}$, we plug this guess on the right hand side of the equations 3, solve the individuals problem, and compute the corresponding new value functions $V^1$. We iterate on this process until the distance between $V^N$ and $V^{N+1}$ is smaller than some convergence criterion.

- we compute the invariant distribution of wealth associated with the value function just calculated. To do so, we need to construct the transition matrix $M$ for asset holding. This matrix contains the probability of moving from state $i$ in period $t$ to state $j$ in period $t+1$, where the states are given by the combination of all possible values of individual type (worker, entrepreneur, old), current income, and asset holding. This matrix is huge, but sparse. Sparse matrix techniques should be used: to find the invariant distribution, we start from a guess $\pi$ then iterate on $\pi' = M\pi$ until $\pi$ and $\pi'$ are close enough.

- we compute the government budget constraint associated with the distribution of asset found above. If there is a deficit, we raise the labor tax (and viceversa) and restart the algorithm with the new tax rate. We iterate until the government budget constraint is satisfied.

The algorithm was implemented in Fortran 90 on a Pentium II 500, and takes approximately 10 minutes for a grid of 200 points.

# 7 Calibration

The main difference between entrepreneurs and workers in our model is the exogenous income process. Our definition of income includes all forms of pre-tax labor income and government transfers. Since we assume that there is only one risk-free asset in the economy, the relevant definition of income for the entrepreneurs includes also the returns from risky business assets. In other words, we assign all the variability faced by entrepreneurs to their income process.

Our interest lies in explaining the extreme concentration of the distribution of wealth among the richest. Therefore our ideal definition of entrepreneurs includes only people who run a risky entrepreurial activity and have invested a certain mininum amount in business assets.[8] It would not be appropriate for us to use (self reported) self-employment status. Many self-employed do not in fact own any business activity, but do report themselves as self-employed because they are not directly employed by a firm.

Unfortunately, panel data on entrepreneurs are scarce. The Panel Study of Income Dynamics (henceforth PSID) has good information on all sources of income, including income from business activity. However, it is not a representative sample for the richest top 5%, and it oversamples the poor. The Survey

[8] This is the definition also considered by Gentry and Hubbard [7], who use $5,000 invested in business assets as a cutoff point.

of Consumer Finances has very good information on wealth and on the richest, but has less information on income and it is only a cross-section, so that it is not possible to use it to estimate the time series properties of the income process. An interesting source of data could be the Panel of Individual Tax Returns (commonly referred to as Tax Model), which has annual data both on income and on assets.[9] We are currently trying to obtain this data set, which is not publicly available.

The current values for the income process used in these simulations are described in appendix A.

Another important factor influencing entrepreneurial choices is the probability of default. We take it as an exogenous process, that depends on the current value of income realization (the higher the income realization, the lower the probability of business failure). For now we use values close to the ones used by Quadrini [13], who estimates them from the PSID.

The baseline value for the fixed cost of entry is calibrated to match the 8.6% fraction of households who are entrepreneurs (see Gentry and Hubbard [7]). We find a calibrated value of $c_f = .4$ of average worker's income.[10] We perform sensitivity analysis on this parameter.

The values of the other parameters are shown in table 1. The discount factor is calibrated to match a ratio of capital to GDP of 3. The labor tax is calibrated so that the government budget constraint is satisfied, and varies slightly across experiments. It is 32% for the baseline experiment.

| Parameter | Value | Description |
|---|---|---|
| $\alpha$ | .0225 | prob retiring |
| $\tilde{\alpha}$ | .089 | prob dying |
| $\gamma$ | 1.5 | risk aversion |
| $\beta$ | .952 | discount factor |
| $\eta$ | 1 | altruism |
| $r$ | 3% | interest rate |
| $\delta$ | 8% | depreciation rate |
| $\tau_a$ | 25% | tax on capital income |
| $\tau_b$ | 10% | estate tax |
| $ex$ | 30 average income | estate exemption |
| $p$ | 40% average income | pensions |
| $g$ | 19% GDP | government expenditure |

Table 1: Parameters.

$\gamma = 1.5$, $\eta = 1$

| K/Y ratio | Wealth Gini | Percentage wealth in the top 1% | 5% | 20% | 40% | 80% | Perc. $\leq 0$ | Top holdings 2% | 5% |
|---|---|---|---|---|---|---|---|---|---|
| Entrepreneurs | | | | | | | | | |
| 3.0 | .56 | 6.8 | 22.0 | 55.8 | 81.2 | 99.2 | 2.3 | 19.5 | 14.6 |
| No entrepreneurs | | | | | | | | | |
| 2.9 | .53 | 4.6 | 18.5 | 53.3 | 79.4 | 99.0 | 2.4 | 15.7 | 12.6 |
| No entrepreneurs, ($\beta = .954$, $c_f = +\infty$) | | | | | | | | | |
| 3.0 | .53 | 4.5 | 18.0 | 52.6 | 79.5 | 99.0 | 2.0 | 16.4 | 13.3 |

# 8 Results

The first row of table 8 shows the results of our baseline calibration, described in table 1. The percentage of the total wealth held by the top 1% and 5% is much smaller than that in the data (respectively around 28% and 49%). The current version of the model is very simplified, and is clearly missing some important features of entrepreneurship. We already discussed some other factors that can be important to explain entrepreneurial behavior (such as the distinction between business and nonbusiness assets), and we plan to introduce some of them later on.

