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ABSTRACT

The Decision to Become an Entrepreneur and the Firm Size Distribution: A Unifying Framework for Policy Analysis*

Developing and emerging economies have high entrepreneurship rates and relatively many small firms. There is enormous heterogeneity among these firms and entrepreneurs. This paper presents a simple occupational choice model that captures motives for entrepreneurship at both edges of the size distribution. The model is then used to analyse the effects of productivity growth, distortions, financial and labor market frictions, and risk. Capturing entrepreneurship across the size distribution allows for different reactions of high- and low-ability entrepreneurs to changes in policies and the environment. These may result in powerful general equilibrium effects. In particular, policies affecting high-ability entrepreneurs potentially running large firms can indirectly have a strong effect on entry by low-ability entrepreneurs and thus on the prevalence of small firms.

JEL Classification: J24, L26, O11, O17

Keywords: entrepreneurship, firm entry and exit, development, labor market regulation

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1 Introduction

Entrepreneurs commercialize new business ideas and thereby undoubtedly make an important contribution to aggregate economic growth and employment. Yet, they do not all do so to the same extent: a closer look reveals that entrepreneurs and the firms they run are highly heterogeneous. For example, Hsieh and Klenow (2009) show that the ratio of productivity between manufacturing establishments in the 90th and the 10th percentile of the productivity distribution in the United States is larger than 2, and substantially larger than that in China and India.[1] These large differences imply that not all firms, and thus not all entrepreneurs, are equally important for aggregate outcomes.

Large firms account for the bulk of employment virtually everywhere. For instance, in the U.S., the 5% largest firms accounted for more than 75% of employment in 2010.[2] In Mexico, the 10% largest firms account for 70% of employment (Bartelsman, Haltiwanger and Scarpetta 2009, Table 6), and in Thailand, the 2.25% largest for 48% (Wiboonchutikula 2002). Typically, these are the most productive firms in the economy.

At the same time, most firms everywhere are small. In the U.S., more than 60% of firms with employees had less than 5 employees in 2010 (SUSB). Smaller firms typically have low productivity and contribute less to employment growth (Haltiwanger, Jarmin and Miranda forthcoming). Even so, they are there to stay: Bartelsman, Scarpetta and Schivardi (2003, Figure 6) show that the effect of size on the probability of exit is small once age is controlled for. Poschke (2013*a*) shows that even people who engage in a small business "because they have no better opportunity" are not much more likely to

[1] Note also that for data availability reasons, Hsieh and Klenow (2009) are forced to drop a large fraction of manufacturing establishments. Since these are mostly small ones with less than 10 employees, their reported figure understates dispersion in the entire distribution.

[2] Source: Statistics of U.S. Businesses (SUSB), from the Small Business Administration Office of Advocacy. Data publicly available at `http://www.sba.gov/advocacy/849/12162`.

exit than others, except when their business is very young.

Of course, large firms tend to start small, and therefore some small firms turn out to be important for aggregate growth. For instance, Foster, Haltiwanger and Krizan (2001, 2006) show that entry and exit of firms contribute a quarter of growth over a five-year horizon in U.S. manufacturing, and account for virtually all of it in the U.S. retail sector. More specifically, as shown by Haltiwanger et al. (forthcoming), it is young, small firms, not small firms generally, that in an "up or out" process have a chance to experience substantial growth and to turn into large firms. For the remainder, the statement by Hurst and Pugsley (2011) based on a variety of U.S. data sources applies: "Most small businesses do not want to grow or innovate." Schoar (2010, p. 59) comes to a similar conclusion: "Recent evidence suggests that not only are the people engaging in these two types of entrepreneurship very distinct in nature but also that only a negligible fraction of entrepreneurs transition from one type to the other."

This pronounced heterogeneity of firms is a particular concern in developing, emerging, and transition economies, as small firms are more prevalent in poorer countries. This is clearly evident in Figure 1, which is taken from Poschke (2011). Gollin (2007) provides related evidence that the share of self-employment in the labor force is higher in poorer countries. At the same time, policy makers in these countries worry about a lack of labor demand from larger firms. It is thus important to understand the sources of differences in the firm size distribution across countries, with their potential repercussions for aggregate employment and output.

To address this issue, this paper provides a simple theory of the firm size distribution based on occupational choice between employment and entrepreneurship and uses this framework to analyse how a variety of environmental and policy factors may affect the firm size distribution. The framework, which is intentionally kept very simple, captures key differences between factors that drive highly able entrepreneurs to start large firms,

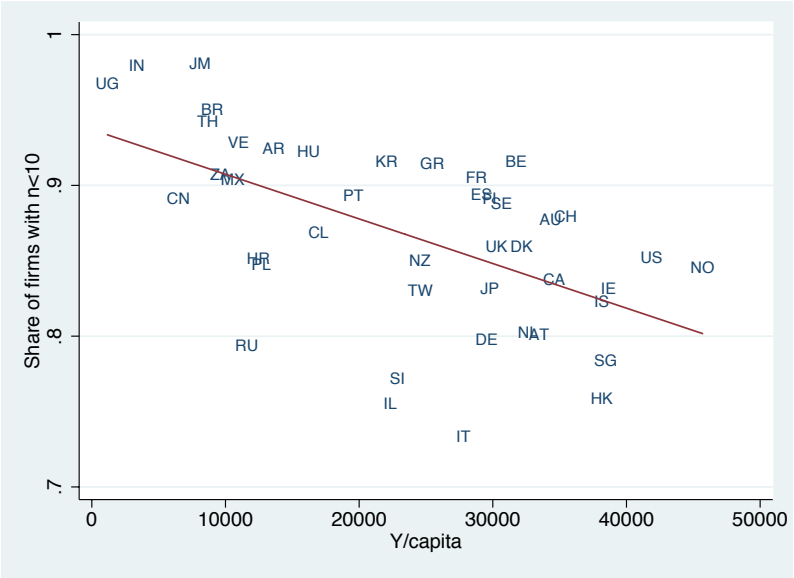

Figure 1: The share of small firms across countries

Notes: Real GPD per capita for 2005 at purchasing power parity from the Penn World Tables (Summers and Heston 1991, Heston, Summers and Aten 2009); data on the size distribution from the Global Entrepreneurship Monitor (GEM), `http://www.gemconsortium.org`. The regression line plotted in the figure is significant at the 5% level.

and those that drive some people into operating small firms or even into subsistence self-employment at the other end of the spectrum. It is geared towards providing illustrative results on what kind of features of the environment and policy can affect the firm size distribution, in particular the prevalence of large and small firms, as a guide for policy analysis and empirical work.

The framework (presented in Section 3) is a simple model of choice between employment and entrepreneurship. Individuals differ in working ability and entrepreneurial ability. For simplicity, I assume that entrepreneurial ability is a deterministic, increasing function of working ability. (This is easy to relax, at the cost of a loss of tractability.) Entrepreneurs choose their size of operation, employ workers, and claim profits.[3] The

[3]Almost every paper in the literature on entrepreneurship contains a debate about measurement. For this paper, the key characteristic of entrepreneurs is that they are residual claimants. The self-employed or small-business owners obviously are such. While some of the large firms entering the data just cited are public and not run by an entrepreneur anymore, they usually were so at some time and therefore are not excluded from the analysis.

setup is specifically designed to be consistent with some demographic features distinguishing employees and two types of entrepreneurs in the data. This evidence is briefly discussed in Section 2. Section 4 uses the model to analyse the effects of productivity changes, taxes and distortions, financial and labor market frictions, and income risk on occupational choice and the size distribution.

