Entrepreneurship, Saving and Social Mobility *

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Abstract

This paper examines entrepreneurship in order to analyze, first, the degree to which the opportunity to start or own a business affects the household's saving behavior and the implication of this behavior for the distribution of wealth and, second, the relationship between the extent of entrepreneurship in the economy and socioeconomic mobility, that is, the movement of families across wealth classes over time.

First, a number of stylized facts based on data from the Panel Study of Income Dynamics and the Survey of Consumer Finances are outlined. They show relevant differences in asset holdings and wealth mobility between entrepreneurs and workers. Second, a dynamic general equilibrium model with an explicit formalization of the entrepreneurial choice is developed. Through the modeling of the entrepreneurial activities, the model generates a concentration of wealth similar to the one observed in the U. S. economy and it replicates the main patterns of wealth mobility in which entrepreneurs experience higher upward mobility than workers. (JEL E21,D31,J23)

Introduction

Several empirical studies of income and wealth distribution show that household wealth is highly concentrated and substantially more concentrated than the distribution of income. (See, for example, Wolff (1995)). However, still unknown are the reasons why some families—notably those at the top of the wealth distribution—accumulate such a high level of wealth. The purpose of this paper is to explore the role of entrepreneurship with reference to this issue by addressing two questions. First, is entrepreneurship relevant in characterizing the different accumulation behavior of agents that are located at the top of the wealth distribution? Second, if entrepreneurship is relevant in differentiating the accumulation behavior of these agents, is this different behavior quantitatively important to generate higher concentration of wealth?

The analysis begins with the description of the main empirical differences in asset holdings between *entrepreneurs* and *workers*, where entrepreneurs are defined as families owning their own business, and workers are defined as all other families. Using data from the Panel Study

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of Income Dynamics and the Survey of Consumer Finances, the first section of the paper shows that there is a marked concentration of wealth that is held by entrepreneurs. Moreover, this concentration of wealth is not simply due to the higher incomes earned by entrepreneurs, since they also have a higher wealth-to-income ratio than workers. This finding suggests that not only are the higher asset holdings of entrepreneurs a consequence of the selection of entrepreneurs among richer families due to the presence of borrowing constraints (as in Evans & Jovanovic (1989)), but it can also be interpreted as evidence of their higher saving rates.

The hypothesis that the higher asset holdings of entrepreneurs may be a consequence of higher entrepreneurial saving, implies that in order to understand the mechanisms that generate wealth concentration, it is necessary to analyze the different accumulation behavior of these two categories of agents: namely, entrepreneurs and workers. This observation motivates the construction, in section II, of a general equilibrium model that explicitly formalizes the agents' choice of undertaking an entrepreneurial endeavor. Two factors determine this choice: the self-perceived ability of the agents to manage a business and their asset holdings. The ability to manage a business is modeled as a stochastic process that implicitly incorporates a learning process through which agents acquire the ability to run larger businesses by managing smaller ones. The level of asset holdings is important in the agents' decision to undertake an entrepreneurial activity due to the presence of borrowing constraints and financial intermediation costs.

When the different roles played by entrepreneurs and workers are considered, the model economy is able, first, to generate the different accumulation patterns observed for these two types of agents and, second, to reproduce the inequality in the distribution of wealth observed in the U. S. economy. This is an important result of this study, given the inability of a large class of calibrated models to reproduce this inequality as shown in Quadrini & Ríos-Rull (1997) and Carroll (1998). In particular, a standard model with uninsurable idiosyncratic shocks to labor earnings and borrowing constraints, as the one used in Aiyagari (1994), severely under-predicts the degree of wealth inequality, and this under-prediction is especially acute in the upper tail of the distribution. In the standard model with idiosyncratic shocks, the imposition of a borrowing limit induces agents to accumulate wealth (buffer-stock) in order to smooth consumption. Because each agent has a different history of earnings, and therefore, a different history of wealth accumulation, the level of asset holdings varies among agents. This is the mechanism through which the standard buffer-stock model generates wealth inequality. However, as discussed in Carroll (1997), the incentive to accumulate wealth diminishes as wealth grows, and once the amount of assets has reached a certain level, the incentive to further accumulate wealth becomes very small. As a result, this model is not able to generate the high levels of asset holdings that are observed in the data. Consequently, some other mechanism through which small groups of agents accumulate higher levels of wealth, relative to their income, must be at work. The strategy followed in this study, and suggested by the empirical analysis, is to introduce an additional incentive to save for the subgroup of agents who have the opportunity to undertake an entrepreneurial activity.

In the model, there are three key factors that explain the change in saving behavior after or right before an entrepreneurial activity is undertaken. The first factor is the incentive of a household to accumulate the minimal capital requirements needed to engage in entrepreneurship or to implement larger projects. The second factor stems from the uninsurable entrepreneurial risk encountered by enterprising households. Because entrepreneurs face greater financial risks than wage workers and are risk averse, their patterns of saving are more conservative. The third factor that underlies the difference or change in saving behavior results from the cost of external financing available to the potential entrepreneur. The high interest rate paid on borrowing increases the marginal return on saving for those entrepreneurs whose level of wealth is lower than the level of capital invested in their business.

As a consequence of the higher saving behavior of entrepreneurs, they accumulate more wealth than workers and this mechanism generates higher concentration of wealth. However, in order for entrepreneurs to accumulate these high levels of wealth, they need a long period of time during which they save at higher rates. In this respect, the choice of modeling agents as infinitely lived dynasties represents an important assumption in the model. In a life-cycle model in which agents start their active life with zero wealth and die after a certain number of periods, they would not be able to accumulate very large amount of wealth given the finite life horizon: they would have enough time. Although the choice of modeling agents as infinitely lived dynasties does not allow to analyze interesting life-cycle pattern of savings, however, it implicitly captures the large intergenerational transfers of wealth that are observed in the economy. As shown by Holtz-Eakin, Joulfaian, & Rosen (1994), these intergenerational transfers are important in affecting the choice to start a new business.

In addition to analyzing the causes of wealth concentration outlined above, this study also focuses on the dynamic aspects of wealth distribution, that is, on the movement of households among wealth classes or socioeconomic mobility. Several empirical and theoretical studies analyze income and wealth mobility. Some empirical studies document intergenerational mobility, (see Behrman & Taubman (1990), Solon (1992), and Zimmerman (1992)) while others concentrate on the mobility of the same individual (see Duncan & Morgan (1984), Sawhill & Condon (1992) and Hungerford (1993)). Theoretical approaches typically examine intergenerational mobility (see, for example, Banerjee & Newman (1991, 1993) and Aghion & Bolton (1997)). In contrast, this study is primarily interested in analyzing the mobility properties experienced by different economic agents, namely, enterprising households as compared to other households within one generation.

In the data analysis below, I show that entrepreneurs experience greater upward wealth mobility than other agents. It should be stressed that—similar to the higher levels of asset holdings—the higher upward mobility is not merely a consequence of their higher incomes, since entrepreneurs experience greater upward mobility in the ratio of wealth to income as well. These mobility features are replicated by the model economy, in addition to generating higher entrepreneurial assets. The analysis of social mobility is complementary to the analysis of the different accumulation patterns of workers and entrepreneurs: that is, the same factors which in the model generate the higher asset holdings of entrepreneurs, also generate their upward wealth mobility.

Financial elements are especially important in this study of social mobility. The presence of borrowing constraints and the higher cost of external financing make the undertaking of an entrepreneurial activity less likely for those households located in the lower portion of the wealth distribution: because the undertaking of an entrepreneurial activity increases a household's probability of moving to higher wealth classes, those households with lower levels of wealth—due to financial constraints and/or to the higher cost of external finance—have fewer opportunities to raise their class of wealth. This observation may have relevant policy implications for a government wishing to alter existing patterns of socioeconomic mobility.

The organization of the paper is as follows. Section I presents some stylized facts of wealth distribution and mobility. Section II develops a general equilibrium model with an explicit formalization of entrepreneurial activities. Section III describes the calibration procedure, and Section IV uses the calibrated model to obtain an estimate of the quantitative importance of entrepreneurship in generating wealth concentration. A sensitivity analysis with respect to some key parameters is also performed in order to evaluate the dependence of the obtained results from these parameters. Finally, Section V summarizes the results and concludes.

I Some empirical facts on wealth concentration and mobility

This section of the paper highlights some of the main differences in asset holdings and wealth mobility between workers and entrepreneurs resulting from the analysis of two sets of survey data: the Panel Study of Income Dynamics (PSID), which is a national survey conducted annually in the United States since 1968 on a sample of approximately 5,000 families, and the Survey of Consumer Finances (SCF), which has been conducted in the United States in several years on approximately 3,000 families. Although the PSID survey is conducted annually, the main variable of interest for this study—family wealth—is available for only three years: 1984, 1989 and 1994. Therefore, the main data analysis is based on these three years. With regard to the SCF, the analysis is based on the 1989 and 1992 surveys.

Two definitions of entrepreneurs can be adopted. According to the first definition, entrepreneurs are families that own a business or have a financial interest in some business enterprise, and workers are identified as all other families. According to the second definition, entrepreneurs are families in which the head of the household is self-employed in his or her main job, while workers are families in which the head of the household is a wage worker. Given the similarity of the results obtained using the two definitions, the main statistics reported in this section are based on the first definition of entrepreneurs. A description of the main variables used in this study is provided in Section A of the Appendix. For a more extensive empirical analysis see Quadrini (1999) and Gentry & Hubbard (1999).

I.1 Entrepreneurship and wealth concentration

Table I reports the percentiles and Gini indices for family wealth and income computed from the PSID and the SCF samples for selected years.

The strong concentration of wealth can be summarized by the percentage of total wealth owned by the top 1 percent of asset holders. For example, according to the PSID data, the top 1 percent of families owned 30, 25 and 23 percent of total household wealth in 1984, 1989 and 1994 respectively. When the SCF data are used, the percentage of total wealth owned by the top 1 percent of families was 35.7 percent in 1989 and 29.5 percent in 1992. The distribution of income appears less concentrated: the top 1 percent of families earned 7.5, 8.1 and 7.2 percent of total income according to the two PSID surveys and 16.9 and 18.5 percent of total income according to the two SCF surveys.

In order to evaluate whether entrepreneurship has an important role in generating this high concentration of wealth, Figure 1 reports the proportion of entrepreneurs in different wealth classes, where each class includes 5 percent of all families.[1] As can been seen from the figure,

[1] Given the similarity of the 1984, 1989 and 1994 PSID data and the similarity of the 1989 and 1992 SCF data, the figure reports the averages over the corresponding years.

Table I: Distribution of U. S. household wealth and income.

