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## Entrepreneurship in macroeconomics

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**Abstract** This paper reviews the main studies on entrepreneurship conducted during the past two decades that are relevant for the understanding of various macroeconomic issues. I organize the discussion by distinguishing three groups of contributions. The first group includes studies whose main purpose is to understand the factors that affect the decision to become an entrepreneur. The second group includes studies that look at the aggregate and distributional implications of entrepreneurship for savings and investment. The third group deals with issues of economic development and growth.

**Keywords** Entrepreneurship · financial constraints · savings · investment · wealth distribution · economic growth

### Introduction

In this article I discuss several entrepreneurial studies conducted in the field of economics. Although entrepreneurship is a widely studied subject in other fields such as finance, corporate business, and sociology, in this article I concentrate on the most relevant issues for macroeconomics. Since a comprehensive review of entrepreneurial studies over the last 20 years is impossible to do in the space provided, this article reviews the research that has received the greatest attention and that best represents future research trends.

Despite some overlap, the entrepreneurial studies that are most relevant for the understanding of the macro-economy can be categorized in three groups.

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The first group includes studies whose main purpose is to understand the factors that affect the occupational decision of an individual. The main question is why certain individuals choose to work for themselves while others choose to work for others. Although many of these studies take an approach that is micro in substance, their findings are central for constructing entrepreneurial models that are used to study macroeconomic issues.

The second and third groups of studies are interested in the macroeconomic consequences of entrepreneurship: the economic performance of a country, aggregate savings, investment, inequality and the optimal design of fiscal and institutional policies. I first discuss the studies that look at the aggregate and distributional implications of entrepreneurship for savings and investment (second group). I then discuss the studies whose focus is on economic development and growth (third group).

A controversial issue is how to define an entrepreneur. From a theoretical point of view there are different notions. Studies that focus on the occupational choice identify entrepreneurs as those working for themselves (self-employed). Other studies emphasize the ownership of a business together with an active management role. For studies that focus on innovations, the identification of an entrepreneur depends on the particular task exercised within the business organization. Along these lines, a manager involved with the creation of new business projects or firms can be considered an entrepreneur even if he or she does not share the ownership of the project or firm.

It seems that the right concept of entrepreneur depends on the particular issue we want to address and, for applied studies, on the availability of data. For most of the empirical studies I review in this article, especially those reviewed in Section 1, the main definition is based either on the occupation of the individual<sup>1</sup>—self-employed as opposed to working for someone else—or on the business ownership together with an active management role. In practice, most of the individuals who work for themselves are also business owners. It is then not surprising that these two definitions lead to similar findings.

Although the identification of an entrepreneur as self-employed or business owner may not be satisfactory for studies that view entrepreneurs as the main driving force for technological innovations (as some of the studies reviewed in Section 3 do), it may still be the best definition for studies investigating the different savings behaviors of workers and entrepreneurs (as those reviewed in Section 2 do).

## 1 The determinants of the occupational choice

There are both empirical and theoretical contributions studying the factors affecting the occupational choice between working for a wage and being self-employed. A well known contribution is Evans and Jovanovic [1989]. The main question addressed in this study is whether personal wealth is important for the choice to become an entrepreneur.

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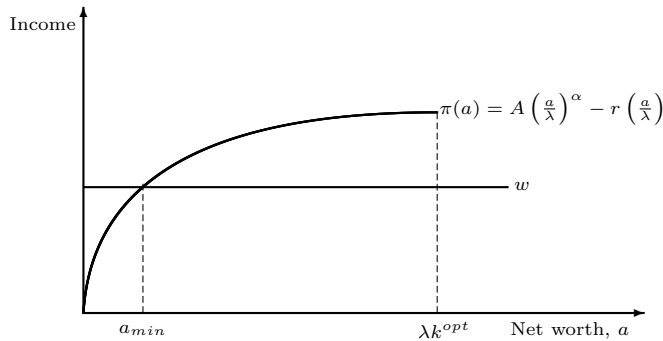
<sup>1</sup> In the case of a household, it is usually the occupation of the household's head.

In general, starting a business requires capital. However, capital can be financed externally only partially because of financial constraints. Therefore, the lack of personal wealth may compromise the choice to become an entrepreneur. Evans and Jovanovic show this point with a simple theoretical model where individuals become entrepreneurs only if their wealth is above a minimum threshold. The main theoretical idea can be illustrated as follows.