The theory is particularly useful for two reasons. Firstly, it takes into account how small and large firms may react differently to environmental features and policy interventions. This is often ignored, but is of course key for aggregate outcomes. For example, consider tax-financed entry subsidies for the unemployed. These are often thought to promote entrepreneurship. As Schoar (2010, p. 59) argues, the reason is that "instead of recognizing the existence of these very different types of entrepreneurs, many current approaches to development policy implicitly or even explicitly assume that subsistence entrepreneurship is the first step toward transformational entrepreneurship." In fact, the model suggests that it is entirely possible that such subsidies lead to more entry of small firms, less entry of large firms (because of the tax burden), lower labor demand at given wages, and a "worse" firm size distribution. Therefore, while entry subsidies may provide some insurance to the unemployed, it is not obvious that they are helpful for the long-run economic well-being of low-income individuals. Well-intended policies can easily backfire, and heterogeneity makes it more difficult to realise this.

Secondly, the theory is useful because it shows that general equilibrium effects can be important. These are often neglected when individual policies are discussed. The key link here is that policies affecting high-productivity firms indirectly affect low-productivity firms and low-income individuals, too, since they affect labor demand by large firms, and thus wages. Policies intended to "help" the self-employed or entrepreneurs running small firms, in contrast, are not necessarily the optimal policies for helping these individuals; improving their outside option in the labor market may well

be more valuable.

Despite the staggering heterogeneity of entrepreneurs in the data, there are very few theories that can accommodate small and large firms at the same time. The burgeoning recent literature on firm heterogeneity in macroeconomics building on Hopenhayn (1992) often focusses on heterogeneity of firms above a certain size. These models thus are not well-suited for capturing the motivations of the subsistence self-employed in poor countries, or even of many entrepreneurs running small firms more broadly. Some exceptions are Jovanovic (1994), Astebro, Chen and Thompson (2011), Ohyama (2012) and Poschke (2011, 2013*b*). (The theory presented here draws particularly strongly on the latter.) However, these papers largely concentrate on explaining the coexistence of very heterogeneous entrepreneurs and, unlike this paper, do not focus on the effects of policies and environmental features.

2 Entrepreneurs are very heterogeneous

2.1 Characteristics of entrepreneurs and employees

It is well known that the dispersion of income among entrepreneurs is much larger than that among employees. For instance, Hamilton (2000, Table 3) shows that the standard deviation of earnings is about twice as large for entrepreneurs as for employees in U.S. data from the Survey of Income and Program Participation (SIPP). The ratio between earnings at the 75th and the 25th percentile of the earnings distribution for each group is at least 50% larger for entrepreneurs compared to employees. Qualitatively similar results have been shown in the 1980 U.S. Census (Borjas and Bronars 1989) and in the U.S. Survey of Consumer Finances (Cagetti and De Nardi 2006).

Recent work demonstrates that income is not the only characteristic that is more dispersed among entrepreneurs. The pattern also holds for education – a demographic

that can proxy for ability and is a likely determinant of the occupational choice – and for consumption.

For instance, Gindling and Newhouse (2012) divide entrepreneurs into employers and own-account workers, and then compare average educational attainment within these groups to that for employees, using household data from 98 countries. Figure 2 illustrates their finding that in the entire sample as well as within country income categories, entrepreneurs are at the extremes of the education distribution: employers have relatively high education, and own-account workers relatively low attainment. Employees lie in the middle. The authors also show that a similar pattern holds for household income and consumption.

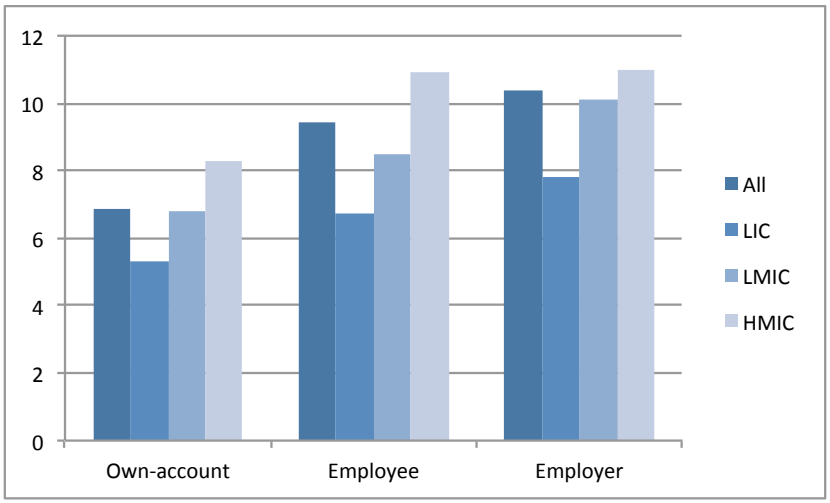

Figure 2: Years of schooling by entrepreneurial choice

Source: Gindling and Newhouse (2012), Table 5. Computed from household level surveys made comparable in the World Bank's International Income Distribution Database (I2D2) project. Not reported here are education levels for non-paid employees, the unemployed, and agricultural workers. LIC: low-income economies, LMIC: lower-middle-income economies, HMIC: upper-middle-income economies, all according to the World Bank's classification.

Poschke (2013*b*) shows related evidence indicating that in U.S. National Longitudinal Survey of Youth (NLSY) data, individuals with high or low education are more likely to be entrepreneurs than individuals with intermediate education. That paper

also summarizes similar findings from the literature for several other countries and data sources. It also shows that another ability proxy, the average wage in previous employment, plays a similar role: individuals with relatively high or low wages in previous employment are more likely to be or to become entrepreneurs.

Previous work reported similar results for some specific countries. A key paper is De Mel, McKenzie and Woodruff (2010). These authors document a similar education-entrepreneurship pattern in Sri Lanka not only for the individual's schooling, but also for that of their fathers and mothers. They also report that in several tests of cognitive ability, own-account workers score lowest and employers highest, with employees coming in in the middle. In terms of other variables, like parents' income and wealth and psychological variables like risk aversion, desire of achievement etc., patterns are much more mixed. Gluzmann, Jaume and Gasparini (2012) conduct a similar analysis for 18 Latin American countries. They report a similar pattern in completion of secondary school for all but five of these countries. (In those five, employees on average have more schooling than both employers and own account workers.) For all countries except Chile, they also find the pattern for a comparison of average and median income across groups. Berniell (2012) also finds the education pattern in a different survey of households across major cities in Latin America.[4] Besides education, the pattern also holds for income, wealth (measured as size of the home), and parents' education and wealth.

Finally, De Mel et al. (2010) also perform a "species classification" exercise using discriminant analysis. They first show that demographics like age, gender and education, combined with ability measures, family background variables and measures of attitudes allow them to predict whether someone is an employer or an employee with an almost 80% success rate (compared to the 50% success rate of a random procedure).

[4]The data set is a new survey run by the CAF, the Development Bank of Latin American. Berniell (2012) compares employers with at least 3 employees with formal sector workers and non-professional own-account workers.