	Top percentiles					Gini	Negative
	1%	*5%*	*10%*	*20%*	*30%*	**Index**	**and Zero**
Wealth							
- PSID 1984	30.0	49.2	61.7	76.6	85.8	0.76	10.6
- PSID 1989	25.4	47.0	60.9	77.1	86.9	0.76	12.3
- PSID 1994	22.6	44.8	59.1	75.9	85.9	0.75	12.9
- SCF 1989	35.7	58.0	70.1	83.7	91.8	0.86	11.7
- SCF 1992	29.5	53.5	66.1	79.5	87.6	0.78	6.9
Income							
- PSID 1984	7.5	19.4	30.2	46.9	60.0	0.43	0.5
- PSID 1989	8.1	20.6	31.6	48.2	61.0	0.45	0.5
- PSID 1992	7.2	19.9	31.1	48.4	61.7	0.45	0.7
- SCF 1988	16.9	31.7	42.3	57.2	68.8	0.54	0.7
- SCF 1991	18.5	34.4	45.1	59.9	70.9	0.57	1.2

the percentage of business families increases as we move to higher wealth classes, and about half of the families located in the top class are business families.[2]

The fact that business families tend to be located in higher wealth classes, and therefore, they own more wealth than worker families, would not be of particular interest if business families also earned more income (in proportion to wealth). To better evaluate the importance of entrepreneurship for wealth concentration, it is then necessary to analyze the joint distribution of income and wealth between these two categories of families.

Figure 2 reports the average per-family wealth of business and worker families located in each income decile as a proportion of total per-family wealth: the top graph uses PSID data and the bottom graph uses SCF data. In constructing these graphs, I have determined the income decile with respect to the total sample, and therefore, worker and business families located in the same income decile dispose approximately of the same income.[3]

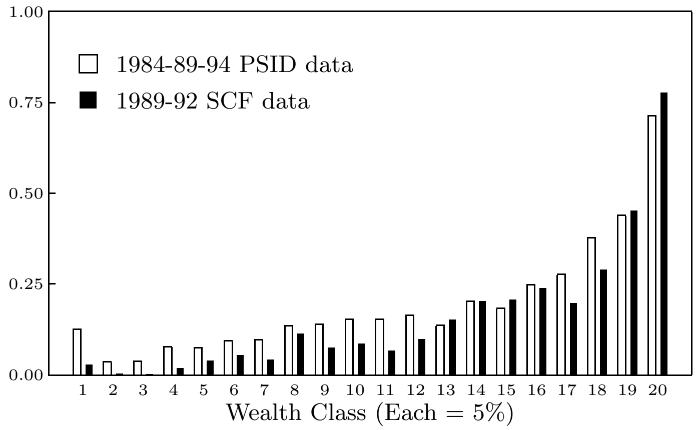
Figure 2 clearly shows that business families own, on average, higher levels of wealth relative to their income than do worker families. If we consider the total sample of business and worker families, the ratio of wealth to income is about twice as large for business families. In terms of total distribution, we find that approximately 14 percent of all families are business families in the PSID sample; they earn about 22 percent of the total income and they own 40 percent of the total wealth. Similar statistics are found in the SCF sample. Therefore, there is a concentration of wealth among business families which is not purely explained by the concentration of income among these families.[4]

[2]Henceforth, I will use the terms entrepreneur, business family or enterprising family interchangeably.

[3]This is not necessarily true for the first and last decile, as the lower income threshold for the first decile and the upper income threshold for the last decile are not bounded.

[4]Demographic features and, in particular, the age of the components of the family might be important in explaining the high concentration of wealth toward business families. Because the acquisition of a business is less likely for younger families, the concentration of wealth toward business families might just be the consequence of a concentration of enterprising families in middle-age classes that, in general, own higher levels of wealth. In Quadrini (1999) the higher wealth-to-income ratio of business families is formally tested and found significant

Figure 1: Percentage of business families over wealth classes. Each class includes 5 percent of all families.



I.2 Entrepreneurship and social mobility

The top section of table II reports net wealth transition matrices of four subsamples of families in the period 1984-89 using PSID data.[5] The first subsample is composed of *staying workers*, that is, families that did not own a business in either 1984 or 1989. The second subsample is composed of *switching workers*, that is, families that owned a business in 1989 but not in 1984. The third subsample is composed of *switching entrepreneurs*, that is, families that owned a business in 1984 but not in 1989. The fourth subsample is composed of *staying entrepreneurs*, that is, families that owned a business in both 1984 and 1989. The selected subsamples have been divided into three classes according to the 1984 and 1989 net family wealth, where the class thresholds are determined by dividing the total sample into three wealth groups. Each group includes one-third of the families. Each row of the matrices specifies the class position in 1989 of families that were located in a particular 1984 class of wealth. The bottom section of table II reports the same information for the period 1989-94.

Looking at the transition matrices for families that at the beginning of the period (that is, in 1984 for the top section of the table and 1989 for the bottom section) did not own a business, we observe the following:

- In the lower class, the percentage of families that move to a higher class is greater for the subsample of workers who acquire a business than for staying workers.
- In the middle class, for the subsample of workers who become entrepreneurs, the percentage of upwardly mobile families is higher than the percentage of downwardly mobile families. The reverse is observed for staying workers.

even after controlling for the age of the head of the family.

[5] The selected sample is composed of PSID families that were interviewed in the initial and final years and headed by the same person in both years. I only use PSID data because the SCF does not keep track of the identity of the families.

Figure 2: Wealth holdings of workers and entrepreneurs over income classes as fraction of average wealth. Each class includes 10 percent of all families. Panel A: Average 1984, 1989 and 1994 PSID data. Panel B: Average 1989 and 1992 SCF data.

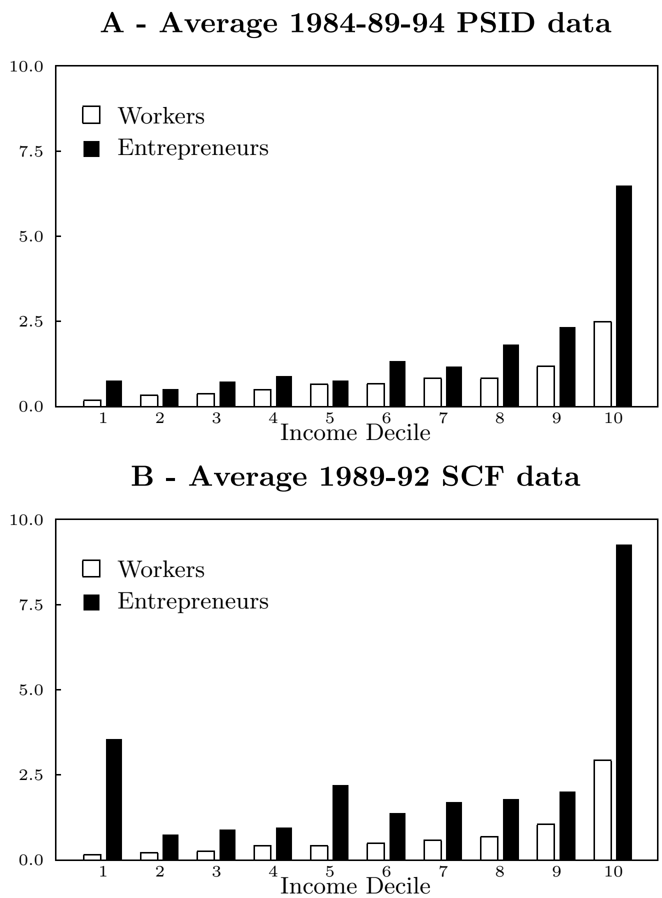


Table II: Five-year transition matrices for net family wealth. Sample period 1984-89 in panel A) and 1989-94 in panel B).

A) 1984-1989 transition

	Class I	Class II	Class III	Class I	Class II	Class III
	Staying Workers			**Switching Workers**		
Class I	0.81	0.17	0.02	0.52	0.31	0.17
Class II	0.22	0.65	0.13	0.12	0.51	0.37
Class III	0.02	0.22	0.76	0.00	0.20	0.80
	Switching Entrepreneurs			**Staying Entrepreneurs**		
Class I	0.81	0.14	0.05	0.25	0.49	0.26
Class II	0.23	0.58	0.19	0.17	0.37	0.46
Class III	0.01	0.21	0.78	0.02	0.09	0.89

B) 1989-1994 transition

	Class I	Class II	Class III	Class I	Class II	Class III
	Staying Workers			**Switching Workers**		
Class I	0.78	0.18	0.04	0.51	0.29	0.20
Class II	0.21	0.65	0.14	0.12	0.51	0.37
Class III	0.03	0.22	0.75	0.04	0.08	0.88
	Switching Entrepreneurs			**Staying Entrepreneurs**		
Class I	0.70	0.24	0.06	0.67	0.22	0.11
Class II	0.29	0.63	0.08	0.14	0.49	0.37
Class III	0.03	0.19	0.78	0.03	0.08	0.89

- In the upper class, the percentage of families that fall to lower classes is smaller for switching workers than for staying workers.

Looking at the bottom section of Table II, which reports data for families that at the beginning of the period owned a business (entrepreneurs), we observe the following:

- In the lower class, the percentage of families that move to a higher class is greater for the subsample of staying entrepreneurs.
- In the middle class, for the subsample of staying entrepreneurs, the percentage of upwardly mobile families is higher than the percentage of downwardly mobile families. The reverse is observed for switching families.
- In the upper class, the percentage of families that fall to a lower class is smaller for non-switching families than for the other families.

The observations listed above point out substantial differences in the mobility patterns of entrepreneurs and workers. While worker families (both new and old) tend to stay in or move to lower positions of wealth, business families tend to stay in or move to higher positions.

In order to show that the upward mobility experienced by entrepreneurs is not only a consequence of higher incomes earned by entrepreneurs, Table III reports the transition for the ratio of wealth to income. As can be seen from the table, the same mobility pattern found for household's wealth in table II, are also found for the wealth-to-income ratio. Therefore, the undertaking of an entrepreneurial activity is an important way for families to switch to higher classes of wealth.[6]

Table III: Five-year transition matrices for family wealth-to-income ratio. Sample period 1984-89 in panel A) and 1989-94 in panel B).