Consider an individual with personal wealth  $a$ . The individual can choose to work for a wage  $w$  or to be an entrepreneur. In this case he or she can generate output  $Ak^\alpha$ , where  $k$  is the input of capital and  $A$  is the entrepreneurial ability of the individual (relative to his or her ability to earn a wage income). The optimal input of capital is determined by maximizing the income or profit net of the opportunity cost of capital, that is,  $\pi = Ak^\alpha - rk$ , where  $r$  is the gross interest rate. Solving for the first order condition,  $\alpha Ak^{\alpha-1} = r$ , and substituting back in the function for the net income gives  $\pi^{opt} = (\alpha A/r)^{\alpha/1-\alpha}$ .

For individuals with a sufficiently high  $A$ ,  $\pi^{opt} > w$  so that they would generate higher income by choosing to become entrepreneurs. As long as there are no financial constraints, this model predicts that individuals with  $A$  above a certain threshold become entrepreneurs and the others choose to become workers. With financial constraints, however, personal wealth  $a$  also becomes important.

Suppose that agents can borrow only a fraction  $1 - \lambda$  of the capital  $k$ . This implies that  $k \leq a/\lambda$  and, for  $a < (1 - \lambda)k^{opt}$ , the input of capital is sub-optimal, reducing the income generated by the entrepreneur. Substituting  $k = a/\lambda$  in the profit function, we get  $\pi(a) = A(a/\lambda)^\alpha - r(a/\lambda)$ . The occupational choice is made by comparing  $\pi(a)$  with  $w$  as shown in Figure 1.



**Fig. 1** Occupational choice.

Only if the individual has a net worth bigger than  $a_{min}$  he or she chooses to become an entrepreneur. Adding a random factor, we have the testable implication that personal wealth increases the probability of becoming an entrepreneur, which is supported by the empirical estimation conducted in Evans and Jovanovic. A similar finding is obtained in Evans and Leighton [1989]. Although these are not direct tests of the existence of borrowing constraints,

the conventional interpretation, at least until recently, has been that financial constraints affect the decision to become an entrepreneur.

The finding that wealth is important for occupational choice is confirmed by other studies. Especially interesting is the work of Holtz-Eakin et al. [1994] and Blanchflower and Oswald [1998]. They also test whether personal wealth affects the decision to become an entrepreneur but using the increase in wealth deriving from inheritance and gifts. The main idea is that, if the increase in wealth coming from inheritance and gifts increases the probability of becoming self-employed, then personal wealth must be an important factor for occupational choice. This is what they find in their empirical estimations.

Again, this is not a direct test for the existence of financial constraints but it has often been interpreted in this way. However, Blanchflower and Oswald [1998] also report that, when directly questioned in interview surveys, potential entrepreneurs say that raising capital is their principal problem. Although this does not necessarily imply that financial constraints affect the ‘decision’ to become an entrepreneur, it suggests that financial factors do play a role in the management of a (small) business. The relevance of this point will become clearer in the next section.

The result that wealth affects entrepreneurial activity is also found in other countries, including those in the developing stage. Especially interesting is the study of Paulson and Townsend [2004]. They use data from rural and semi-urban Thailand and find that financial constraints play an important role in shaping the patterns of entrepreneurship. In particular, wealthier households are more likely to start businesses, more likely to invest in their businesses, and they face fewer constraints. The finding is important for some of the studies I will review in Section 3.

More recently, Hurst and Lusardi [2004] challenge the view that personal wealth is a key factor for the decision to become an entrepreneur. These authors look at the problem in a more disaggregated fashion. Most of the previous findings were based on a probit or similar empirical estimations where personal wealth (and in some cases a polynomial function of wealth) was included as a dependent variable. Hurst and Lusardi decompose the sample in different wealth groups and run the estimation within each group. The main finding is that personal wealth seems to be statistically important only for the richest households, in particular, households located in the top quintile of the distribution. Since these households are quite wealthy, it is difficult to interpret the importance of wealth for these households as a sign of borrowing constraints. More importantly, for the majority of households, once we exclude the very top, wealth does not seem to be significant. The authors also provide some evidence that the start-up capital of many new entrepreneurs is rather small. Given the modest amount of start-up capital, it is doubtful that finding the money to finance a new business is a major deterrent to entrepreneurship.

Hurst and Lusardi’s paper is an important contribution in this literature because it challenges the common wisdom about the importance of wealth for entrepreneurship. It encourages us to rethink the factors that are really

important for entrepreneurial choice. Is it really the imperfection of financial markets that restrains talented people from becoming entrepreneurs?

Although the study casts doubts about the importance of financial constraints for the individual decision to ‘become’ an entrepreneur, it does not say anything about the impact of financial constraints on ‘entrepreneurial activity’. What Hurst and Lusardi show is that wealth may not be that important for the ‘choice’ of working as a self-employed person or as a wage worker. But it does not say anything about the initial scale of the business and its future operation. In other words, financial constraints may not be a deterrent to becoming an entrepreneur but may affect in important ways the initial operation of a business and its future dynamics.