Almost all the power comes from demographic variables including education. They then show that in terms of these characteristics, own account workers are much more similar to employees than to employers. Berniell (2012) obtains similar results using Latin American data. This is, of course, fully in line with results above, which showed that in terms of education, own-account workers are far removed from employers and more similar to workers.

Results on firm size dynamics reinforce the role education has been found to play here. It is well known that education is strongly correlated with entrepreneurial income (see e.g. the surveys by van der Sluis, van Praag and Vijverberg 2005, 2008). De Mel et al. (2010) also show that in their data, own-account workers with higher ability measures are more likely to add employees and become employers. This is in line with the general importance of education for success, and with findings in Poschke (2013*a*) that entrepreneurs who claim to be pursuing an opportunity have higher growth expectations than "necessity entrepreneurs". Finally, transitions among the two types of entrepreneurs are rare. For instance, Mondragón-Vélez and Peña (2010) show that in Colombia, it is much more likely for the self-employed to become wage earners or unemployed than to grow their business substantially. Gluzmann et al. (2012) find a similar result for Argentina, Brazil and Chile.

These results reveal a systematic pattern: Dividing entrepreneurs into two groups using characteristics of their enterprise (for example employers versus non-employers) reveals that proxies of their ability, like education, bracket those of employees. This is also true for their income. This pattern has several implications: Firstly, while higher education contributes to success as an entrepreneur, it does not necessarily strongly affect the propensity to be an entrepreneur. Therefore, studies with a broad sample of entrepreneurs should not be expected to find strong effects of linear measures of

education on the propensity to enter.[5] Secondly, there are large, persistent differences between different entrepreneurs. Policy analysis must take this into account. While constraints may prevent some firms from growing, not all small firms are small because of constraints – some will never be large and may well be at their optimal size, given the owner's ability and the quality of the business idea.

Moreover, the different educational profiles of own-account workers, employees and employers imply substantial differences in labor market opportunities among these groups. This has consequences for entrepreneurial choice. For a theory of occupational choice between employment and entrepreneurship to do justice to the heterogeneity in the data, it is thus necessary to take into account the heterogeneity of returns in both entrepreneurship and potential employment.

The theory presented next does exactly this. It is designed to reflect the occupational choice patterns in the data presented in this section, with relatively high education/ability individuals choosing entrepreneurship and earning high incomes, relatively low education/ability individuals making the same choice, but running small firms and earning low incomes, and individuals with intermediate levels of education/ability choosing employment.

2.2 From data to theory

How can a model account for the peculiar pattern of ability among entrepreneurs? Consider a population that is heterogeneous in "ability", as proxied e.g. by educational attainment. Clearly, it must be that the value of choosing entrepreneurship exceeds that of choosing employment at the top and bottom of the ability distribution, and is

[5] Of course, this may be different for samples that are skewed, either because of omission of the top (e.g. because they are classified as employees – owner-managers of incorporated firms are employees of their own firm) or at the bottom. Non-linear controls for education can uncover the pattern, as in Poschke (2013*b*).

inferior in the middle of the distribution.[6]

It is not surprising that high-ability agents are more likely than average to run firms. Of course, these agents would also earn relatively high wages in employment. Yet, to the extent that their skills in employment are also valuable in entrepreneurship, as entrepreneurs they can leverage them: The value of a great entrepreneurial idea or of great management skills can be spread across inputs used in the firm, and thereby "augments" these inputs. This is captured naturally in settings with production functions where the entrepreneur's ability multiplies a function of inputs to the production process, as commonly used in the quantitative literature on entrepreneurship and in the literature on firm heterogeneity in macroeconomics. The insight that in such a setting, more able individuals will opt for entrepreneurship goes back at least to the seminal paper by Lucas (1978).[7]

In the perspective of this literature, it is harder to see why low-ability individuals would choose entrepreneurship. Previous work has hypothesised that they may simply like the independence of running their own business (see e.g. Hamilton 2000). While there may well be some of this, it is unclear why taste for independence should be more pronounced at the bottom of the ability distribution. It may also be that entrepreneurship or self-employment serves as insurance, for example after job loss and in situations where finding employment takes a long time. This may be an important factor in particular in countries with highly frictional labor markets. At the same time, this does not provide a strong explanation for why many low-skill individuals persist

[6]In the data, there are no "sharp" cutoffs, in the sense of two education cutoffs perfectly determining the occupational choice. This suggests that the presence of additional heterogeneity, e.g. in tastes for entrepreneurship. While the main analysis abstracts from this for simplicity, it is easy to accommodate, as discussed below.

[7]The pattern of selection is similar in other theoretical work on determinants of entrepreneurship, e.g. Calvo and Wellisz (1980), Evans and Jovanovic (1989) or Holmes and Schmitz (1990), and also in the recent literature on firm dynamics that incorporates occupational choice (Cagetti and De Nardi 2006, Buera, Kaboski and Shin 2011): The most skilled potential entrepreneurs choose that activity (if constraints allow them to do so). Gollin (2007) explicitly models self-employment, with similar results.

in entrepreneurship for a long time. When for instance a survey respondent in the Global Entrepreneurship Monitor survey says that he/she chose entrepreneurship because no better opportunities were available, this may indicate a more permanent lack of opportunities than just problems due to a current spell of unemployment.

It may thus simply be that entrepreneurship yields a higher return than employment for some low-ability individuals – making their motivation the same as that at the other end of the spectrum. Some recent papers have proposed some potential reasons for this. The first candidate is technology, which drives entrepreneurship by low-ability agents in Poschke (2011) and Ohyama (2012). Key here is a lower bound to returns to self-employment that exceeds the lower bound on wage income. This could arise, for example, if coordination or monitoring costs are sufficiently high. Secondly, Poschke (2013*b*) considers a setup where entrepreneurship, unlike employment, gives individuals the opportunity to find their optimal market niche. Agents with worse outside options have a lower cost of searching for that niche and are thus more likely to choose entrepreneurship. Finally, Astebro et al. (2011) propose an explanation driven by mismatch. In their model, complementarities in production imply that the quality of the match between a firm and its workers matters, and mismatched workers earn less. If workers with high or low ability are more likely to be mismatched, they will be more likely to "opt out" and strike out on their own as entrepreneurs.

For the purposes of the present paper, I abstract from the exact source that drives selection of entrepreneurs from the extremes, and rely on a simple technological driver that keeps expressions tractable.[8]

[8]This implies potentially ignoring some additional channels like for example the impact of financial frictions on the search for the optimal market niche. In most cases, these should be secondary to the first-order effects discussed in the text below.

3 A simple model of occupational choice between employment and entrepreneurship

This section summarises a simple model of occupational choice by heterogeneous agents. Some more formal detail is provided in the Appendix.

Consider an economy consisting of a continuum of individuals who differ in ability a. Ability refers to the amount of efficiency units of labor an individual can supply as an employee. It is known by the individual and by potential employers. Let its distribution in the population be $f(a)$. With competitive labor markets, an individual's potential labor income is simply ability a times the wage rate w. The wage rate is endogenous and determined by labor market clearing in general equilibrium.