A) 1984-1989 transition

	Class I	**Class II**	**Class III**	**Class I**	**Class II**	**Class III**
	Staying Workers			**Switching Workers**		
Class I	0.79	0.19	0.02	0.54	0.30	0.16
Class II	0.21	0.61	0.18	0.14	0.46	0.40
Class III	0.05	0.23	0.72	0.07	0.17	0.76
	Switching Entrepreneurs			**Staying Entrepreneurs**		
Class I	0.71	0.25	0.04	0.42	0.40	0.18
Class II	0.23	0.55	0.24	0.12	0.46	0.42
Class III	0.06	0.20	0.74	0.01	0.15	0.84

B) 1989-1994 transition

	Class I	**Class II**	**Class III**	**Class I**	**Class II**	**Class III**
	Staying Workers			**Switching Workers**		
Class I	0.75	0.20	0.05	0.51	0.25	0.24
Class II	0.22	0.60	0.18	0.15	0.49	0.37
Class III	0.07	0.19	0.73	0.03	0.23	0.74
	Switching Entrepreneurs			**Staying Entrepreneurs**		
Class I	0.70	0.22	0.09	0.51	0.22	0.27
Class II	0.25	0.56	0.20	0.16	0.51	0.32
Class III	0.03	0.32	0.65	0.03	0.25	0.72

[6] These differences are formally tested and found significant in Quadrini (1999).

Table IV: Exit rates from entrepreneurship (top section) and entrance rates to entrepreneurship (bottom section). Annual values averaged over the sample period 1973-92.

	Exit rate	**N. of families***
a) Business owners		
- All business families	24.2	522
- With one year of entrepreneurial tenure	44.7	151
- With two years of entrepreneurial tenure	30.8	80
- With three or more years of entr. tenure	13.4	291
b) Self-employed		
- All business families	13.6	384
- With one year of entrepreneurial tenure	35.2	75
- With two years of entrepreneurial tenure	19.1	48
- With three or more years of entr. tenure	7.2	261

	Entrance rate	**N. of families***
a) Business owners		
- All worker families	3.7	4,722
- Without entrepreneurial experience	2.6	4,506
- With entrepreneurial experience	23.1	216
b) Self-employed		
- All worker families	2.9	2,837
- Without entrepreneurial experience	2.0	2,556
- With entrepreneurial experience	27.2	281

* The number of families is the average sample size in each year, from 1973 through 1992.

I.3 Entrepreneurial persistence and turnover

One of the hypotheses underlying the higher asset holdings of entrepreneurs is that the household's saving behavior changes with the undertaking of an entrepreneurial activity. As a consequence of this change in the saving behavior, business families accumulate more wealth than workers and rapidly move to higher wealth classes (upward mobility). It is this mechanism that generates higher concentration of wealth. In this dynamics, an important role is played by entrepreneurial persistence and duration: the longer the business life is, the higher the wealth accumulated by business families. One way of looking at entrepreneurial persistence is to look at the rates of exit from and entrance to entrepreneurship for agents with different levels of business experience.

The top section of table IV reports the average exit rates from entrepreneurship for the whole sample of business families and for three subsamples: families with one year of business tenure, families with two years of business tenure, and families with three or more years of business tenure. The table distinguishes between two definitions of entrepreneurs—business owners and self-employed—and the numbers reported are averages over the sample period 1973-92.

As can be seen from the table, the exit rate is high for new entrants (those with one year of business tenure) but declines quickly for surviving entrepreneurs. This can be interpreted as evidence of the hypothesis that there is a learning process associated with the entrepreneurial activity through which successful entrepreneurs maintain and consolidate their businesses: surviving entrepreneurs run better businesses and, consequently, face lower probabilities of exiting.

The bottom section of table IV reports the entrance rates into entrepreneurship for the sample of all worker families and for two subsamples: worker families without business experience in all three years prior to initiating an entrepreneurial activity and worker families which engaged in an entrepreneurial activity during at least one of these years. The table reveals substantial differences between the entrance rates of experienced and inexperienced families. While the entrance rate for experienced families is greater than 20 percent, the entrance rate for inexperienced families is lower than 3 percent.

The combination of low exit rates and high entrance rates of experienced families implies that for this restricted group of families, the turnover rate in the business group is low, and the entrepreneurial persistence is high. It is this persistence that allows the restricted group of business families to accumulate higher levels of wealth relative to workers which, in turn, generates a higher concentration of wealth.

II A model with entrepreneurs

The economy is populated by a continuum of infinitely lived households, of total measure 1. In each period they decide whether to run an entrepreneurial activity in addition to or as an alternative to supplying their labor services to the market. In the description of the model, I distinguish three sectors: the household sector, the production sector, and the intermediation sector. I start with the description of the household sector.

II.1 Household sector

Preferences

Households maximize the expected lifetime utility:

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^t u(c_t) \right\} \tag{1}$$

where β is the intertemporal discount rate, $u(c_t)$ is a continuous and strictly concave utility function that depends on consumption c_t, and E_0 is the expectation operator at time zero. It is assumed that $\lim_{c \to 0} u(c) = -\infty$ and $\lim_{c \to \infty} u'(c) = 0$.

Labor ability

Households are endowed with $\varepsilon \in \mathcal{E} = \{\varepsilon_1, ..., \varepsilon_{N_\varepsilon}\}$ units of labor efficiencies. These units can be directly employed in one's own business as specified below, or they can be supplied to the market in return of the wage rate w. I assume that labor is equally productive in one's own business or in others' business. Consequently, the household is indifferent whether to employ its labor services directly into the business in substitution of hired labor or to supply them in the market. Given this property, in the description of the model I assume that the household supplies all the services of labor in the market.[7]

[7] An alternative is to assume that the entrepreneur uses all the available labor managing the business and the profits of the business is the only source of income. By properly changing the structure of the technology in the noncorporate sector, we can have that the total income of the entrepreneur has the same properties of the

The variable ε is observed at the end of the period and follows a first order Markov process with transition probability $\Gamma(\varepsilon'/\varepsilon)$.

Entrepreneurial opportunity

In addition to supplying labor services to the market, the household can run a business project by implementing an entrepreneurial idea κ drawn at the end of each period from the set $\mathcal{K} = \{0, k_1, ..., k_{N_k}\}$. The first element of this set corresponds to the case in which there is no entrepreneurial idea and, thus, has been set to zero. The new entrepreneurial idea, together with the project implemented in the current period, form the set of projects with which the household can run a business in the following period. This variable κ is a stochastic control process with probability distribution denoted by $P_k(\kappa)$, where the subscript k denotes the project implemented in the current period. The dependence of this probability on k formalizes the hypothesis that associated with the business activity, there is a learning process through which the probability of getting better entrepreneurial ideas increases if the agent is running better projects. The content of an entrepreneurial project will be specified below in the description of the production technology.

II.2 Production sector

There are two sectors of production. The first sector is characterized by small units of production (small firms), while the second is dominated by large units of production (large firms). Entrepreneurship is pursued by running business projects (firms) in the small sector of production. The main reason to separate a small sector of production from the rest of the economy is to isolate those business activities that are closely related to one or few specific households as opposed to the impersonality of big corporate organizations. For the present study, there are two important features that characterize and differentiate a small business as compared to a big corporation: the uninsurable entrepreneurial risk and the strictness of the financial constraints. On the one hand, the greater difficulties of insuring and diversifying the risk of small entrepreneurial activities (for example, by transferring part of the ownership) make the whole household wealth involved in the result of the business. On the other, the strictness of financial constraints for small firms makes the capital endowment of these firms closely dependent on the asset holdings of the owners. This view is consistent with the empirical findings of Fazzari, Hubbard, & Petersen (1988), Gertler & Gilchrist (1994) and Gilchrist & Himmelberg (1994).

Because most small activities are run in the form of noncorporate organizations, while big firms are generally organized as corporations, in the rest of this paper I use the label *noncorporate sector* of production for the aggregation of all activities run by entrepreneurs and I label *corporate sector* of production the other production activities. These two sectors differ in the technologies employed to produce a homogeneous good that can be used for consumption and investment purposes. I describe first the noncorporate sector.

Noncorporate sector

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income earned by an entrepreneur in the current version of the model. By doing so, the results of the paper would not change. However, by assuming that entrepreneurs retain their labor earnings, it is easier to see that the undertaking of a business activity implies an increase in the income risk of the agent because it adds another source of income uncertainty in addition to the uncertainty in labor income.

The noncorporate sector of production is generated by the aggregation of all production technologies run by households engaging in entrepreneurial activities. As specified above, in each period, the households obtain an entrepreneurial idea κ from the set $\mathcal{K} = \{0, k_1, ..., k_{N_k}\}$ for the realization of an entrepreneurial project. The amount of capital required for the realization of an entrepreneurial project is indivisible. If the entrepreneur wants to run a business by implementing a specific project, he or she has to invest the fixed amount of capital required by that project. Therefore, an entrepreneurial idea is characterized by the amount of capital $k \in \mathcal{K}$ required for its implementation.

The production technology associated with the particular project k is given by:

$$y = g(\eta, k, n) = \eta^{\nu} k^{\nu} n^{1-\nu} \qquad 0 < \nu < 1 \tag{2}$$

where y is gross output (final production plus non-depreciated capital),[8] n is the number of efficiency units of labor employed in production and $\eta \in \mathcal{N}_k = \{\eta_1, ..., \eta_{N_\eta}\}$ is an idiosyncratic technology shock observed at the beginning of the current period that follows a first order Markov process with transition probability $Q_k(\eta'/\eta)$. The set from which the shock η takes values, as well as its probability distribution, depend on the implemented project k. The first component of the shock, η_1, is assumed to be a bad shock with high persistence. This implies that, in the event of this shock, the entrepreneur will decide to abandon the business activity, and η_1 acts as an absorbing shock for entrepreneurs.

The k units of capital had to be invested in the previous period, while the employment decision n is made after the observation of the shock η. Therefore, the production plan is determined in two sequential steps: at the end of the period, the entrepreneur decides which project to implement among the available ideas, and at the beginning of next period, after observing η, he or she decides how much labor to hire. I assume that the entrepreneur can always run the project implemented in the current period. Therefore, the set of implementable projects is given by the current project (if the agent is already an entrepreneur) and the new idea drawn in the current period.

Corporate sector

The technology employed in the corporate sector is simply given by the constant return to scale production function:

$$Y_c = F(K_c, N_c) = K_c^{\theta} N_c^{1-\theta} \tag{3}$$

where Y_c is output, K_c is the input of capital, and N_c is the input of efficiency units of labor. Capital depreciates at rate δ_c.