Here is an example. Suppose I believe that running a limo service in the nearby airport is a profitable business but my personal wealth is limited. Would this discourage me from entering the business? Probably not. It is unlikely, though, that I enter with a brand new vehicle. Of course, the quality of the vehicle will affect my business, but only temporarily. As time goes by, I will replace the old vehicle with a new one and, perhaps, I will add a second vehicle driven by a hired worker. But these investments are possible only if I accumulate enough wealth, which is a big incentive to save.

In terms of Figure 1, this is captured by assuming that  $a_{min}$  is very close to zero. Therefore, even if my net worth is very small, I may still choose to become an entrepreneur. This is especially true in a dynamic environment. The current profits may be smaller than the wage income. However, by starting the business today I expect to generate much higher profits in the future. This point is shown with a dynamic model in Bohacek [2006]. This study finds that most entrepreneurs enter despite lower initial earnings and they save to relax the borrowing constraints. Therefore, financial constraints are very important not because they affect the occupational decision but because they keep the initial scale of the business far below the optimal size  $k^{opt}$ .

The example above makes clear that personal wealth may be irrelevant for the decision to become an entrepreneur but it could be very important for the investment and saving decision of entrepreneurs. This is key for appreciating the contribution of the studies I discuss in the next section, where personal wealth plays a central role due to financial constraints. As we will see, it is not the impact of financial constraints on the decision to ‘become’ an entrepreneur that plays a key role in these studies. Instead, what plays a crucial role is the impact of financial constraints on the behavior of the entrepreneur after he or she has made the occupational choice.

Another observation that, on a superficial level, may cast some doubt upon the importance of financial constraints for the decision to become an entrepreneur is the fact that the fraction of self-employed workers in developing countries—where financial markets are also less developed—is much larger than in industrialized countries. See, for example, Gollin [2006] and Table 1 of Blanchflower [2008] in this issue.

Of course, there are many factors that could contribute to generating a greater share of the labor force in self-employment occupations, for example,

the different economic structure of countries that are still in the early development stage. But even taking this into account, the cross-country evidence seems to contradict the hypothesis that financial constraint is the key factor for explaining the individual decision to become an entrepreneur. If this was the case, then we should observe fewer workers choosing to become self-employed in developing countries.

This conclusion, however, may be premature. Even if financial constraints do not affect the decision to become an entrepreneur at the individual level, they may still affect the number of self-employed at the aggregate level. This is because, with tighter constraints, the scale of businesses that ‘create’ employment opportunities is smaller and there will be fewer jobs for wage workers. In this environment, self-employment becomes the only viable occupation.

To illustrate this point consider a simple static example. Suppose that agents have the choice to be workers and earn the wage  $w$  or be self-employed and earn the income  $y$ . For simplicity I assume that  $y$  is fixed while  $w$  is determined in the general equilibrium as specified shortly. In the economy there is a corporate sector producing output according to the production function  $K^\alpha L^{1-\alpha}$ . The presence of a corporate sector distinct from the entrepreneurial sector is made in several models used in the literature. An example is Quadrini [2000]. The demand for labor is determined by equalizing the marginal productivity of labor to the wage rate, that is,  $(1-\alpha)(K/L)^\alpha = w$ . The capital  $K$  owned by the corporate sector depends on financial development: the higher the financial development is, the higher  $K$  is.

The wage and employment decision is shown in Figure 2. Given the capital stock, the demand for labor is downward sloping. The supply of labor is zero for  $w < y$  (all workers choose to be self-employed), flat for  $w = y$  (they are indifferent between entrepreneurship and being a wage worker) and equal to 1 for  $w > y$  (they all prefer a wage job). The intersection between demand and supply determines the allocation of the labor force between wage workers,  $\bar{L}$ , and self-employed,  $1 - \bar{L}$ .

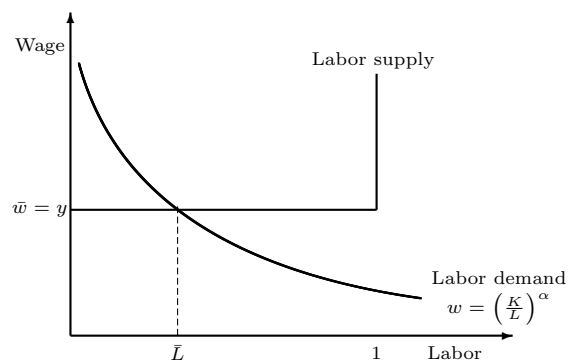


Fig. 2 Employment equilibrium.