Firms produce a homogenous good y using capital k and labor n. Because of limited span of control of the entrepreneur, returns to scale to capital and labor jointly are decreasing. Output also depends on aggregate productivity z and on the owner's entrepreneurial ability s. Concretely, assume that

$$y = zs(n^{\alpha}k^{1-\alpha})^{\gamma}, \alpha, \gamma \in (0,1). \tag{1}$$

Firms choose capital and labor optimally, given factor prices r and w. These are both endogenous: The interest rate r is determined by household saving behaviour. Abstracting from long-run growth and risk, it equals households' common rate of time preference in steady state. The wage rate w is determined by labor market clearing, where aggregate labor demand and supply both depend on occupational choices. This is because occupational choices determine the quantity and ability of employees and the quantity and productivity of employers.

Since entrepreneurial ability s enters the production function multiplicatively, factor

demands, output and profit of a firm all are increasing, convex functions of s. Intuitively, this occurs for the following reason: consider a firm using a certain amount of inputs. Raising the ability of the entrepreneur running that firm by 1% increases output of the firm by 1% without changing inputs. Yet, a more able entrepreneur optimally chooses to use more inputs. This leads to an output increase of more than 1%. With the production function above, profits $\pi(s)$ are a constant fraction of output and therefore increase by the same proportion. As a consequence, profits are a convex function of s.

Occupational choice outcomes depend on the shapes of $\pi(s)$ and wa, and on the relationship between a and s. A higher propensity for entrepreneurship at the extremes of the wage or education distribution arises if profits exceed earnings in that range. The evidence cited above suggests that s and a are positively related across individuals. To match both empirical patterns, assume that s is a function of a, $s(a)$, with $s(0) > 0$ and $s' > 0$. To ensure entrepreneurship at the top, also assume that $s(a)$ is not too concave.[9]

Under these assumptions, the payoff to working is linear in a, while that to entrepreneurship is increasing and convex in a. Figure 3 shows the payoffs to the two activities as functions of a. The figure is drawn for the case that matches the patterns in the data: the payoff functions intersect twice, at a_L and a_H. Individuals with $a < a_L$ or $a > a_H$ become entrepreneurs, and those with intermediate a become employees.[10] High-a individuals become entrepreneurs because of the possibility to leverage their ability by expanding inputs, or the positive impact of entrepreneurial ability on the marginal product of the firm's inputs. Low-a individuals become entrepreneurs be-

[9]More precisely, the required assumption is $s''(a)/s'(a) > -\frac{\gamma}{1-\gamma}s'(a)/s(a)$. If s is a constant elasticity function of a with elasticity x, i.e. $s = a^x$, this corresponds to $x > 1 - \gamma$. Evidence on the profit share suggests that γ is between 0.8 and 0.9, implying that the assumption is not very restrictive, as only very concave $s(a)$ (x below 0.1–0.2) are ruled out.

[10]In principle, it is also possible that only one intersection at a_H exists. This could occur e.g. if the domain of a is such that for the lowest a in the population, $wa > \pi(s(a))$. The case without any intersection cannot be an equilibrium: if everyone became an entrepreneur, there would be no employees for entrepreneurs to employ, and the labor market would not clear.

cause entrepreneurial income is bounded below at a higher level than earnings from employment.

This selection pattern is unaffected by taste heterogeneity – a factor that has been stressed in the recent literature on entrepreneurship (see e.g. Hamilton 2000, Hurst and Pugsley 2011) – if preferences are uncorrelated with ability. In that case, the profit curve plotted in Figure 3 is the relevant one for someone with neutral attitudes towards entrepreneurship, and needs to be shifted up or down in line with attitudes. The ability thresholds similarly are the relevant ones for someone with neutral attitudes. Due to preference heterogeneity, at each level of ability, some agents choose entrepreneurship and others do not. However, at the extremes, only agents with a severe dislike for entrepreneurship will not choose it, whereas in the middle, only those who like it most will opt for it. For simplicity, the remainder abstracts from taste heterogeneity, but it is clear that allowing for it would not affect results much: instead of moving sharp occupational choice cutoffs, changes in the returns to entrepreneurship and employment then simply affect the proportion of agents at each a that chooses entrepreneurship.

The values of entrepreneurship and of employment and thus the thresholds depend mainly on the key endogenous variable, the wage rate w. This in turn is a function of the output-weighted average productivity of active firms. Denote this by $\bar{s}$. Increases in $\bar{s}$ or in the number of firms, M, raise labor demand and the wage, and thus imply that the value of employment pivots up and that of entrepreneurship down, resulting in lower a_L and higher a_H. Increases in labor supply affect the wage in the opposite way and thus move the thresholds in the opposite direction.

In equilibrium, the labor market clears, and individuals with ability a_L or a_H are indifferent between employment and entrepreneurship. Figure 4 represents equilibrium M and w as the intersection between a free entry condition (labelled FEC) and a labor market clearing condition (LM) in (M, w)-space. The free entry condition $\pi(a_x) =$

wa_x, $x = L, H$, states that the marginal entrepreneurs with $a = a_L$ or $a = a_H$ are indifferent between entrepreneurship and employment. Higher w implies that fewer people choose entrepreneurship, resulting in lower M. The FEC thus implies a negative relationship between M and w. The labor market clearing condition requires that labor demand equal labor supply. Because a larger number of firms raises labor demand, it requires a higher wage for the labor market to clear, implying a positive relationship between M and w.

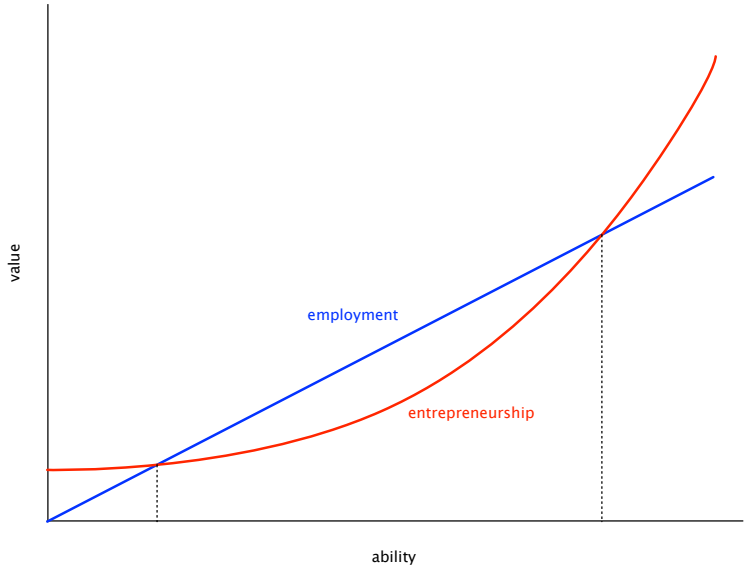

Figure 3: The values of employment (blue) and entrepreneurship (red)

In this setting, policies or features of the economic environment affect the values of entrepreneurship and of employment and therefore also affect the ability thresholds at which the optimal occupational choice switches. This, in turn, results in changes in labor demand and supply, and thus the wage rate and the measure of active firms. The next section explores the effects of various such policies.