II.3 Intermediation sector and borrowing constraints

In this economy, there is an intermediation sector which collects deposits from households with positive balances by paying the interest rate r_D and makes loans to households asking for funds and to the corporate sector. The lending activity is based on a constant return to scale technology with a proportional cost per unit of funds intermediated. While this cost is zero

[8]The domain of the production function is specified as gross output (final production plus non-depreciated capital) in order to allow for the possibility of large losses in the business activity. If y is simply interpreted as final production, then the maximum operational loss would be the depreciation of capital. The formulation chosen is equivalent to assuming that the capital invested in the business is subject to stochastic depreciation.

for funds intermediated to the corporate sector, the lending activity to households engaging in entrepreneurial activities implies a proportional cost ϕ per each unit of funds intermediated. Competition among banks makes intermediation profits zero and the lending rates equal r_D for loans to the corporate sector and $r_L = r_D + \phi$ for loans to the household sector.

Households can borrow only up to a maximum amount, the size of which depends on the lending policy of the intermediaries. This policy consists of lending up to the amount that the borrower will be able to repay with certainty at the end of the following period. Therefore, bankruptcy is not allowed.

Let η_{min} be the minimum possible value of the shock associated with the project k. If the entrepreneur invests k units of capital in the business, then the minimum amount of resources that can be disposed of at the end of the period, and before repaying the debt, is given by:

$$DR_{min} = \max_n \{\eta_{min}^{\nu} k^{\nu} n^{1-\nu} - nw\} + \varepsilon w \tag{4}$$

where DR_{min} stands for disposable resources when the shock takes the minimum possible value. In the above equation, it is implicitly assumed that $k > a$. This means that the entrepreneur is a net borrower, and therefore, the relevant interest rate is the lending rate r_L. The amount of funds that the entrepreneur has to pay back to the bank (that is, principal and interest) is given by $(k - a)(1 + r_L)$. According to the lending policy of the bank, this has to be smaller than DR_{min}. Therefore, the restriction imposed on the net asset holdings is given by the inequality:

$$a \geq k - \frac{DR_{min}}{1 + r_L} \tag{5}$$

Notice that this limit is also the borrowing limit for a worker. In this case $k = 0$ and $DR_{min} = \varepsilon w$.

Given the assumption that the household's utility function tends to $-\infty$ as consumption tends to zero, the borrowing limit is never binding. In fact, if the agent chooses to borrow up to the limit, there is a positive probability of zero consumption, which implies a value for the utility of $-\infty$. Therefore, it is never optimal to borrow up to the limit.

II.4 The cost of capital and business profits

If a household decided at the end of the previous period to run a business with the project k, then at the beginning of the current period, after observing the technology shock η, the household decides the quantity of labor services to hire by solving the following (profit) maximization problem:

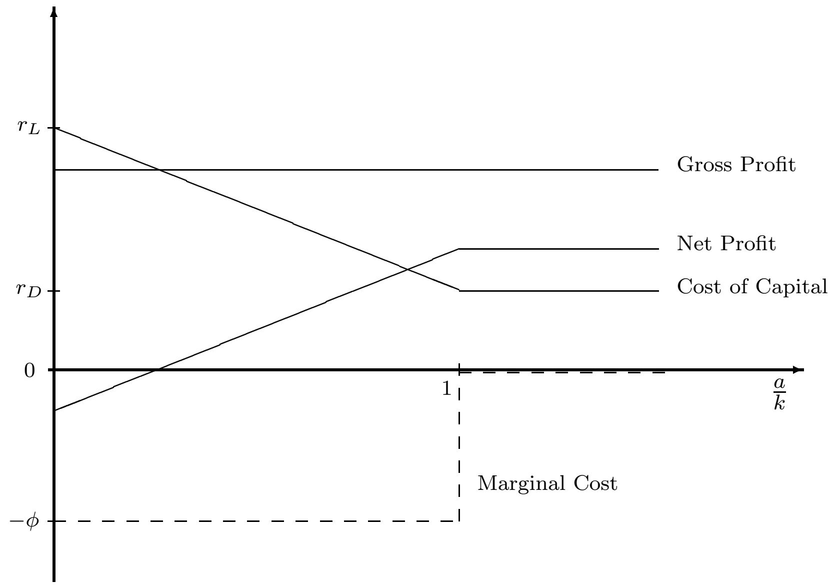
$$\pi(a, k, \eta) = \max_n \left\{ \eta^{\nu} k^{\nu} n^{1-\nu} - nw - (1 + r)k \right\} \tag{6}$$

with

$$r = \begin{cases} r_D, & \text{if } k \leq a \\ r_D + \phi \left(\frac{k-a}{k} \right), & \text{if } k > a \end{cases}$$

The variable r is the cost of capital from internal and external sources of finance and the definition of profit is net of the opportunity cost of capital. If $k \leq a$, the project is entirely

Figure 3: Cost of capital and profits as functions of internal sources of financing



financed with internal sources, and the cost of capital is given by the opportunity cost r_D. If $k > a$, part of the capital that is invested in the business is financed with debt, and the cost of capital is an increasing function of the ratio of debt to capital. The household takes r_D, r_L, and w as given, and the solution is given by:

$$n(k, \eta) = \eta k \left(\frac{1-\nu}{w} \right)^{\frac{1}{\nu}} \tag{7}$$

Substituting equation (7) in (6) and rearranging, we obtain the ex post entrepreneur's profit:

$$\pi(a, k, \eta) = \nu \eta k \left(\frac{1-\nu}{w} \right)^{\frac{1-\nu}{\nu}} - (1+r)k \tag{8}$$

Given the dependence of the cost of capital on the fraction financed with debt, profits are an increasing function of the ratio between the entrepreneur's net assets and the capital invested in the business. The expected profits per unit of invested capital, along with the average and marginal costs of capital, are plotted in Figure 3.

Given the higher cost of external financing, business profits are negatively related to the asset holdings of the entrepreneur. For low values of the entrepreneur's net assets, net profits are negative, and this might prevent the entrepreneur from undertaking the business activity or investing in larger scale projects. Only those agents with asset holdings greater than a minimum threshold undertake the project, and therefore, the higher cost of external finance may have the same effect of imposing a borrowing limit. The marginal cost of capital, which determines the marginal return on savings, is negative and equal to $-\phi$ if $a < k$, and zero otherwise. This structure of the cost of capital plays an important role in determining different accumulation behaviors of workers and entrepreneurs.

II.5 Household's problem and definition of equilibrium

The timing of the household's decisions is as follows.

- **Beginning of period** – If the household runs a business, it observes the technology shock η, and given the invested capital k, it decides how much labor to hire.
- **End of period** – The household observes the entrepreneurial idea κ and the labor ability ε'. Then, knowing the implementable projects (k, κ) and the labor ability ε', it decides, first, whether to invest in the business activity and, second, how much to save.

At the beginning of the period, agents differ over several dimensions or states. The first state variable, which is not under the control of the agent, is the labor ability ε. The other state variables are given by the net value of assets a, the implemented project k (decided at the end of the previous period) and the technology shock η observed at the beginning of the current period. If $k = 0$, the agent is a worker; in the other cases, the agent is an entrepreneur. Therefore, the full set of individual state variables at the beginning of the period is given by $(\varepsilon, a, k, \eta)$, and the aggregate states of the economy are given by the distribution of agents over individual states represented by the probability measure $\mu(\varepsilon, a, k, \eta)$. In this study, however, I consider only *steady state* equilibria, that is, equilibria in which the distribution of agents over the individual states is invariant over time. Consequently, all the aggregate variables (like the prices of capital and labor) are constant over time, and they can be treated parametrically in the optimization problem of the agent.

Define $v(\varepsilon, a, k, \eta)$ to be the beginning-of-period value function of an agent that at the end of the previous period decided to run (and invested in) the entrepreneurial project k, and $\tilde{v}(\varepsilon, a, k, \eta, \kappa, \varepsilon')$ the end-of-period value function after the realizations of κ and ε'.[9] Let's consider first the agent's problem at the end of the period, after the observation of the variables κ and ε'. The agent's problem is:

$$\tilde{v}(\varepsilon, a, k, \eta, \kappa, \varepsilon') = \max_{a', k' \in \{k, \kappa\}} u(c) + \beta \sum_{\eta'} v(\varepsilon', a', k', \eta')\, Q_k(\eta'/\eta) \tag{9}$$

subject to

$$c = a(1 + r_D) + \pi(a, k, \eta) + \varepsilon w - a'$$

$$a' \geq k - \frac{\nu \eta_{min} k' \left(\frac{1-\nu}{w}\right)^{\frac{1-\nu}{\nu}} + \varepsilon' w}{1 + r_L}$$

The conditions constraining the agent's problem are the budget constraint and the borrowing constraint. The function π in the budget constraint is the net income from the business (net

[9] The value functions also depend on μ. However, I do not include μ as an explicit argument because, as observed above, in a stationary equilibrium it is constant.

of the opportunity cost of capital), and it is defined in (8). In solving this problem, the agent takes as given the wage rate w and the interest rates r_D and r_L, and the solution is given by the state contingent functions $a'(\varepsilon, a, k, \eta, \kappa, \varepsilon')$ and $k'(\varepsilon, a, k, \eta, \kappa, \varepsilon')$.

The beginning-of-period value function can now be defined as the expected value of the end-of-period value function $\tilde{v}$, conditional on the information available at the beginning of the current period, that is:

$$v(\varepsilon, a, k, \eta) = \sum_{\kappa, \varepsilon'} \tilde{v}(\varepsilon, a, k, \eta, \kappa, \varepsilon')\, P_k(\kappa)\, \Gamma(\varepsilon'/\varepsilon) \tag{10}$$

Definition II.1 (Steady state equilibrium) *A steady state recursive competitive equilibrium for this economy consists of: (a) Value functions $v(\varepsilon, a, k, \eta)$, $\tilde{v}(\varepsilon, a, k, \eta, \kappa, \varepsilon')$, and decision functions $n(k, \eta)$, $a'(\varepsilon, a, k, \eta, \kappa, \varepsilon')$, $k'(\varepsilon, a, k, \eta, \kappa, \varepsilon')$; (b) Interest rates r_D and r_L and wage rate w; (c) Capital and labor demands K_n and N_n from the noncorporate sector; capital and labor demands K_c and N_c from the corporate sector; (d) A function $\Psi(\mu)$ mapping the space of households' distribution μ into the next period distribution and an invariant distribution μ^*. Such that: (a) The decision rules $a'(.)$ and $k'(.)$ solve the agent's problem described in* (9)*, and the functions $\tilde{v}(.)$ and $v(.)$ are the associated value functions; the hiring choice $n(.)$ for entrepreneurs solves problem* (6)*. (b) Prices are competitive. The wage w and the interest rate r_D equal the marginal productivity of labor and capital (net of depreciation) in the corporate sector, and $r_L = r_D + \phi$. (c) Capital and labor markets clear, that is:*

$$\sum_{\varepsilon,k,\eta} \left\{ \int_a k\, \mu(\varepsilon, a, k, \eta)\, da \right\} + K_c = \sum_{\varepsilon,k,\eta} \left\{ \int_a a\, \mu(\varepsilon, a, k, \eta)\, da \right\} \tag{11}$$

$$\sum_{\varepsilon,k,\eta} \left\{ \int_a n(k,\eta)\, \mu(\varepsilon, a, k, \eta)\, da \right\} + N_c = \sum_{\varepsilon,k,\eta} \left\{ \int_a \varepsilon\, \mu(\varepsilon, a, k, \eta)\, da \right\} \tag{12}$$