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Financial development allows the corporate sector to raise more funds and increase capital. This shifts the demand of labor to the right and a larger share of the labor force becomes wage workers. This mechanism may explain why the establishment size is smaller in developing countries (see Buera et al. [2007] and Quintin [2000]) and the fraction of self-employed workers larger. This ‘general equilibrium’ effect also plays a role in the studies I discuss in the next section.

The presence of financial constraints or more generally of contractual frictions may create incentives for the formation of partnerships (entrepreneurial teams). In any economy, the concentration of entrepreneurial talents is likely to differ from the concentration of wealth. In the absence of financial frictions, this would not be a problem as wealth is made available to the most able entrepreneurs through financial contracts. With financial frictions, however, the transfer of wealth to skilled entrepreneurs is limited. It is in this context that the ownership share of a firm between able entrepreneurs and wealthy investors could be important for mitigating the impact of financial constraints.

Motivated by this, Basaluzzo [2006] extends the typical entrepreneurial model by allowing for partnerships created endogenously through a matching process. He shows that the explicit consideration of entrepreneurial teams mitigates the impact of financial constraints and, in the calibration exercise, the formation of partnerships reduced the output gap (due to financial constraints) by about a quarter.

Another issue that received some attention is whether the choice to become an entrepreneur is always driven by the higher economic return, which is the typical assumption in most of the occupational choice models, such as the one described in Figure 1. This assumption is challenged by the empirical study of Hamilton [2000] according to which “most entrepreneurs enter and persist in business despite the fact that they have both lower initial earnings and lower earnings growth than in paid employment.” According to this study there is a 35 percent median earnings differential for individuals who stay in business for 10 years.

Another study that casts some doubt upon the assumption of higher entrepreneurial returns is Moskiwitz and Vissing-Jorgensen [2002]. Using data for the second half of the 1990s, they show that the return from private equity has not been higher than the return from public equity. If we accept this result and individuals only care about the return they get from their occupational choice, then those owning private equities should sell their private ownership, invest in public equities and choose to become a worker. Because there is not much evidence of this, this finding appears to be a puzzle.

There are several factors that may explain this. The most obvious candidate is that entrepreneurship is a more gratifying occupation than wage occupations, that is, it provides extra utility beyond the pecuniary return (nonpecuniary benefits). There is some empirical support for this in the study of Blanchflower and Oswald [1998]. Perhaps, this is similar to the gratification we get from owning our own residence instead of renting it.

Some of the nonpecuniary benefits may derive from the social status of being an entrepreneur. For example, Clemens [2006] develops a model where agents' utility depends on the social status measured by the relative income of the occupational class to which the agent belongs. Because of this, agents may be more inclined to become entrepreneurs because the average income of entrepreneurs (the social status) is higher.

There is no doubt that 'status' plays some role in the choice of certain occupations and entrepreneurship may be one of these. However, status is not necessarily associated with income, as assumed in Clemens. This is why status could help explain why certain individuals choose to become entrepreneurs even if they earn less than wage workers. The main problem with the status hypothesis is that it is not easily measurable, and therefore, it is difficult to test empirically.

There could also be an economic explanation that relates to the risk of undertaking an entrepreneurial activity. From the consumption side, risk reduces utility so it discourages entrepreneurship. On the revenue side, it may encourage it. One key aspect of entrepreneurship is that risk is bounded below but potentially unbounded above. This creates a convexity encouraging the undertaking of more risk even if the expected return is not very large. Suppose that I see an investment opportunity with very high uncertainty. If the investment turns out to be unsuccessful, my losses are limited because of the option to default. However, if the business is successful, my gains could be quite large. This creates a kink (convexity) in the objective function encouraging risk-taking as shown in Herranz et al. [2007] and Hopenhayn and Vereshchagina [2003]. The convexity of the objective function leading to risk-taking has also been used to explain the stock market tech-boom of the 1990s. See Pastor and Veronesi [2006].

## 2 Entrepreneurial savings and investment

Empirical evidence shows that rich households tend to save more than poor households. This has stimulated a significant body of literature whose goal is to understand the differential saving behavior between rich and poor households. See Carroll [1998].

One avenue of research that tries to explain the differential saving behavior is to look at entrepreneurs. The main question is whether entrepreneurs behave differently than other households in their saving decisions. This was motivated by the observation that the net worth of business owners is substantially higher than the net worth of non-business owners, a finding that at first may appear obvious given that business owners earn higher incomes. However, even if we control for income, the net worth of business owners is much higher than for other households. These features are shown in Gentry and Hubbard [2004] and Quadrini [1999] and are suggestive of different savings behavior between entrepreneurs and non-entrepreneurs. It is also shown that the wealth of entrepreneurs is highly undiversified, suggesting limits to the feasibility of ex-



ternal financing. Some forms of contractual frictions or borrowing constraints must be at work to explain why entrepreneurs take so much risk.<sup>2</sup>

Motivated by these findings, several studies have extended the basic model of precautionary savings, such as Carroll [1997], Huggett [1993], and Aiyagari [1994] to incorporate entrepreneurs. These new studies are quantitative in nature and they all share the following features:

1. The choice to become an entrepreneur is endogenous.
2. Entrepreneurs generate income with the input of capital.
3. External financing is limited due to some form of financial frictions.