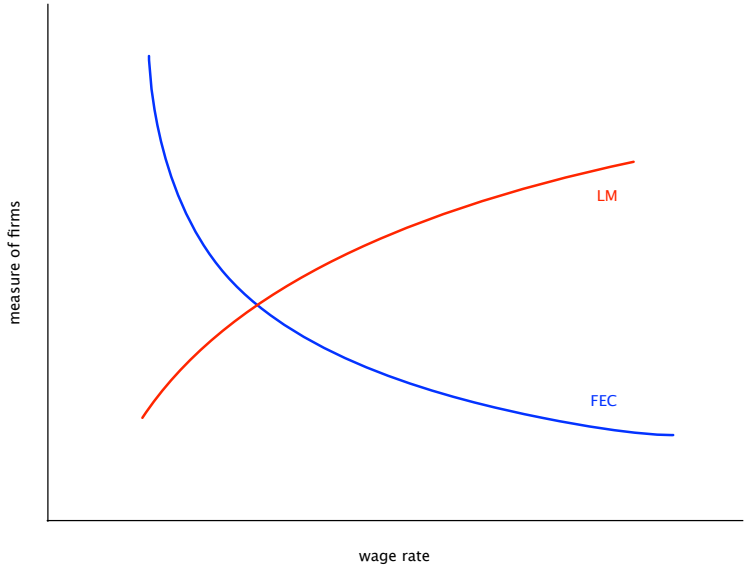

Figure 4: The determination of w and M

4 Environmental and policy determinants of entrepreneurial choice

There are a myriad features of the economic environment or policies that may affect entrepreneurial choice. This section discusses a few key features that have been topics of recent academic or policy discussion. Some of them can be modelled directly, whereas others can only be "approximated" without complicating the model much. Throughout, the focus will be on predictions of the model that arise from general equilibrium effects and from interactions across skill groups.

The first part of the section is concerned with factors that appear to primarily affect profits, like productivity shocks or taxes, but that turn out to have important general equilibrium effects. The second part presents some simple ways of rendering the effect of frictions, and the third part treats the effect of risk.

4.1 Factors affecting profits

It is important to realise that in general equilibrium, factors affecting profits also affect wages, and thus may alter both the value of entrepreneurship and that of employment. An excellent example of this is the effect of changes in aggregate productivity.

Aggregate productivity. Shocks to aggregate productivity affect profits and therefore the value of entrepreneurship. Their effect on occupational choice also depends on their effect on wages. Consider a negative shock to aggregate productivity. It reduces not only entrepreneurs' profits, but also their demand for inputs, including the demand for labor. Reduced labor demand, in turn, depresses wages. How large is this effect? If the production function exhibits constant elasticity of output with respect to labor and entrepreneurial ability – standard assumptions satisfied by the production function (1) – wages fall by exactly the same proportion as profits.[11] The outcome is illustrated in Figure 5. Since values of both activities fall by the same proportion, people who were indifferent between the two activities are still indifferent after the shock, and occupational choices do not change.

The outcome is different when wages are rigid. If wages fluctuate less than profits over the business cycle, e.g. because they are rigid downward or because firms offer implicit contracts including insurance against wage fluctuations (see e.g. Beaudry and DiNardo 1991), the payoff to entrepreneurship falls more in a recession than the return to working. As a consequence, a negative aggregate productivity shock reduces a_L and raises a_H, and there is less entry by entrepreneurs in recessions.

Note that uniform taxes on firm output, or distortions affecting all firms equally, have exactly the same effect as shocks to aggregate productivity. While taxes on firms

[11] If the production function exhibits constant elasticity with respect to labor and entrepreneurial ability and input markets are competitive, the fractions of output that go to employees and to the entrepreneur are constant. Then, both are hit equally by the reduction in output due to the shock.

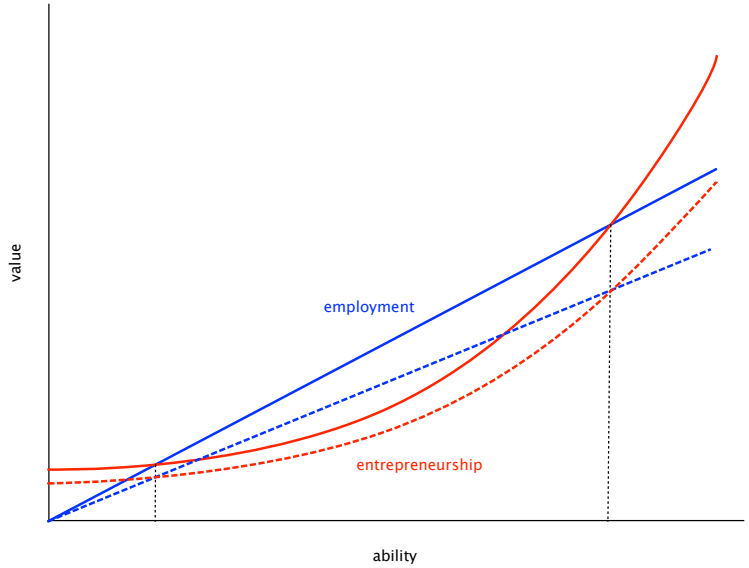

Figure 5: The values of employment (blue) and entrepreneurship (red) before (solid line) and after (broken line) a negative shock to aggregate productivity

reduce entrepreneurs' income, they also reduce wages. Taxes may however affect the productivity distribution if they do not affect all firms in the same way, as shown below.

Long-run growth. The result just shown – independence of the firm size distribution from aggregate productivity – is not consistent with patterns in cross-country data. Figure 1 showed that the fraction of smaller firms is systematically lower in richer, more productive economies. Self-employment rates are also lower in richer countries (Gollin 2007). In addition, Lucas (1978) has pointed out that average employment per firm has increased over time in the U.S. economy. This trend has continued more recently, as is evident in Business Dynamics Statistics (BDS) data (Poschke 2011). The counterpart of an increase in workers per firm is, of course, a decline in the number of firms per worker. Hence, long-run productivity growth or productivity differences across countries do appear to be related to differences in occupational choice. This suggests that their effect on occupational choice is different from the effect of productivity shocks.

Poschke (2011) shows that a theory where more able entrepreneurs benefit more from technological improvements can match how the firm size distribution varies with income per capita across countries. Such a setup is in line with results from Bloom, Sadun and Van Reenen (2012), who find that establishments run by U.S. multinationals in the UK are not only more productive than other establishments there, but have also reaped higher returns to investing in the new technology of IT. Figure 6 illustrates the effect of long-run economic growth in such a scenario: While labor earnings increase with productivity growth at all ability levels, potential profits increase for high-ability entrepreneurs but fall for low-ability entrepreneurs. The reason is that for the latter, the benefit from higher productivity is more than outweighed by the burden of higher wages. As a consequence, the threshold a_L drops with aggregate productivity growth.

How do changes in the thresholds translate into changes in average productivity? In general, raising a_L (a_H) while keeping a_H (a_L) constant implies that productivity of the average firm decreases (increases). If the thresholds move in opposite directions by the same amount, it is plausible that the effect of the change in a_L dominates, as the density of the ability distribution is likely to be larger at a_L than at a_H. By reducing a_L, long-run growth thus reduces the fraction of entrepreneurs running small firms and raises employment in large firms. This corresponds exactly to changes in entrepreneurship and the firm size distribution that occur with development. Poschke (2011) shows that such a theory provides a good quantitative fit to changes in the firm size distribution with development both across countries and in the U.S. over time.[12]

[12]The upper threshold a_H may increase or fall in reaction to productivity growth. Denote by $\tilde{a}$ the unique level of a at which the elasticities of profits and labor earnings with respect to aggregate productivity are equal. Profits increase proportionally more (less) with productivity growth above (below) $\tilde{a}$. In empirically reasonable settings, $\tilde{a}$ is always larger than a_L, but it could be larger or smaller than a_H. Moreover, continuing growth raises $\tilde{a}$ and ultimately drives it above a_H.