(d) The distribution μ^* is a fixed point of the mapping Ψ which, given the subsets S_ε, S_a, S_k, S_η, is defined by the functional equation:

$$\mu'(S_\varepsilon, S_a, S_k, S_\eta) = \Psi(S_\varepsilon, S_a, S_k, S_\eta)(\mu) = \textstyle\sum_{\varepsilon' \in S_\varepsilon} \sum_{k' \in S_k} \sum_{\eta' \in S_\eta} \tag{13}$$
$$\textstyle\int_{a' \in S_a} \left\{ \sum_{\varepsilon,k,\eta} \sum_{\kappa} \left\{ \int_a I(\varepsilon, a, k, \eta, \kappa, \varepsilon')\, P_k(\kappa)\, \Gamma(\varepsilon'/\varepsilon)\, Q_k(\eta'/\eta) \mu(\varepsilon, a, k, \eta)\, da \right\} da' \right\}$$

where $I(\varepsilon, a, k, \eta, \kappa, \varepsilon')$ is an indicator function that takes the value of one if $a'(\varepsilon, a, k, \eta, \kappa, \varepsilon') \in S_a$ and $k'(\varepsilon, a, k, \eta, \kappa, \varepsilon') \in S_k$, and zero otherwise.

III Calibration

Four sets of parameters are calibrated. They relate to i) household's preferences; ii) process for labor ability; iii) technology in the corporate and noncorporate sectors; and iv) technology in the intermediation sector. The calibration period is one year.

As described below, some parameters are calibrated using equilibrium conditions that can be verified only by solving the model. The complexity of the model economy, however, does not allow to derive analytical solutions, and consequently, some numerical methods are applied. These methods are described in Section B of the Appendix.

III.1 Household's preferences

The household maximizes the expected lifetime utility $E_0 \sum_{t=0}^{\infty} \beta^t u(c_t)$, where the per-period utility is assumed to be of the relative risk aversion form $u(c_t) = c_t^{1-\sigma}/(1-\sigma)$. The risk aversion coefficient σ is assumed to be 2.0 and the discount factor β is calibrated such that in equilibrium, the annual interest rate on deposits r_D equals the value representative of all financial investments. Mehra & Prescott (1985) report that the return on government bonds, representative of risk-free assets, in the postwar period averaged 0.5 percent, while for the same period the return on risky financial assets averaged 6.5 percent. Because in the model developed in this paper deposits are representative of both risky and risk-free financial investments, I choose the mean value of these two returns and I set $r_D = 0.035$.

III.2 Labor ability

The labor ability ε is assumed to follow a four-state Markov process with transition probability matrix Γ. In order to calibrate this process I make the following assumptions. Each household is thought of as a sequence of finitely lived generations. In each period, there is a positive probability p that the current generation is replaced by a new generation. This probability is calibrated assuming an average generation duration of 35 years, which implies $p = 1/35$.[10]

The labor ability of each generation follows a two-state Markov process with transition probability matrix Γ_ε. However, different generations, are characterized by different mean values of the labor ability ε. More specifically, each generation can be of two types: the labor ability of type 1 takes value in the set $\{\varepsilon_{11}, \varepsilon_{12}\}$, while the labor ability of type 2 takes value in the set $\{\varepsilon_{21}, \varepsilon_{22}\}$. When an old generation is replaced by a new one (which, as assumed above, happens with probability p), the earning type of the new generation is determined by a stochastic process that depends on the earning type of the generation from which it descended. The probability with which a new generation is of the same earning type of the generation it descended from, is set to 0.75. This implies an intergenerational correlation of earnings of 0.5, which is consistent with the estimates of Behrman & Taubman (1990), Solon (1992) and Zimmerman (1992).

Taking into consideration the probability p with which an old generation is replaced by a new one, and the probability with which a new generation is of the same earning type of its descendent, we can construct the transition probability across earning types. This probability matrix is denoted by Π and takes the following values:

$$\Pi = \left\{ \begin{array}{cc} 0.9929 & 0.0071 \\ 0.0071 & 0.9929 \end{array} \right\}$$

Given Π, the transition probability matrix Γ is simply given by the Kroneker product of Π and Γ_ε, that is, $\Gamma = \Pi \otimes \Gamma_\varepsilon$.

To calibrate Γ_ε and $\{\varepsilon_{11}, \varepsilon_{12}, \varepsilon_{21}, \varepsilon_{22}\}$, I assume that for each generation, the logarithm of the household's labor ability ε follows the autoregressive process:

$$\ln(\varepsilon_{i,t+1}) = \alpha_i + \rho \ln(\varepsilon_{i,t}) + \upsilon_{t+1} \qquad \upsilon_{t+1} \sim N(0, \sigma_\upsilon^2) \tag{14}$$

[10] The duration of a generation does not correspond to the life of the individuals of that particular generation. We can approximately think of the duration of a generation as the period that extends from the time in which the children of a generation get married and form new families to the time when the newborns of these new families get married and form new families themselves.

where i is the index for the generation type and the parameter α_i is the generation-specific earning parameter characterizing the mean of the earning process. Therefore, the log-earning process of different generation types has the same variance but different means.

The autocorrelation coefficient ρ and the standard deviation σ_υ of the earning process (14) are estimated using PSID data for the period 1970-92. Household earnings are defined as the sum of three components: *a*) the wages and salaries of the household head and spouse; *b*) the imputed labor income portion of other incomes of the household head and spouse (like business incomes); *c*) the monetary transfers of the household head and spouse. The imputation of the labor portion of other incomes (the second component of earnings) and, in particular, of business income, is required by the hypothesized earning process that is assumed in the model economy.[11] The addition of monetary transfers (the third component of earnings) is justified by the absence of a government in the model.[12] After selecting the families that were interviewed in the all years from 1970 to 1992 and that reported positive earnings,[13] I estimate the following equation:

$$\log(E_{i,t+1}) = \alpha_i + \varphi_1 A_{i,t} + \varphi_2 A_{i,t}^2 + \varphi_3 A_{i,t}^3 + \rho \log(E_{i,t}) + \upsilon_{i,t+1} \tag{15}$$

where $E_{i,t}$ is the earnings of family i at time t, α_i is the household-specific earning parameter, and $A_{i,t}$ is its age. On the right side of the regression, the cubic polynomial in age is included in order to detect possible life-cycle patterns of earnings. The estimation results are reported in Table V.[14]

Table V: Estimation of the earning equation. Dependent variable $\ln(E_{i,t+1})$.

	$A_{i,t}/100$	$A_{i,t}^2/1000$	$A_{i,t}^3/10000$	$\log(E_{i,t})$
Coefficients	9.436	-1.642	0.080	0.496
Standard errors	(0.411)	(0.080)	(0.005)	(0.005)
t-Statistic	22.94	-20.43	16.07	107.67

Standard error $\sigma_\upsilon = 0.332$
Number of cross sectional units = 1,717
Number of periods = 22
$R^2 = 0.349$

After estimating the two parameters ρ and σ_υ, the labor ability ε of a generation with a specific earning parameter α_i is approximated by a two-state Markov process with symmetric transition probability matrix $\Gamma_\varepsilon(\varepsilon/\varepsilon)$. The three moments used to pin down the parameters

[11]In this process, the owner of a business is indifferent when it comes to supplying his or her labor services to the market in return for the wage rate w or directly working in the business in substitution of hired labor. Consistent with this assumption, the measure of earnings should also include the opportunity cost of the labor employed in the business.

[12]However, due to the absence of data, I do not subtract income taxes paid on that income.

[13]The selection of families with positive earnings is required because the estimation of the earning process is based on the log-transformation. However, the number of families with zero earnings is small compared to the selected sample, and therefore, the estimation bias should be negligible.

[14]Hubbard, Skinner, & Zeldes (1994) estimates a similar earning process also using PSID data with similar results. Abowd & Card (1989) use other sets of data, in addition to the PSID, and they obtain similar estimates of the autocorrelation coefficient and standard deviation of the earning process.

of this process are: (i) the unconditional mean of $\log(\varepsilon)$, which is equal to $\alpha_i/(1-\rho)$; (ii) the autocorrelation ρ; and (iii) the standard deviation $\sigma_v/\sqrt{1-\rho^2}$. Finally, the earning parameters α_i, $i \in \{1,2\}$, are pinned down such that the Gini index for earnings in the model economy equals 0.38, which is the average of the Gini index found in the PSID data for the period 1970-92.

III.3 Production technology

The first step in the calibration of the production sector is to specify a consistent measurement of aggregate capital that best fits the notion of capital adopted in the model economy and to determine the percentage of that capital employed in the two sectors of production, that is, the corporate and the noncorporate sectors. Given the absence of a government, I abstract from public capital, and I consider only private tangible assets. An estimate of the stock of tangible assets privately owned is provided by the Federal Reserve Board with the flow of funds in The Balance Sheet for The U.S. Economy (1990). The flow of funds account distinguishes five types of assets—*plant and equipment*, *inventories*, *land at the market value*, *residential structures*, and *consumer durables*—and report the distribution of them among five sectors of the economy—*households and nonprofit institutions*, *farm business*, *nonfarm noncorporate business*, *nonfarm nonfinancial corporations*, and *financial institutions*.

Among the five types of tangible assets privately owned, a particular role is played by consumer durables. Given the difficulty of quantifying the market value for these assets and the values of their services, I exclude consumer durables from the measurement of aggregate capital. Consequently, the adopted notion of aggregate capital results from the aggregation of plant and equipment, inventories, land at market value, and residential structures. This is the notion of capital that is consistent with a measurement of output given by the gross domestic product (GDP).[15] Using this notion of capital and measuring output with GDP, the average capital-to-output ratio in the period 1957-90 is 2.65. This is the value that the capital-to-output ratio in the artificial economy has to match.