We do however perform some experiment on the model to understand the importance of some of the different elements already present in this setup. In the second and third line of table 8, we compute the distribution of wealth in economies without entrepreneurs. In the second row, we keep the same parameters as in the baseline economy. We can see that there is less capital accumulation, the gini index decreases and the upper tail is thinner. However these effects are not large enough to get significantly closer to the actual distribution of wealth. In the third line we recalibrate the discount factor to match a capital to GDP ratio of 3; the results about the distribution of wealth are unchanged with respect to the second row.

In table 8 we increase the degree of risk aversion to $\gamma = 3$. Some microeconomic estimates of $\gamma$ (as for instance Cagetti [2]) suggest in fact that for most households $\gamma$ can in fact be larger than such value. We first note that even by setting the fixed cost to 0, we cannot match the fraction of entrepreneurs in the total population. Since precautionary savings are much more important, we need to decrease the discount factor considerably to match the capital to gdp ratio of 3. In the second row, we set $\eta$ to zero (no altruism), and the fraction of entrepreneurs decreases further. These results show that preferences, in particular the degree of risk aversion, can be quantitatively relevant to explain entrepreneurial decisions: the more risk averse the individuals are, the less likely they are to become entrepreneurs. Self selection based on preferences can thus be important.

In table 8 we set $\eta$ to zero. The first row shows the results when all the other parameters are the same as in the baseline model. Lack of altruism

[9] Heaton and Lucas [8] use this data set to analyze the importance of entrepreneurial risk for portfolio choices.

[10] This value is consistent with some evidence suggested by Gentry and Hubbard [7].

$\gamma = 3$

| K/Y ratio | Wealth Gini | Perc. entr. | Percentage wealth in the top 1% | 5% | 20% | 40% | 80% | Perc. $\leq 0$ | Top holdings 2% | 5% |
|---|---|---|---|---|---|---|---|---|---|---|
| $\eta = 1$, $\beta = .912$, $c_f = 0$ | | | | | | | | | | |
| 3.0 | .51 | 7.3 | 6.2 | 20.2 | 51.9 | 78.2 | 98.4 | 1.0 | 17.15 | 13.6 |
| $\eta = 0$,$\beta = .935$, $c_f = 0$ | | | | | | | | | | |
| 2.9 | .53 | 5.0 | 6.0 | 20.2 | 55.2 | 81.9 | 99.6 | 2.4 | 15.7 | 12.6 |

significantly reduces the aggregate amount of capital (the capital to GDP ratio is now 2.1), and the fraction of entrepreneurs (that drops from 9% to 2.4%). When we recalibrate the model to match the GDP ratio of 3, the results are similar to the baseline model. However, we need to increase the degree of patience significantly, and above all, we need to reduce the cost of becoming entrepreneurs. This shows that bequests are a quantitatively significant factor in the decision to become entrepreneurs.

# 9 Conclusions and extensions

We have presented a simplified, basic model, that shows that intergenerational transfers through bequests, together with the presence of borrowing constraints for entrepreneurs, can have a significant impact on entrepreneurial choices, and hence increase the dispersion of wealth, and the amount of wealth held by the top few percents of the population. We have also shown that the number of entrepreneurs depend crucially on the magnitude of the initial cost, as well as on the preference parameters, in particular the degree of risk aversion.

We will enrich our baseline model and add more features to it. First, we want to consider the possibility that agents can become entrepreneurs also after starting their working life. Right now, the only way to become entrepreneurs

$\gamma = 1.5$, $\eta = 0$

| K/Y ratio | Wealth Gini | Perc. entr. | Percentage wealth in the top 1% | 5% | 20% | 40% | 80% | Perc. $\leq 0$ | Top holdings 2% | 5% |
|---|---|---|---|---|---|---|---|---|---|---|
| Entrepreneurs, non recalibrated | | | | | | | | | | |
| 2.1 | .63 | 2.4 | 6.5 | 22.9 | 62.2 | 88.3 | 99.9 | 15.1 | 12.6 | 9.9 |
| Entrepreneurs, $\beta = .971$, $c_f = .45$ | | | | | | | | | | |
| 3.1 | .60 | 9.5 | 6.8 | 23.0 | 60.1 | 85.2 | 99.0 | 10.2 | 21.5 | 16.8 |
| No entrepreneur, $\beta = .971$, $c_f = +\infty$ | | | | | | | | | | |
| 3.0 | .58 | 0.0 | 5.2 | 19.9 | 58.3 | 83.9 | 99.1 | 10.2 | 18.7 | 15.0 |

is to have bequests. However, an individual may start an entrepreneurial activity only later on, after having worked and accumulated wealth. Indeed, the possibility of becoming an entrepreneur may provide an additional incentive to save.