There is a long list of papers including, but not limited to, Akyol and Athreya [2007], Bohacek [2006], Buera [2007], Cagetti and DeNardi [2004, 2006], Li [2000], Meh [2005], Meh and Terajima [2007], Quadrini [2000], and Terajima [2006]. Although the issues addressed by these papers are different, they all share the features listed above, and a central mechanism of these models is the impact of financial constraints on entrepreneurial investment and savings. Because of the financial constraints, entrepreneurial investment depends on wealth. From this derives the incentive of entrepreneurs to accumulate wealth to overcome the borrowing constraints. In equilibrium, we observe a large concentration of wealth in the hands of entrepreneurs.

To show how financial constraints lead to higher savings, we can refer again to Figure 1. The straight line denotes the income earned by a worker above the interest earned on the net worth. The concave curve, instead, denotes the income earned by an entrepreneur, also above the interest earned on the net worth. Both incomes are plotted as a function of the net worth. The derivatives of these two functions capture the marginal return, above the interest rate, of personal wealth. As can be seen from the picture, before net worth reaches  $a = \lambda k^{opt}$ , the marginal return for an entrepreneur is bigger than the marginal return for a worker. This explains the higher propensity to save for entrepreneurs until their net worth reaches  $a = \lambda k^{opt}$ . Therefore, they tend to accumulate more wealth than workers.

Through this mechanism, these models have been able to capture the high concentration of wealth we observe in the data. As shown in Cagetti and DeNardi [2006] and Quadrini [2000], the modeling of entrepreneurship is very important for generating the high concentration we observe at the very top of the wealth distribution, with around 30% of wealth owned by the top 1% of households. Models without entrepreneurs are successful in capturing the left tail of the distribution but not the right tail (see Huggett [1996] and Quadrini and Ríos-Rull [1997]).

This point is illustrated in Table 1. The table contains the numbers reported in Cagetti and DeNardi [2006] (see their Table 6). If we eliminate the

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<sup>2</sup> Some point out that the limited diversification could be explained by the desire to keep the control of the firm. However, if this was the case, the entrepreneur could write contracts in which external investors are entitled to the profits of the firm while the entrepreneur retains full management control. One way to do that is by buying state contingent claims from some financial institution. Clearly, these claims are very limited in practice and the reason must be linked to the presence of contractual frictions.

entrepreneurs from the model and assume that all agents are wage workers—which is the typical model with idiosyncratic earnings risks such as Aiyagari [1994]—the model generates a very small concentration of wealth. The top 1% of wealth holders own only 4% of the total wealth. This is very far from the 30% share found in the data. However, once we introduce entrepreneurs, the ownership of the top percentiles become very close to what we observe in the data.

**Table 1** The distribution of wealth: Data and Model. Source: Cagetti and De Nardi (2006).

	Top percentiles				Gini Index
	1%	5%	20%	40%	
Data, 1989 SCF	30	54	81	94	0.8
Model without entrepreneurs	4	20	58	95	0.6
Model with entrepreneurs	31	60	83	94	0.8

Of course, this is not the only mechanism that can generate a strong concentration of wealth on the right tail of the distribution, as Castaneda et al. [2003] show. A process of earnings with the possibility of very high but infrequent realizations of earnings (for example, for sport stars) could also generate a very high concentration of wealth. The approach based on entrepreneurs can generate a high concentration of wealth even in the absence of very large realizations of earnings. The key mechanism is the incentive of entrepreneurs to save more than workers in order to overcome the borrowing constraints or more generally the high cost of external finance. This is a compelling explanation that is solidly supported by cross-sectional and panel survey data collected at the household level.

The relation between entrepreneurship and wealth is further investigated by Terajima [2006], who looks at different educational and occupational groups. Starting from the observation that during the period 1983-2001 the earnings of college self-employed households increased substantially compared to other groups, he asks whether the change in the distribution of earnings can explain the increase in the concentration of wealth observed during the same period. Using a general equilibrium model with endogenous educational and occupational choices, he finds that only part of the increased concentration of wealth can be accounted for by the change in the distribution of earnings among the different educational/occupational groups.