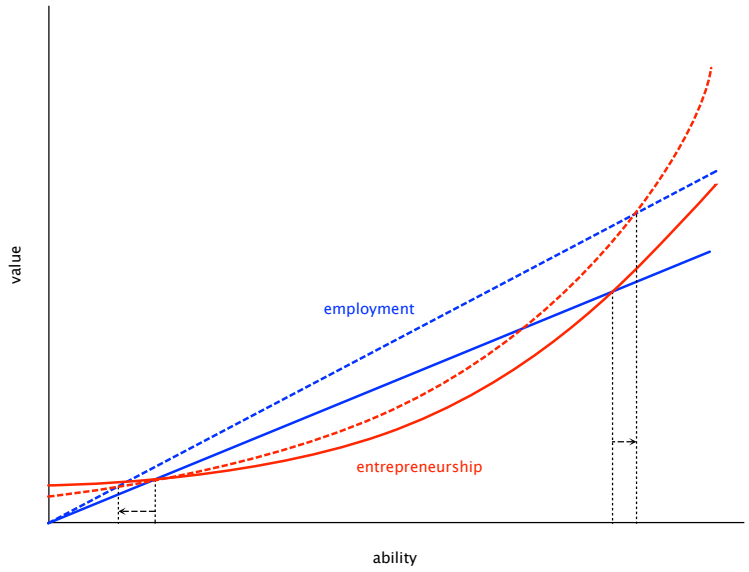

Figure 6: The values of employment (blue) and entrepreneurship (red) when long-run growth benefits more able entrepreneurs more (solid line: initial situation, broken line: the effect of growth)

Size-related taxes and distortions. Not only growth may affect different potential entrepreneurs differently. Regulation may do the same. There are many rules and regulations that apply only to firms above a certain size, or that are enforced more strictly for larger firms. For example, in many countries, labor market regulation only affects firms above a certain size threshold. One such case is Italy, where for a long time firing restrictions were much stricter for firms with more than 15 employees (Schivardi and Torrini 2008). In India, a "growth tax" applied to revenue beyond a certain level (Little, Mazumdar and Page 1987). More examples and a quantitative analysis are provided in Guner, Ventura and Xu (2008) and Restuccia and Rogerson (2008). Following these authors, it is convenient to conceptualize such differences in regulation as size- or productivity-dependent taxes: the higher regulatory burden implies additional costs for more productive firms, which have a similar effect to higher taxes.[13]

[13]Larger firms also face stricter enforcement of payment of non-wage benefits to workers. Whether this constitutes an asymmetric distortion depends on whether wages adjust to ensure that total compensation does not change with enforcement. Almeida and Carneiro (2011) provide evidence on this

Differences in tax rates by productivity clearly affect occupational choice.[14] Their effect is exactly the inverse of the previous case, so again refer to Figure 6, where now, the broken lines can be thought of as the value of entrepreneurship and employment without productivity-dependent taxes, and the solid lines as the value with such taxes. Productivity-dependent taxes clearly reduce the value of entrepreneurship to highly able entrepreneurs. For occupational choice, their general equilibrium effects are key: high tax rates on highly productive firms imply a substantial reduction in labor demand and thus in the wage rate. Less productive entrepreneurs may benefit more from this wage reduction than they suffer from the tax, which is low for them. As a consequence, entrepreneurship by agents with a just above a_L is encouraged, and the lower threshold a_L shifts up. At the other end of the spectrum, the threshold a_H may shift up or down, as discussed in footnote 12. Overall, higher taxes on more productive firms imply less employment in large firms, and in many cases also a larger share of small firms.

4.2 Financial and labor market frictions

Frictions to the efficient functioning of markets are a concern everywhere, and may pose particularly large problems in emerging and developing economies. There are large literatures analyzing the effect of financial frictions on the efficiency of the allocation of factors across firms, and of labor market frictions on unemployment and informal employment. Clearly, frictions also affect occupational choice. This section provides some illustrative arguments about the likely effect of financial and labor market frictions in this context, leaving a full analysis of the model with frictions for future work.

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mechanism using Brazilian data.

[14] They could also contribute to the existence of the informal sector, along the lines of Rauch (1991). It should be noted that the effects of productivity-dependent taxes go beyond their implications for occupational choice. They also reduce aggregate productivity by reducing the efficiency of resource allocation (Guner et al. 2008, Restuccia and Rogerson 2008) and discourage innovation (Gabler and Poschke 2013) and human capital investment (Bhattacharya, Guner and Ventura 2013).

Financial frictions. The key effect of financial frictions is that they prevent entrepreneurs from running their firms at the optimal size. For various incentive reasons, entrepreneurs may not be able to obtain credit to finance the optimal level of inputs. This may occur for instance if entrepreneurs can renege on debt contracts. Then, banks may worry that a borrower could hide funds or use them for personal benefit and default on the bank's loan, and may therefore require borrowers to post collateral. As a consequence, an entrepreneur's holdings of collateralizable assets will limit his or her ability to borrow and thus constrain the potential scale of the operation.[15]

Clearly, financial frictions reduce firm value and thus the value of entrepreneurship. Which type of firm is most affected? Consider an individual without collateralizable assets who without constraints would have chosen entrepreneurship but for whom financial constraints imply that immediate entrepreneurship is not optimal. Depending on ability, this individual thus either permanently chooses employment, or chooses employment and saves in order to enter entrepreneurship once enough assets have been accumulated (see Cagetti and De Nardi 2006, Buera 2009). Clearly, the loss due to delayed entry is largest for those individuals with the largest gap between unconstrained entrepreneurial income and employment income, i.e. high-ability individuals. The loss is borne longer the lower the individual's initial asset holdings are. As a result, financial constraints affect high-ability, low-wealth potential entrepreneurs most strongly.[16]

[15]Key references on finance, growth and the determinants of financial frictions are King and Levine (1993), La Porta, Lopez-De-Silanes, Shleifer and Vishny (1998) and Beck, Demirgüç-Kunt and Levine (2000). There also is a vast literature on the effect of financial frictions on entrepreneurs. Important empirical contributions are Evans and Jovanovic (1989), Evans and Leighton (1989) and Hurst and Lusardi (2004). There are also many recent contributions using data from developing economies. Banerjee and Duflo (2005) and Udry (2012) give an overview. Banerjee and Newman (1993), Lloyd-Ellis and Bernhardt (2000), Cagetti and De Nardi (2006), Antunes, Cavalcanti and Villamil (2008), Buera et al. (2011) and Kaboski and Townsend (2011) constitute important theoretical and quantitative contributions. With the exception of a set of empirical papers on developing economies, most of this work focusses on relatively large firms.