We also plan to distinguish between financial assets and business assets. In the current model, all income for entrepreneurs comes from labor income. However, entrepreneurial income may also be modeled as the high, but risky return from business assets, instead of an entirely exogenous income stream. This will allow to study also the composition of wealth for entrepreneurs, who often hold a large proportion of their wealth in the form of business assets.

Finally, in this version of the paper we have consider economies where all agents have the same coefficient of risk aversion, and compared economies with different values for such parameter. We will allow for preference heterogeneity within the population, to study the impact of the distribution of risk aversion within the population on self selection into an entrepreneurial activity.

We also need to improve on our current calibration, in particular regarding the data on income. The PSID is a panel and provides good information on income. In some years, it also asks about wealth holdings, so that it is possible to define entrepreneurs based also on their business asset holdings, not only on self reported employment status. Unfortunately, it has very few observations in the top 2 or 3% of the wealth distribution,[11] so that there is little information about the income of this group. However, it is a panel, and this allows us to estimate transition probabilities to and from entrepreneurship, as well as the stochastic structure of individual earnings. Data on the very rich may be found in the Survey of Consumer Finances, which however contains only cross sectional data. The Tax Model may provide panel data also for rich people.

# References


[1] David G. Blanchflower and Oswald J. Andrew. What makes an entrepreneur? *Journal of Labor Economics*, 16(1):26–60, January 1998.

[2] Marco Cagetti. Wealth accumulation over the life cycle and precautionary savings. Mimeo, January 2000.

[3] Ana Castaneda, Javier Díaz-Giménez, and José-Victor Ríos-Rull. Earnings and wealth inequality and income taxation: Quantifying the trade-offs of switching the U.S. to a proportional income tax system. Mimeo, August 1998.

[4] Mariacristina De Nardi. Wealth inequality, intergenerational links and estate taxation. Mimeo, November 1999.

[5] David S. Evans and Boyan Jovanovic. An estimated model of entrepreneurial choice under liquidity constraints. *Journal of Political Economy*, 97(4):808–827, August 1989.

[6] David S. Evans and Linda S. Leighton. Some empirical aspects of entrepreneurship. *Journal of Political Economy*, 79(3):519–535, June 1989.

[7] William M. Gentry and R. Glenn Hubbard. Entrepreneurship and household savings. Mimeo, February 1999.


[11] See Juster et al. [10] for a comparison between the Survey of Consumer Finances and the PSID regarding the distribution of wealth.

[8] John Heaton and Deborah Lucas. Portfolio choice and asset prices: The importance of entrepreneurial risk. *Journal of Finance*, 2000. Forthcoming.

[9] Douglas Holtz-Eakin, David Joulfaian, and Harvey S. Rosen. Entrepreneurial decisions and liquidity constraints. *Rand Journal of Economics*, 25(2):334–347, 1994.

[10] F. Thomas Juster, James P. Smith, and Frank Stafford. The measurement and structure of household wealth. Mimeo, 1998.

[11] Arthur Kennickel and Annamaria Lusardi. Assessing the importance of precautionary savings motive: Evidence from the 1995 SCF. Mimeo, August 1999.

[12] Richard E. Kihlstrom and Jean Jacques Laffont. A general equilibrium entrepreneurial theory of firm formation based on risk aversion. *Journal of Political Economy*, 87(4):719–748, August 1979.

[13] Vincenzo Quadrini. Entrepreneurship, saving, and social mobility. *Review of Economic Dynamics*, 1999. Forthcoming.

[14] Vincenzo Quadrini. The importance of entrepreneurship for wealth concentration and mobility. *Review of Income and Wealth*, 45(1):1–19, March 1999.

[15] Vincenzo Quadrini and José-Victor Ríos-Rull. Models of the distribution of wealth. Mimeo, January 1997.

[16] Kjetil Storesletten, Chris Telmer, and Amir Yaron. Asset pricing with idiosyncratic risk and overlapping generations. Mimeo, June 1999.

[17] George Tauchen and Robert Hussey. Quadrature-based methods for obtaining approximate solutions to nonlinear asset pricing models. *Econometrica*, 59:371–396, March 1991.

# A The income process

We assume that the income processes, both for the workers and for the entrepreneurs, are AR(1) in logarithms. The two parameters describing each income process are therefore their persistence and the variances of the innovations. We then discretize the processes using the method described by Tauchen and Hussey [17]. Since the income process for entrepreneurs is more volatile, we use 5 income states for the workers and 14 for the entrepreneurs.

For now the take the persistence of the two processes to be .95.[12]

We normalize the means so that the average income for workers is 1 and that for entrepreneurs is 1.16 (the value is taken from CPS data for self-employed. As discussed above, this may not be the best definition for our purposes.) We choose the variances so that the variance of the discretized processes for entrepreneurs is double that for workers, and the crossectional gini index for income matches the aggregate data (.4).

As explained in the text, we are still looking for better data to estimate the process more carefully, above all the one for entrepreneurs.

[12]This value is taken from Storesletten et al. [16], who estimate it from the whole sample of workers in the PSID.