After defining the empirical counterpart of the adopted notion of aggregate capital, I have to determine the fraction of this capital employed in the two sectors of production. In the model economy, the noncorporate sector includes all business activities that are closely related to one or few specific households as opposed to the impersonality of big corporations that, instead, are part of the corporate sector of production. As a first approximation, the capital employed in the small sector of the economy can be identified with the assets owned by farms and unincorporated businesses, while the stock of capital employed in the corporate sector gathers the assets owned by the other sectors of the economy, that is, nonprofit institutions and households, nonfinancial corporations, and financial institutions. Using this criterion, I estimate the average fraction of capital employed in the noncorporate sector in the period 1957-90 as on the order of 0.30. This number, however, underestimates the size of the noncorporate sector of the economy, as thought in the theoretical model. In fact, there are several firms that are organized in the form of a corporation, but the equities of these firms are owned by a limited number of shareholders (sometimes only one family). The dimensions of these firms are typically small relative to other corporate organizations, and they are closer to the notion of entrepreneurial businesses,

[15] In fact, the GDP does not include either an estimation of the services from the stock of government capital or an estimation of the services from the stock of consumer durables. However, it includes the imputed rents of owner-occupied houses.

as thought in the model. Consequently, they should be included in the noncorporate sector of the economy, and the percentage of total capital employed in this sector should be larger than 30 percent. As a compromise, I assume that 40 percent of aggregate capital is employed in the noncorporate sector of the economy.

The stock of capital in both sectors of the economy is assumed to depreciate at the same rate δ. The calibration of δ is based on the aggregate capital accumulation equation $K_{t+1} = (1-\delta)K_t + I_t$, where K_t is the aggregate stock of capital, and I_t is the aggregate investment at time t. After imposing the steady state conditions, we get $\gamma + \delta = \frac{(I/Y)}{(K/Y)}$, where Y is the aggregate output and γ its growth rate. The capital-to-output ratio has been set above to 2.65, and the investment-to-output ratio is determined using data from the national income and product account (NIPA). Aggregate investment is measured as the sum of expenditures on producer durables, residential structures, and changes in the value of inventories; output is measured with GDP. Because the artificial economy is normalized such that in equilibrium no growth is displayed, the value assigned to the depreciation rate is given by $\gamma + \delta$, which in the calibration period 1957-90 is equal to 0.062.

Corporate technology

The corporate technology is represented by a Cobb-Douglas production function, with capital income share θ. The value assigned to this parameter is 0.33.

Noncorporate technology

In the noncorporate sector there are three entrepreneurial projects, identified by the capital inputs k_1, k_2, and k_3. To calibrate the size (capital requirement) of these projects, I use data on the households' distribution of business wealth. Table VI reports the decile distribution of business wealth among families reporting a net value of the business greater than zero, using data from the 1989 and 1992 SCF.[16] The table shows a very concentrated distribution of business wealth. In order to better approximate the skewness of the distribution of this capital, I assign smaller percentages of entrepreneurs to larger projects, with 60 percent running the smallest project, 30 percent the mid-sized project, and 10 percent the largest project. After selecting those families with a positive value of the business, I divide them into three groups according to their business wealth, with each group counting 60, 30 and 10 percent, respectively. The ratios among the average values of business wealth in each group define the relative distribution of business capital. Combining 1989 and 1992 data, I set $k_2/k_1 = 10$ and $k_3/k_1 = 100$.

Table VI: Percentage of business wealth owned by group percentiles in the SCF.

	Business wealth decile									
	1st	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*	*9th*	*10th*
1989 SCF	0.02	0.12	0.33	0.75	1.30	1.91	3.08	5.35	10.53	76.61
1992 SCF	0.08	0.28	0.52	0.91	1.45	2.34	3.65	6.22	11.71	72.84

The technology shock takes only two values, $\eta \in \{\eta_1, \eta_2\}$, and it follows a first order Markov process with a transition probability $Q_k(\eta'/\eta)$. The first component of the technology shock

[16] Data on business wealth is not available in the PSID.

is highly persistent with $Q_k(\eta_1'/\eta_1) = 1$. Moreover, the value of η_1 is sufficiently low that entrepreneurs will abandon his or her business when a low value of the shock is realized. Given these assumptions, only one component for each of the three transition probability matrices Q_k, for $k \in \{k_1, k_2, k_3\}$, needs to be determined. The calibration of these components is based on the exit rates from entrepreneurship according to the following principles. First, as shown by Table IV in Section I.3 of this paper, the exit rate from entrepreneurship is very high for new entrants, and then it quickly declines with entrepreneurial tenure. According to the process for the entrepreneurial idea described above, households running larger projects are households with higher entrepreneurial tenure, and therefore, smaller probabilities of the low shock should be assigned to larger projects. Second, as observed in Section I, the exit rates from entrepreneurship underestimate business persistence because the entrance rate of households with business experience is higher. Therefore, in order to take into account the higher probability of reentering entrepreneurship for experienced agents, the values assigned to the probabilities of the low shock for agents running larger projects should be smaller. Taking into consideration these principles, I assign the value of 0.25 to the smallest project, 0.08 to the mid-sized project, and 0.03 to the largest project. This implies an average exit rate from entrepreneurship of 18 percent, which is between the average exit rates resulting from the two definitions of entrepreneurs: business owners and self-employed.

Using the equilibrium factor prices derived from the first order conditions in the corporate sector $w = (1-\theta)(K_c/N_c)^{\theta}$ and $r + \delta = \theta(K_c/N_c)^{\theta-1}$, and the optimal input of labor in the noncorporate sector derived in (7), the aggregate output-capital ratio can be expressed as:

$$\frac{Y}{K} = \left(\frac{r+\delta}{\theta}\right) s_c + \left[\bar{\eta}\left(\frac{1-\nu}{1-\theta}\right)^{\frac{1-\nu}{\nu}} \left(\frac{r+\delta}{\theta}\right)^{\frac{\theta(1-\nu)}{\nu(1-\theta)}} - (1-\delta)\right] s_n \tag{16}$$

where s_c is the fraction of capital employed in the corporate sector, s_n is the fraction of capital employed in the noncorporate sector, and $\bar{\eta}$ is the average productivity parameter in the noncorporate sector. I assume that the mean of the shock to entrepreneurial activities is the same for all entrepreneurs, and therefore, the average productivity parameter $\bar{\eta}$, conditional on survival, is given by the mean of the technology shock η.

From the calibration analysis conducted so far, I know the values of $r, \delta, \theta, s_c, s_n, Y/K$. However, there are still two parameters that are unknown in equation (16). These are $\bar{\eta}$ and ν. The extra condition used to pin down these two parameters is obtained by imposing that the percentage of total income earned by entrepreneurs is 22 percent. This is the average percentage found in the PSID data. Given the mean value of the shock and the transition probabilities, the values of η_1 and η_2 for each project are then calibrated to obtain the desired volatility of business income. To take into consideration that experienced entrepreneurs run less risky projects, in the baseline model I impose that the conditional standard deviation of business income is 1.20 for the smallest project, 0.80 for the mid-sized project, and 0.40 for the largest project. This can be compared with the conditional standard deviation for the earning process, which is 0.33.

The probability distribution of the entrepreneurial idea $\kappa \in \{0, k_1, k_2, k_3\}$, depends only on the project implemented in the current period, and it is denoted by $P_k(\kappa)$. I assume that the probabilities of new ideas are positive only for the projects closer to the ones currently being run. This implies that in order to run a large-scale project, it is first necessary to run a smaller one. The assumption is a simple way to formalize the hypothesis of the existence of a learning process through which the ability to run large businesses increases with entrepreneurial tenure. This assumption, together with the assumption that an entrepreneur can always run the project implemented in the previous period, simplifies the calibration of the vectors P_k, for $k \in \{0, k_1, k_2, k_3\}$. What is relevant is only the probability of getting the higher (and closer) idea; therefore, only one component of each vector P_k needs to be calibrated. At the same time, the probability distribution for an entrepreneur running the largest project is irrelevant because a large-scale entrepreneur never chooses to reduce the scale of production, if he or she realizes a good realization of the shock. Therefore, only three parameters need to be calibrated, and they are determined such that in equilibrium, the distribution of entrepreneurs equals the imposed distribution of entrepreneurs among the four projects—60, 30, and 10 percent, respectively—and the total fraction of entrepreneurs equals 0.12. This is the average fraction of entrepreneurs found in the PSID data for the period 1970-92 and in the SCF data for the years 1989-92.

III.4 Intermediation technology

The banking sector intermediates funds to noncorporate businesses at the proportional cost ϕ. This cost determines the difference between the interest rate on loans r_L and the interest rate on deposits r_D. Diaz-Gimenez, Prescott, Alvarez, & Fitzgerald (1992) report the average interest rates paid on various categories of household borrowing and lending to banks and other intermediaries for selected years. Based on these data, they calibrate the nominal interest spread at 5.5 percent. In the baseline model, I set $r_L - r_D = \phi = 0.045$. A sensitivity analysis will be conducted in order to analyze the importance of this parameter for the obtained results.

To summarize, Table VII reports the set of parameter values for the baseline version of the economy.

IV Results

In this section, the model economy described in Section II and calibrated in Section III is used to evaluate quantitatively the importance of entrepreneurship for wealth concentration and mobility, which are endogenous in the model.[17] First, I evaluate the model's ability to replicate the main differences in asset holdings and wealth mobility between workers and entrepreneurs, as well as its ability to generate the same concentration of wealth as observed in the data. Then, I examine the importance of entrepreneurship for wealth concentration by comparing the distribution of wealth generated by the model economy with the distribution generated by an alternative model that abstracts from entrepreneurial activities. Finally, I perform a sensitivity analysis in order to examine the importance of some parameters for the obtained results.

IV.1 Asset holdings and wealth mobility of workers and entrepreneurs

The top section of Table VIII reports the average wealth-to-income ratio of workers and entrepreneurs found in the stationary equilibrium of the model economy described in Section II. Agents are grouped into three income classes, where each class includes one-third of the population. In order to compare this ratio with that for the U. S. economy, the bottom section of

[17] As explained in the previous section, the calibration does not make use of conditions referring to the accumulation of assets and to the distribution of wealth.

Table VII: Calibration values for the baseline model.