[16]In a related vein, Buera et al. (2011, Table 1) document that firms in manufacturing in the U.S. are larger and rely more on external financing than services firms. If large firms require a more able entrepreneur, this constitutes a piece of empirical evidence indicating that more able entrepreneurs are more strongly affected by financial constraints because the activities they would naturally choose

The consequences of occupational choice again correspond to the situation shown in Figure 6, with the broken lines representing an economy with low financial frictions and the solid lines a situation with larger frictions. The frictions reduce the value of entrepreneurship most at the right. At the same time, reduced labor demand due to the financial frictions implies that the value of employment also falls.[17] Just like productivity-dependent taxes, financial frictions encourages entrepreneurship by low-ability agents (who are not much affected by the friction and see their outside option worsen), with an ambiguous effect on a_H. Financial frictions thus not only prevent existing firms from operating at the optimal scale, but may also lead to a worse distribution of firm productivity, with more low- and potentially fewer high-productivity firms.

Labor market frictions. Another potential key factor for entry into entrepreneurship, in particular by low-ability agents, are labor market frictions. This is because for an unemployed person, entrepreneurship may sometimes be an attractive option, in particular if job search is expected to take a long time. This is sometimes called "unemployment push" entrepreneurship. At the same time, within a given country, times of low job finding rates are usually recessions, which may also imply lower expected profits from self-employment. The contemporaneous presence of these two channels has made it hard to identify unemployment push entrepreneurship in the data.

The use of micro data has helped researchers to overcome this problem. Using data from the National Longitudinal Survey of Youth, Rissman (2003) shows the presence of push entrepreneurship among young men in the U.S.. Millán (2012) finds a similar pattern in several European countries using data from the European Community

to engage in are more sensitive to such constraints.

[17]This occurs even if employers do not borrow to pay the wage bill, but borrow for investment or working capital. With less capital, firms demand less labor.

Household Panel (ECHP), and so do Røed and Skogstrøm (2010) using Norwegian data. Rissman (2007) and Millán (2012) calibrate search and matching models with the three states of employment, unemployment and self-employment using U.S. Current Population Survey (CPS) and ECHP data, respectively. The calibrated models suggest a more nuanced result, namely that some workers transit through self-employment on the way from unemployment to wage employment, while others do well enough in self-employment (compared to their own outside option) that they continue to pursue it. The model presented here has a similar flavor, with the difference that it also features permanent heterogeneity, which Rissman (2007) and Millán (2012) abstract from. Note that the employed may also indirectly be affected by the possibility of unemployment: If they start a business project but fail, they may become unemployed. This channel is discussed below in Section 4.3.

To analyze a situation with labor market frictions in a very simplified way,[18] assume that there are constant probabilities with which employment relationships break down and firms fail. If this occurs, the employee and possibly the entrepreneur enters unemployment. The unemployed find a job with some fixed probability per period. Entrepreneurship entry is possible right away, both from employment and from unemployment.[19] However, for any level of ability a, entering entrepreneurship from unemployment results in a firm of lower productivity than entering from employment. This assumption is in line with findings in Millán (2012), who shows that there is a substantial income penalty for entering entrepreneurship from unemployment, conditional on a set of demographics. This could for instance arise because employees acquire some knowledge that is useful when running one's own business and that decays in unemployment, or because they take customers with them when they leave their previous

[18] The setup in this section closely follows that analyzed in Poschke (2012).

[19] Assuming that it takes time to have an idea does not change qualitative results as long as ideas arrive sufficiently frequently compared to job offers.

employer.

The resulting situation is represented in Figure 7. The convex lines represent the value of entrepreneurship as before. The value of entering from employment is represented by the solid line, and that of entering from unemployment by the broken line. The solid straight line represents the value of employment, and the broken straight line the value of searching for a job. If the job finding probability is independent of a, the value of unemployment is a constant fraction of the value of employment at all a.[20]

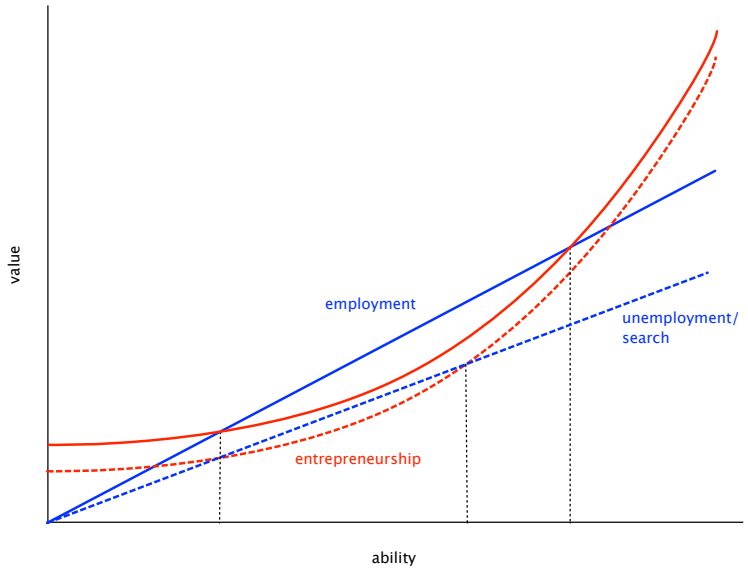

Figure 7: The values of employment (solid blue), unemployment/job search (broken blue) and entrepreneurship (red) when entering entrepreneurship from unemployment (broken) or from employment (solid)

Unemployed agents compare the broken blue and red lines. Again, there are two cutoffs; people at the extremes of the ability distribution are more likely to become entrepreneurs. Similarly for employed agents, who compare the solid blue and red lines.

[20]Note that unemployment benefits or a payoff from home production would put a positive lower bound under the value of unemployment. They would thus create an additional threshold a_U below which unemployment would be preferred to both job search and entrepreneurship. With generous unemployment benefits, this threshold may in principle lie to the right of a_L, implying an absence of low-ability entrepreneurs. Given the patterns documented in Section 2, this does not appear to be the empirically relevant case in either the U.S. or developing economies.

The choice thresholds for employed and unemployed agents are different. Whether the pattern of selection from the extremes of the ability distribution is more pronounced among people entering entrepreneurship from employment or from unemployment depends on the extent to which entrants from employment make better entrepreneurs. If they are much better, the distance between the two convex lines is large, and the selection thresholds for employees are closer to the middle. (In the graph, two of the thresholds coincide.) Whether people are "pushed" from unemployment into entrepreneurship also depends on this distance. There is more "push" entrepreneurship if the unemployment penalty when entering entrepreneurship is not too large, at least at low levels of ability.

What is the effect of changing labor market frictions? This depends on the source. A simple decrease in the job finding rate pivots down the value of job search and leads to more entry into entrepreneurship by the unemployed – the "push" effect. If the job finding rate falls due to a recession, the value of entrepreneurship and wages will also change, and net effects could go either way. (Because of the frictions, a productivity shock here has more complicated effects than above in Section 4.1, and the occupational choice thresholds may shift.)

The increase in frictions could also be due to policies. Botero, Djankov, La Porta, Lopez-De-Silanes and Shleifer (2004) have documented policy differences across countries in, among other things, firing restrictions. Such restrictions make firms more reluctant to hire, reduce job turnover, and reduce job finding probabilities. Empirically, firing restrictions have been shown to affect worker flows e.g. by Micco and Pagés (2006), Autor, Kerr and Kugler (2007), Kugler and Pica (2008) and Caballero, Cowan, Engel and Micco (2013). They also reduce firm value. The relative size of shifts in the curves in Figure 7 is a quantitative question, but the most plausible scenario is one where the value of unemployment falls most, followed by the value of entrepreneurship,

with only a small change in the value of employment. In this scenario, again, there is "push" entrepreneurship: the unemployed become more likely to enter entrepreneurship. The opposite is the case for the employed. Labor market frictions thus not only lead to worse allocation of labor across firms for a given distribution of productivity across firms, as in the seminal work by Hopenhayn and Rogerson (1993), but may worsen the productivity distribution itself.