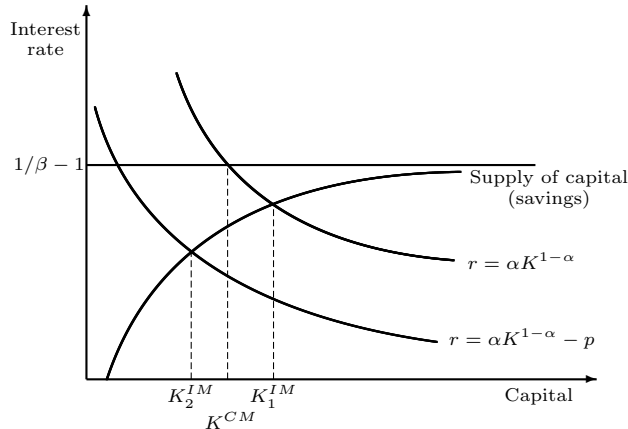
Models with entrepreneurs are especially suited for asking policy questions such as the distributional effects of certain taxes. These questions can also be addressed with models without entrepreneurs. However, because these models cannot easily generate the high concentration of wealth we observe in the data, the answers are less reliable. Again, an exception is Castaneda et al. [2003]. Models with entrepreneurs also allow us to study more specific policies such as business subsidies and corporate taxes. Example of applications along this

dimension are Cagetti and DeNardi [2004], Kitao [2008], Li [2000], and Meh [2005].

Another issue often explored with these models is whether financial imperfections have positive or negative effects on the aggregate accumulation of capital. Fundamentally, the modeling of entrepreneurs introduces a second source of idiosyncratic risk. In addition to ‘earning’ risks, entrepreneurs face uninsurable ‘investment’ risks. In the typical model with only uninsurable idiosyncratic risks to earnings, market incompleteness leads to higher accumulation of capital. In models with uninsurable investment risks, instead, market incompleteness may lead to lower accumulation of capital. See Angeletos [2007], Angeletos and Calvet [2006], Covas [2006], and Meh and Quadrini [2006].

The key difference between models with and without investment risks is the structure of the demand for productive capital (investment). In the typical model with only earning risks, production takes place in a business sector through the production function  $Y = K^\alpha L^{1-\alpha}$ , where  $K$  is the input of capital and  $L$  is the input of labor. The production function is run by competitive firms that rent capital at the market price  $r$ , the interest rate, and labor at the market wage  $w$ . Ignoring for simplicity the depreciation of capital, equilibrium prices satisfy  $r = \alpha(K/L)^{\alpha-1}$  and  $w = (1 - \alpha)(K/L)^\alpha$ .

Usually the supply of labor is constant in these models. Therefore, without loss of generality we can set  $L = 1$ . Then the condition  $r = \alpha K^{\alpha-1}$  defines the demand for capital from firms as an inverse function of the interest rate as plotted in Figure 3.



**Fig. 3** Steady state equilibria with earning and investment risks.

The supply of capital comes from households as a result of their saving decisions. Savings are an increasing function of the interest rate. However, compared to the complete markets model, aggregate savings tend to be higher for each level of the interest rate because of the precautionary motive (the id-

iosyncratic shock cannot be perfectly insured). The supply of capital (savings) is also plotted in Figure 3. The straight line at  $1/\beta - 1$  is the supply of capital in a steady state with complete markets. With incomplete markets the supply is always below the straight line, that is, savings are higher for each level of the interest rate.

The intersection between the demand and supply of capital determines the general equilibrium. As the figure shows, the capital stock in the equilibrium with incomplete markets,  $K_1^{IM}$ , is bigger than the capital stock in the equilibrium with complete markets,  $K^{CM}$ . The opposite is true for the interest rates.

How does the modeling of entrepreneurs change the equilibrium? The key change is in the demand of capital. In this environment, production is carried out by individual entrepreneurs who are subject to uninsurable production (investment) risks. More specifically, the production function takes the form  $y = zk^{\alpha}l^{1-\alpha}$ , where  $z$  is an idiosyncratic productivity shock,  $k$  the individually chosen input of capital, and  $l$  the input of labor. The productivity or investment shock is observed after choosing  $k$  (and sometimes before choosing the input of labor  $l$ ).<sup>3</sup> Because the productivity shock cannot be perfectly insured, the entrepreneur faces a risk which increases with the scale of production. Therefore, the entrepreneur requires a (risk) premium to make the investment. The optimality condition for the input of capital can be written as  $r + p = \alpha(k/l)^{1-\alpha}$ , where  $p$  is the premium. This implies that, with uninsurable investment risks, the marginal productivity of capital is bigger than the interest rate.

The premium  $p$  may differ across entrepreneurs because, at any point in time, they are heterogeneous in net worth. However, for simplicity, let's assume that  $p$  is the same across all entrepreneurs. Then, given the normalization  $L = 1$ , the aggregate demand for capital can be written as  $r = \alpha K^{\alpha-1} - p$ . This function is located below the demand for capital in the economy without investment risks and the equilibrium is characterized by a lower stock of capital, denoted by  $K_2^{IM}$ .