Intertemporal discount rate	β	0.934
Relative risk aversion parameter	σ	2.000
Intermediation cost	ϕ	0.045
Corporate capital income share	θ	0.330
Depreciation rate	δ	0.062
Noncorporate size projects	k	$\left\{ 1.63 \quad 16.26 \quad 162.61 \right\}$
Mean value of the shock	$\bar{\eta}$	2.374
Values of the shock	η	$\left\{ \begin{array}{cc} 1.888 & 2.536 \\ 1.740 & 2.429 \\ 1.842 & 2.390 \end{array} \right\}$
Probability distribution of the shock	$Q_k(\eta'/\eta_2)$	$\left\{ \begin{array}{cc} 0.250 & 0.750 \\ 0.080 & 0.920 \\ 0.030 & 0.970 \end{array} \right\}$
Arrival probability of a new project	$P_k(\kappa)$	$\left\{ \begin{array}{c} 0.024 \\ 0.110 \\ 0.075 \end{array} \right\}$
Values of labor ability	ε	$\left\{ 0.334 \quad 0.720 \quad 1.390 \quad 2.989 \right\}$
Transition probabilities for the labor ability	$\Gamma = \Pi \otimes \Gamma_\varepsilon$	$\left\{ \begin{array}{cccc} 0.743 & 0.250 & 0.005 & 0.002 \\ 0.250 & 0.743 & 0.002 & 0.005 \\ 0.005 & 0.002 & 0.743 & 0.250 \\ 0.002 & 0.005 & 0.250 & 0.743 \end{array} \right\}$

the table reports the same statistics computed from the PSID data as averages of the 1984 and 1989 samples.

One important result is the sizable differences in the ratio of wealth to income between workers and entrepreneurs in all income groups. The lower section of Table VIII shows that this finding is consistent with the empirical evidence for the U. S. economy. Note that due to different data used to calibrate the capital-to-output ratio, the wealth-to-income ratios in the model economy are smaller than the wealth-to-income ratios found in the PSID data. Therefore, the right way to evaluate the performance of the model is to compare the differences in the ratios of wealth to income between workers and entrepreneurs generated by the model, with the same differences found in the data, rather than comparing the absolute values of these ratios. In the artificial economy, the ratio of wealth to income for the total population of entrepreneurs is almost twice as large as the ratio for the total population of workers; in the PSID data, it is more than twice as large for business families.

Another way to evaluate the performance of the model economy is to look at the distribution of workers and entrepreneurs over wealth classes. Table IX reports the percentage of workers and entrepreneurs in each wealth class for the model economy and for the PSID data. Each class includes one-third of the agents. As in the data, in the stationary equilibrium of the calibrated economy, entrepreneurs tend to be concentrated in the upper wealth class. The model also performs well in replicating the proportion of workers and entrepreneurs with negative or zero wealth as shown in the last row of Table IX.

In order to evaluate the performance of the model economy in replicating the main properties of wealth mobility observed in the data, Table X reports the five-year wealth transition matrices

Table VIII: Wealth-to-income ratios for workers and entrepreneurs. Model economy and average 1984, 1989 and 1994 PSID data.

	Workers		**Entrepreneurs**	
	% of Househ.	Wea-Inc Ratio	% of Househ.	Wea-Inc Ratio
Model economy				
- Income Class I	31.0	1.32	2.3	12.51
- Income Class II	30.1	2.41	3.3	2.48
- Income Class III	26.9	3.04	6.4	5.36
- Total	88.0	2.68	12.0	5.15
PSID data				
- Income Class I	31.4	3.74	2.0	11.68
- Income Class II	29.7	2.82	3.6	4.52
- Income Class III	25.2	2.71	8.1	5.90
- Total	86.3	2.86	13.7	5.83

Table IX: Distribution of agents among wealth classes. Model economy and average 1984, 1989 and 1994 PSID data.

	Model economy		**PSID data**	
	% of Workers.	% of Entrepr	% of Workers	% of Entrepr
Wealth Class I	31.6	1.7	31.6	1.8
Wealth Class II	29.4	3.9	29.8	3.5
Wealth Class III	27.0	6.4	24.9	8.4
Total	88.0	12.0	86.4	13.6
Neg & Zero	15.5	0.6	11.3	0.6

for the four subgroups of agents as defined in Section I.2. The table is the analog of Table II of Section I.2 and it is constructed by simulating the artificial economy for five periods, where a period is calibrated to be one year.

The transition matrices generated by the simulation of the calibrated model are, in general, consistent with the empirical matrices constructed in Section I.2. More specifically, looking at agents that at the beginning of the simulation period are workers (in the top section of the table), we observe that: (i) In the lower class, the percentage of agents moving to higher classes is greater for switching workers than for staying workers; (ii) In the middle class, the percentage of upwardly mobile agents among switching workers is higher than the percentage of downwardly mobile agents. The reverse is observed for staying workers; (iii) In the upper class, the percentage of agents falling to a lower class is smaller for switching workers than for the other workers.

Looking at agents that at the beginning of the simulation period were entrepreneurs (in

Table X: Transition matrices for net family wealth. Five-period simulation.

	Class I	**Class II**	**Class III**	**Class I**	**Class II**	**Class III**
	Staying Workers			**Switching Workers**		
Class I	0.81	0.19	0.00	0.61	0.38	0.01
Class II	0.22	0.64	0.14	0.13	0.71	0.16
Class III	0.00	0.18	0.82	0.00	0.15	0.85
	Switching Entrepreneurs			**Staying Entrepreneurs**		
Class I	0.77	0.23	0.00	0.40	0.58	0.02
Class II	0.23	0.66	0.11	0.03	0.64	0.33
Class III	0.00	0.15	0.85	0.00	0.02	0.98

the bottom section of Table X), we observe that: (i) In the lower class, the percentage of agents moving to higher classes is greater for staying entrepreneurs. (ii) In the middle class, the percentage of upwardly mobile agents among the staying entrepreneurs, is higher than the percentage of downwardly mobile agents. The reverse is observed for switching entrepreneurs. (iii) In the upper class, the percentage of agents falling to a lower class is smaller for staying entrepreneurs than for the other agents.

In summary, the general mobility patterns that are generated in the model resemble the mobility properties observed in the data characterized by entrepreneurs who tend to stay in or move to higher wealth classes, and by workers who tend to stay in or move to lower wealth classes. These different mobility properties of workers and entrepreneurs are consequences of the higher saving behavior of entrepreneurs, and they motivate, from a dynamic point of view, the entrepreneurs' higher asset holdings.

IV.2 Entrepreneurship and concentration of wealth

After showing the performance of the model economy in generating the main differences in asset holdings and wealth mobility between workers and entrepreneurs, this section analyzes the ability of the model to generate the concentration of wealth observed in the U.S. economy. The first row of Table XI reports the top percentiles and the Gini index for the distribution of wealth in the stationary equilibrium of the economy. These statistics are compared with the empirical ones reported in the second row of the table based on the PSID data. The wealth concentration generated by the model economy is remarkable: the Gini index takes the value of 0.74, and the top 1 and 5 percent of agents hold, respectively, 24.9 and 45.8 percent of total wealth, almost exactly those in the PSID data. The second section of Table XI reports distributional statistics for income. The concentration of income in the model economy is similar to the empirical one. However, this is a consequence of the exogenous calibration of most components of income (like labor earnings), and therefore, it is not a dimension along which the performance of the model can be evaluated.

The fact that the model economy is able to generate a high degree of wealth concentration does not necessarily imply that entrepreneurship plays an important role in generating this

Table XI: Percentage of total wealth and income held by percentile groups and Gini indexes. Model economy and average 1984, 1989 and 1994 PSID data.

	Top percentiles					**Gini**	**Zero**
	1%	*5%*	*10%*	*20%*	*30%*	**Index**	**&Neg**
Wealth							
- Model economy	24.9	45.8	57.1	73.2	84.0	0.74	15.9
- PSID data	26.0	47.0	60.6	76.5	86.2	0.76	11.9
- Only workers	4.2	15.3	26.2	44.5	58.3	0.55	10.1
Income							
- Model economy	7.9	18.2	28.5	46.8	64.0	0.45	0.1
- PSID data	7.6	19.9	30.9	47.8	60.9	0.44	0.6
- Only workers	3.8	13.4	24.4	45.7	60.2	0.42	0.0

concentration. Therefore, the next question is whether the modeling of entrepreneurial activities is relevant in generating this concentration of wealth. The strategy followed to answer this question is to compare the model economy developed in this study with an alternative economy which abstracts from the entrepreneurial activities. In this alternative model, all agents are workers facing the same earning uncertainty and borrowing constraints faced by the workers in the model with entrepreneurs. Labor services are supplied to the production sector represented by a Cobb-Douglas production function calibrated to match the same aggregate statistics used to calibrate the model with entrepreneurs. This model is similar to the model analyzed in Aiyagari (1994), except that the calibration of the earning process has been modified in order to generate a degree of earning inequality similar to the one observed in the data.[18]

The Gini indexes and the top percentiles of wealth and income generated by this model are reported in Table XI under the heading "Only workers". It is clearly evident that this model generates a much lower concentration of wealth than the model with entrepreneurs. The Gini index is 0.55, and the top 1 percent of agents own only 4.2 percent of total wealth. If we quantify the importance of entrepreneurs in generating wealth inequality by the increase of the Gini index, then 34 percent of wealth concentration is attributable to the existence of the business sector. However, the Gini index is only a summary measure of inequality, and a more detailed description of wealth concentration is given by the percentage of total wealth owned by the top wealth holders. It is in this respect that the modeling of the entrepreneurial activities becomes crucial. In the model with only workers, the top 1 percent of agents hold only 4.2 percent of total wealth, but once entrepreneurs are included in the model, this percentage jumps to 24.9 percent. Therefore, the model with entrepreneurs generates a higher concentration of wealth at the upper tail of the distribution, with distributional statistics closer to the empirical ones.

[18]In Aiyagari (1994), as in this study, the logarithm of earnings is assumed to follow a first order autoregressive process. However, while in Aiyagari all agents have the same unconditional mean of the earning process, the model developed in this study assumes that in each period, the economy is populated by agents of different types, where types are characterized by a different unconditional mean of the earning process. The autocorrelation coefficient and the standard deviation of the log-earning process, instead, are the same across types, and the calibrated values are similar to the values used in the baseline model of Aiyagari. See section III for details.

IV.3 Discussion

After showing the importance of entrepreneurship in generating a higher concentration of wealth, one may wonder why the model without entrepreneurs does not generate such a concentration, while the model with entrepreneurs does. In the standard model with uninsurable risks to labor earnings, the only motive to save is precautionary: in order to smooth consumption, agents build a buffer of wealth. However, as discussed in Carroll (1997), once the buffer has reached a certain level, the incentive to save becomes weak. The introduction of life cycle features, like in Huggett (1996), increases the concentration of wealth as measured by the Gini index. However, the life-cycle model generates this higher concentration of wealth by increasing the proportion of households with zero or negative wealth, rather than by generating a higher concentration at the top of the distribution.[19] DeNardi (1999) introduces bequests motives in the life-cycle model and shows that this feature improves the performance of this model. However, the asset holdings at the top of the distribution are still below what is observed in the data.