As shown in Figure 3, the capital stock with uninsurable investment risks can be even lower than the capital stock with complete markets, that is,  $K^{CM}$ . However, this cannot be generalized as it depends on the specification of preferences and the relative importance of earning versus investment shocks. Ultimately, it depends on whether the precautionary motive of savings dominates the aversion to invest (due to the investment risk), as clearly illustrated in Angeletos [2007] and Angeletos and Calvet [2006]. This ambiguity explains why several studies reach contrasting results in terms of entrepreneurship and the aggregate accumulation of capital. However, independently of the conclusion in terms of aggregate savings, they all share the result that the distribution of wealth is much more concentrated when entrepreneurs are explicitly modeled.

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<sup>3</sup> Not all models discussed in this section are actually making this timing assumption. For example, Cagetti and DeNardi [2006] assume that  $k$ , which is the only input of production, is chosen after observing  $z$ .

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Although in most of the papers reviewed in this section the occupational choice is endogenous, this feature plays only a marginal role in generating the main results of these papers, that is, the different saving behavior between entrepreneurs and workers and the greater concentration of wealth. As emphasized above, what is key is not that personal wealth affects the decision to become an entrepreneur but, once the decision has been made, the scale of the business is constrained by the wealth of the entrepreneur. This constraint induces entrepreneurs to save more in order to speed up the growth of the business, and they accumulate much more wealth than workers. For that reason, the results of Hurst and Lusardi [2004] discussed in the previous section are of little relevance for the studies reviewed in this section. Generally, for most of the models reviewed here, the relation between entrepreneurship and wealth is positive but the slope is quite small. This point is illustrated in Cagetti and DeNardi [2006]. In cross-country studies this relation may become even flatter if there are heterogeneous entry costs. See Fonseca et al. [2007].

### 3 Economic development and growth

There is an extensive theoretical literature linking entrepreneurship to economic development and growth. A comprehensive review of all the contributions would be impossible to do in just one section of an article. Here I simply emphasize some of the most common results.

Some of the papers in this literature provide a formalization of the Schumpeterian idea of economic growth driven by entrepreneurial innovations (Schumpeter [1934]). Other papers, such as Schmitz [1989], formalize mechanisms that are different from the original idea of Schumpeter. But they all tend to have a common implication: policies or institutional reforms that encourage entrepreneurial activities lead to higher growth.

Some of the models are structured to generate endogenous long-run growth while in others the endogeneity of growth is only temporary. But in both types of models the typical property is that entrepreneurship enhances either the long-run ‘growth’ or the long-run ‘level’ of output. The first group of models emphasizes the role of entrepreneurship for promoting innovations that enhance the production frontier. The second group of models emphasizes higher investments or faster adoption of technologies bringing the economy closer to the world frontier.

Because entrepreneurship, either extensively (number of entrepreneurs) or intensively (activity of each entrepreneur), is affected by the availability of financing, many studies have focused on the role played by financial institutions or systems. A contribution along these lines is King and Levine [1993]. They show that more advanced financial systems provide a better evaluation of prospective entrepreneurs, a better mobilization of savings to finance the most productive activities, and a better diversification of risks associated with innovative activities. All of this leads to higher long-term growth.

Sometimes, the goal of these papers is not only to understand how entrepreneurship affects the process of development, but also to understand how the process of development relates to the evolution of income and/or wealth distribution. Examples of these studies are Aghion and Bolton [1997], Banerjee and Newman [1991, 1993], and Piketty [1997]. Because of capital-market imperfections, the distribution of income and/or wealth plays a central role in the growth of the economy. The main idea is that, if the distribution is very concentrated, only a few agents are able to invest in growth-enhancing activity and this reduces growth. The role of financial frictions is also central to the analysis of Castro et al. [2004].

An implication of these studies is that redistributive policies may have important consequences for economic development. For example, this is shown in Clemens and Heinemann [2006] and Ghatak et al. [2001]. The above studies are also related to the papers discussed in the previous section in the sense of showing how entrepreneurship can generate wealth inequality. The main difference, however, is that the papers discussed in the previous section are quantitative in nature. The main issue is not whether entrepreneurship generates more inequality. The question is whether they can match the inequality observed in the data. The papers I referenced above, instead, tend to be purely theoretical contributions. They provide important insights about the role of entrepreneurship for wealth concentration and growth, but the modeling structure is not well suited for structural applications aimed at addressing quantitative questions.

Subsequent studies, however, pushed the research in a more quantitative direction. An example is Erosa [2001]. The paper starts from the observation that the spread between the marginal product of capital and the return on financial assets is much higher in poor countries. This can be attributed to higher inefficiencies in the financial system of these countries. Using an occupational model with a costly intermediation of funds, Erosa shows that these inefficiencies have large macroeconomic consequences not only because they discourage capital accumulation but also because they affect the occupational choice.

A more recent contribution is Antunes et al. [2008]. They consider a model with two types of frictions: intermediation costs and financial contract enforcement. Differences across countries in intermediation costs and enforcement generate differences in occupational choice, firm size, output, and inequality. Using empirical estimates of these frictions, they evaluate the contribution to the economic performance of several countries in Latin American, Europe, and Asia.

Another study that tries to measure the importance of financial intermediation for economic development is Amaral and Quintin [2007]. They present a model where financial differences are generated by differences in the degree of contract enforcement. Lower enforceability of contracts reduces the capital directed at the production sector and the employment of more efficient technologies. The consequence is a sizable effect on aggregate output.

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Also noticeable are some contributions with specific application to Thailand. Gine and Townsend [2004] study the aggregate growth effects and the distributional consequences of financial liberalization from 1976 to 1996 using a general equilibrium occupational choice model. Jeong and Townsend [2007] measure the sources of total factor productivity (TFP) by developing a method of growth accounting based on an integrated use of transitional growth models and micro data. They decompose the sources of TFP growth into four factors: occupational-shift, financial-deepening, capital-heterogeneity, and sectoral-Solow-residuals. They find that 73 percent of TFP growth in Thailand between 1976 and 1996 is explained by occupational shifts and financial deepening.

Some recent studies address questions of relevance for economic development using the basic structure of the models reviewed in the previous section. Buera and Shin [2007] quantify the role of financial frictions in the dynamics of economic development. They show that financial frictions slow down the transition to the steady state, especially when capital is misallocated initially. Growth-enhancing reforms may then be desirable.

Another interesting study addressing issues of economic development is Buera et al. [2007]. One of the motivations is the observation that the price of tradable goods in developing countries, relative to non-tradable, are much higher than in industrialized countries. This must derive from the lower productivity of the tradable sector of developing countries compared to the productivity of the non-tradable sector.

Buera et al. [2007] use a computable entrepreneurial model to show that financial frictions contribute significantly to this finding. Because the size of the investment is larger in the tradable sector, the tighter constraints in developing countries generate a greater misallocation of talents in this sector, leading to lower productivity. In short, the impact of financial constraints is to select entrepreneurs among the richer agents, not among the most talented. The fact that in developing countries the scale of businesses is smaller and there is a larger percentage of family-controlled businesses supports the theory. See also Caselli and Gennaioli [2005].

The recent attempt to use quantitative entrepreneurial models to study issues of economic development is a promising avenue of research and I expect more work to be done in this area.

## 4 Conclusion

In this article I have discussed some of the entrepreneurial studies conducted during the last 20 years that are important for understanding issues of macroeconomic relevance. I have first reviewed those focusing on the factors affecting the occupational choice to become an entrepreneur with special attention to financial factors. Although the methodological approach of these studies is essentially micro, their findings are of relevance for macroeconomic studies as they impose some restrictions on the modeling of entrepreneurship.

The second group of studies looks at the importance of entrepreneurship for savings, investment, and the distribution of wealth. One of the main findings is that entrepreneurship can generate a much stronger concentration of wealth, very similar to the concentration we observe in the data. Some of these studies have also conducted normative analysis, looking at the implications of certain policies on investment, savings, and wealth distribution.

The third group of studies focuses on economic development and growth. Many of these studies are theoretical contributions. However, the more recent direction of research has emphasized the quantitative relevance of entrepreneurship for explaining several issues related to economic development.

Most of the quantitative applications are based on the calibration of these models instead of their estimation. This is because the complexity of these models requires intensive computational techniques that are not very practical for estimation. However, as the speed of computer processing increases, it is likely that formal estimation techniques will be applied. This would be especially useful because some of the parameters of these models cannot be easily pinned down using aggregate steady state targets. The estimation would also be useful for identifying the various sources of idiosyncratic uncertainty (for example, wage uncertainty versus entrepreneurial uncertainty) in an integrated framework instead of calibrating them using estimates from independent and unrelated studies.

The review conducted in this article is by no means complete. Of course, there are many other valuable studies looking at the issue of entrepreneurship from other points of view. For example, there are many contributions that emphasize the business, sociological, and strategic aspects of entrepreneurship. My review has been limited to studies with the greatest implications for the field of macroeconomics. Although this particular set of entrepreneurial studies has already been productive, I expect many more contributions in the near future, such as new studies that use computable general equilibrium models to address quantitative questions.

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