Therefore, there must be other mechanisms inducing some agents to accumulate and maintain very high levels of wealth. One possible mechanism is to assume a different structure of preferences. This is the approach followed, for example, in Krusell & Smith (1998). In this paper, however, I follow a different approach, which is suggested by the data. The hypothesis is that opportunities are related to wealth. On the one hand, due to borrowing constraints and the higher cost of external financing, only agents endowed with enough wealth are able to enter entrepreneurship or to take advantage of better businesses.[20] On the other, the accumulation of more wealth allows entrepreneurs to save the higher cost of external financing (debt), thereby to increase profits. At the same time, the higher risk associated with entrepreneurial activities further increases the conservative saving of these agents.

In summary, three main factors contribute to generate the higher accumulation pattern of entrepreneurs. The first factor is the incentive to save in order to undertake an entrepreneurial activity or to implement larger projects in the presence of borrowing constraints. The second factor is the cost of external financing. In this economy, there are financial intermediation costs that make external financing more expensive. This implies that for those entrepreneurs with a level of wealth lower than the capital invested in the business, the marginal return on saving and, therefore, the incentive to save are higher. The third factor is the uninsurable entrepreneurial risk: when the agent makes the occupational choice, the agent knows with certainty the income he or she will earn if worker. However, if he or she decides to become an entrepreneur, then the agent's income depends on the realization of the shock, which is unknown when the decision is made. Therefore, by undertaking an entrepreneurial activity, the agent faces a higher income uncertainty that induces him or her to save more for precautionary motives.

Along with these three factors that directly influence the entrepreneur's saving behavior, the higher asset holdings generated by the model economy are also a consequence of a selection mechanism. On the one hand, the existence of borrowing constraints have the effect of selecting entrepreneurs among richer workers. On the other, only successful entrepreneurs are able to keep their business, and because they are successful, they are also able to accumulate more wealth.

[19]Huggett (1996) analyzes an overlapping generation economy where agents face two types of risks: earnings uncertainty and lifetime uncertainty. In that economy, the Gini coefficient for wealth is close to the empirical one, but the asset holdings of the top 1 and 5 percent holders is well below the observed values.

[20]This is consistent with the empirical findings that wealth is important in explaining the probability of entering entrepreneurship. See, for example, Evans & Leighton (1989), Holtz-Eakin et al. (1994) and Quadrini (1999).

An important role in concentrating wealth in the hands of entrepreneurs is played by business persistence and turnover. The modeling of a learning process in the business ability is such that experienced households face lower probabilities of exiting entrepreneurship. This implies that a restricted percentage of families (those with business experience) spend, on average, a great deal of time in the business group, and given their higher saving rates, this allows them to accumulate a large amount of wealth.

IV.4 Sensitivity Analysis

In order to analyze the importance of some key parameters for the performance of the model economy, in this section I conduct a sensitivity analysis with respect to two of the main parameters: the intermediation cost ϕ and the volatility of business income. The analysis evaluates the importance of the parameters underlying two of the main mechanisms that in the model generate the concentration of wealth. The first mechanism consists of the accumulation of assets that are induced by the higher marginal return on savings as a consequence of the higher cost of external finance. The second mechanism consists of the higher savings that are induced by the riskiness of the business activity (precautionary motives) and from the incentive to overcome the borrowing limits. Because the stochastic properties of the shock determine the minimum value of assets that are necessary to start a business or to implement larger projects, that is, the borrowing limits, the sensitivity analysis with respect to this parameter provides a joint evaluation of the importance of the riskiness of the business and the borrowing limits.

The first line of Table XII reports distributional statistics for the economy without intermediation cost ϕ. These statistics can be compared with the same statistics for the baseline model that are reported at the bottom of the table. As can be seen, the degree of inequality decreases after the elimination of the intermediation cost.

Table XII: Sensitivity of the distribution of wealth with respect to the cost of capital and the entrepreneurial risk. Numbers are in percentage term.

	Top percentiles					**Gini**	**Zero**
	1%	*5%*	*10%*	*20%*	*30%*	**Index**	**&Neg**
Zero intermediation cost	19.1	39.2	51.6	68.3	81.2	0.69	14.2
Low entrepreneurial risk	19.7	40.0.	52.1	69.2	82.0	0.70	14.9
High entrepreneurial risk	26.1	47.2	58.4	74.3	85.5	0.75	17.1
Without cost and low risk	14.9	34.2	45.7	64.8	77.6	0.66	13.1
Baseline economy	24.9	45.8	57.1	73.2	84.0	0.74	15.9

The riskiness of the business and the borrowing limits also have distributional consequences, as can be seen in the middle section of Table XII which reports distributional statistics when the idiosyncratic technological shock takes the mean value $\bar{\eta}$ (low risk) and when the standard deviation of the shock is doubled (high risk). Note that when $\eta_1 = \eta_2 = \bar{\eta}$, entrepreneurs still face the risk of loosing the business, even though without losses.

Finally, the third section of the table reports concentration statistics for the case in which both the intermediation cost and the technology shock are eliminated. This version of the economy is similar to the economy without entrepreneurs, but with a modified labor earning process that includes the profits from business activities. Looking at these distributional statistics, we see the importance of the intermediation cost and the riskiness of the business in generating wealth concentration.

It is important to point out that the version of the model without intermediation cost and low entrepreneurial risk is not able to generate substantial differences in asset holdings and wealth mobility between workers and entrepreneurs.[21] This result shows that the different saving behavior of workers and entrepreneurs is the key element underlying the different asset holdings and mobility between these two categories of agents.

V Conclusion

The analysis of data from the PSID and the SCF reveals substantial differences in asset holdings and wealth mobility between workers and entrepreneurs. In particular, it shows a significant concentration of wealth among business families which, at least in part, is responsible for the high concentration of wealth observed in the U.S. economy. Consequently, the study of the accumulation behavior of entrepreneurs represents an important step toward understanding wealth concentration and inequality.

By explicitly modeling entrepreneurial activities, the paper shows that it is possible to generate the higher asset holdings of entrepreneurs and to reproduce the high inequality in the distribution of wealth observed in the data. This is an important result of this study considering that the standard model (life-cycle or dynastic) with heterogeneous agents affected by idiosyncratic shocks to labor earnings and subject to liquidity constraints—but which abstracts from entrepreneurial activities—fails to account for such a concentration.

The different accumulation patterns of workers and entrepreneurs have also important implications for shaping the different wealth mobility of these two types of agents: as a consequence of the higher saving behavior of entrepreneurs relative to workers, the model economy is able to replicate the upward wealth mobility experienced by the former and the downward wealth mobility experienced by the latter.

The analysis conducted in this study, while essentially positive in substance, holds interesting normative implications for policy design and raises some important policy questions: can the mobility properties of the whole society be altered by implementing policies which increase the extent of entrepreneurship in the economy? Moreover, what are the indirect effects on socioeconomic mobility of those government policies which reduce the saving incentive for agents located at the lower end of the distribution? An example of these policies are the mean-tested policies considered by Hubbard, Skinner, & Zeldes (1995). As constructed, the model economy allows for the analysis of several other issues such as the effect of entrepreneur-directed incentives on aggregate savings and mobility. These important issues are potential areas of future research.

[21] For economy of space, these statistics are not reported here.

A Data appendix

PSID data: In the Panel Study of Income Dynamics *family wealth* is defined as the sum of the net worth of all family members that results from the aggregation of the following components: house (main home), other real estate, vehicles, farms and businesses, stocks, cash accounts, and other assets. *Family income* is defined as the sum of income coming from all sources plus transfers of all family members.

According to the first definition of entrepreneurs, *entrepreneurs* are families that own a business. This definition is based on the PSID variable *Whether Business* which is based on the following interview question: "Did you (Head) or anyone else in the family own a business at any time during the previous year or have a financial interest in any business enterprise? " Therefore, a broad definition of entrepreneur is adopted: the business ownership of only one member of the family is sufficient to include the whole family in the business group. Moreover, the business activity does not have to be the main occupation of the owner. According to the second definition of entrepreneurs, *entrepreneurs* are families in which the head is self-employed in his or her main job, while *workers* are identified as families in which the head is a wage worker. This classification is based on the following interview question: "In your main job, are you (Head) self-employed or do you work for someone else?"

SCF data: In the Survey of Consumer Finances (SCF), *family wealth* is defined as the net worth of the household. It includes residences and other real estate; farms and all other businesses; checking accounts, certificates of deposit, and other banking accounts; IRA/Keogh accounts, money market accounts, mutual funds, bonds and stocks, cash and call money at a stock brokerage, and all annuities, trusts, and managed investment accounts; vehicles; the cash value of term life insurance policies and other policies; money owed by friends, relatives, businesses, and others; pension plans accumulated in accounts; and other assets net of all debts. *Family income* is defined as the sum of all kinds of income before taxes received by all members of the family. It includes: wages and salaries; income (whether positive or negative) from professional practices, businesses and farms; interest income, dividends, gains or losses from the sale of stocks, bonds, and real estate; rent, trust income, and royalties from any other investment or business; unemployment and worker compensation; child support and alimony; Aid to Dependent Children, Aid to Families with Dependent Children, food stamps, and other forms of welfare and assistance; income from social security and other pensions, annuities, compensation for disabilities, and retirement programs; income from all other sources such as settlements, prizes, scholarships and grants, inheritances, gifts, and so on.

According to the first definition of entrepreneurs, *entrepreneurs* are families for which the dollar value of the business is greater than zero. According to the second definition, *entrepreneurs* are families for which the head is self-employed in his or her main job.

Business wealth is the market value of the business, that is, the dollar amount that the owner would get if he or she sold the business.

B Computational procedure

The first step of the numerical procedure consists of approximating an interval of asset holdings with 3,000 discrete points. The lower bound is determined as the negative of the maximum amount that an agent can ever borrow, while the upper bound is such that in the stationary equilibrium, the measure of agents with this level of asset is zero. The distance between contingent points is chosen to be finer at lower levels of assets and coarser at higher levels. After the discretization of the state space of assets, the household problem is a finite-state discounted dynamic problem with the value function taking $96,000$ possible values.

Given all parameter values, the procedure start by guessing the equilibrium interest rate r_D. Given the Cobb-Douglas technology in the corporate sector, the guess for the interest rate allow us to determine the capital-labor ratio and the wage rate w. Subsequently, the household problem is solved by iterating on the value function. Then, using the resulting decision rules, we seek a stationary distribution by iterating on the probability measure μ. Once the stationary distribution has been found, the corporate capital-labor ratio associated with this stationary distribution is compared with the capital-labor ratio initially guessed. If the difference is greater than a tolerance value, the guess for r_D is updated, and the whole procedure is repeated until convergence.

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