4.3 Risk

No discussion of entrepreneurship is complete without considering risk. In developed economies, entrepreneurship typically implies more risky income flows than employment, and may therefore particularly attract individuals with low risk aversion (Kihlstrom and Laffont 1979). Comparing countries, the riskiness of the economic environment can imply differences in the composition of the population of active entrepreneurs. Two key aspects in this context are the risk of failure of a new entrepreneurial venture, and the comparative riskiness of income flows in entrepreneurship and employment.

The possibility of failure. It is well-known that the quality of entrepreneurial ideas is very hard to assess ex ante. As a consequence, many projects fail and are abandoned early on. The effect of the possibility of failure is subtle. While failure sounds negative, it is intimately linked to the option to terminate unsuccessful projects and start new ones, which is valuable. (The prospect of being obliged to persist in a loss-making venture would without doubt be a significant deterrent from entrepreneurship.)[21]

For simplicity, suppose that there is an exogenous probability that a new project

[21] Discovering which projects are worth pursuing is also valuable from the perspective of the economy as a whole. In this sense, the process of entry, with all the associated failure, can be interpreted as experimentation.

turns out to be a failure. Suppose that this is independent of the ability of the entrepreneur.[22] In the frictionless model, a constant probability of failure reduces the value of entrepreneurship. Because the ensuing decline in the number of active firms reduces the wage rate by the same proportion (see Appendix 4.3 for details), the thresholds a_L and a_H are not affected.

With labor market frictions, the possibility of failure has more pernicious effects. The reason is that the possibility of failure reduces the value of startups out of employment more than that of startups out of unemployment. This occurs because someone who fails with a startup out of employment moves to unemployment and loses his/her productivity advantage, whereas a failed startup out of unemployment just implies a return to the starting point. The penalty that might hit an employee who tries his/her luck as an entrepreneur could thus be quite severe, in particular if labor market frictions are strong. In contrast, a startup out of unemployment could even benefit from the reduction in wages that comes along with the higher probability of failure. As a consequence, introducing a probability of failure in the situation with frictional labor markets depicted in Figure 7 implies that a_H for employees shifts up substantially. The other thresholds move less. The combination of the possibility of failure and labor market frictions thus discourages a relatively high ability group of individuals from entrepreneurship.

On an intuitive level, this mechanism aligns well with survey responses indicating that "fear of failure" is an important factor discouraging entrepreneurship for some people. Anecdotally, this appears to be more important in countries with more rigid labor markets. It would be interesting to see empirical evidence on this channel.

[22]The ability to evaluate the prospect of a business idea ex ante is not necessarily closely related to the skill in executing that idea. Even if it was, an entrepreneur who is better at forecasting risks may well be induced into more risky ventures, resulting in a similar failure probability.

Income fluctuations. Fluctuations in income from entrepreneurship can discourage risk averse individuals from pursuing it if possibilities for hedging this risk are limited. While they definitely are limited in terms of financial instruments the typical own-account worker can access, the greater flexibility to adjust hours offered by entrepreneurship compensates somewhat. At the same time, fluctuations in labor income may also be important for some people, in particular employees in informal sectors jobs. These jobs typically not only pay less, but are also more precarious than formal sector jobs. Wages on the job may fluctuate more, or the job may be less secure, implying more frequent unemployment spells for informal sector workers. For risk averse households who cannot insure against these fluctuations, larger fluctuations reduce the value of informal sector employment. Similarly, a more volatile macroeconomic environment will also affect these workers more.

How income fluctuations and job loss probabilities in informal work compare to profit fluctuations in entrepreneurship for comparable workers is an empirical question. A priori, it appears likely that in developing economies and emerging markets, labor income is particularly volatile for low-a individuals (this may be different in developed economies), while profits are more volatile for high-a individuals. As a consequence, larger risks associated with employment may push low-ability workers into entrepreneurship; somewhat similar to the "unemployment push" channel described above. At the same time, risks in entrepreneurship discourage entrepreneurship by high-ability individuals. While riskiness of income flows could in principle take many forms and have different effects, it thus appears likely that in developing economies, its effect is to worsen the productivity distribution of entrepreneurs.

5 Discussion and directions for future research

The preceding analysis has shown many channels of interaction between incentives for firm creation at the top and the bottom of the ability distribution. A summary of how the thresholds a_L and a_H react to changes in the environment is provided in Table 1.

A striking result from the basic model without labor market frictions is that there are several channels through which factors mainly affecting the profitability of high-productivity firms, like regulation focussed on large firms or financial frictions, end up having an impact on the entry decisions of low-ability entrepreneurs. Other factors, like labor market frictions, tend to have a more direct effect, making job search less attractive and "pushing" some people into entrepreneurship.

Therefore, while the prevalence of self-employment and the large share of small firms in poorer countries may in part be simply due to the levels of income and technology of the country, as argued by Gollin (2007) and Poschke (2011), differences in regulation are likely to also play a role. Importantly, the share of small firms depends not only on factors directly affecting the people running these firms, but also on factors affecting large firms. Research and policies concerned with the prevalence of small firms thus also need to take into account factors limiting the growth of large firms.

For entrepreneurs engaged in small scale business, their businesses provide livelihoods. Small businesses can thus constitute an important way of coping with a lack of other opportunities and therefore provide important insurance at the individual level. At the aggregate level, a large share of small firms may indicate misallocation of resources. If large firms account for relatively little employment due to frictions, not technology, then eliminating frictions and reallocating employment from small to large firms would lead to gains in aggregate productivity.

Overall, the patterns shown in Section 2 suggest that the prevalence of small firms

Table 1: Summary of results

		a_L	a_H
Basic model			
Aggregate productivity shock		=	=
Long-run growth with skill-biased change in entrepreneurial technology		↓	↑[a]
Larger tax on large firms		↑	↓[a]
Financial frictions		↑	↓[a]
Labor market frictions			
Smaller job finding rate only		↑	↓
Higher firing costs	entrants from unemployment	↑	↓
	entrants from employment	↓	↑
Higher failure probability with labor market frictions			
	entrants from employment	↓	↑

Notes: [a] If a_H is below average productivity.

in poor countries goes a step beyond the issue of 'Tokman vs De Soto' (as in the title of De Mel et al. 2010), or opportunities (or lack thereof) vs constraints as the main source of the large number of small firms in poor countries. Many small business owners with relatively low entrepreneurial ability may well be running their firms at optimal scale. Observing a firm of small scale thus does not necessarily imply that it is constrained. At the same time, small business owners may be running a firm instead of searching for employment because of frictions affecting other, higher-productivity firms. The latter thus have an important effect on observed outcomes for small firms.

Heterogeneity and general equilibrium are thus key. The important role for heterogeneity stressed throughout the analysis above has further implications for empirical work. For instance, a substantial portion of the empirical literature on entrepreneurship, in particular that focussed on developing economies, has focussed on identifying financial frictions. Success has been mixed, as summarized by Udry (2012). The reason may well be heterogeneity: financial frictions apply to different firms to different degrees. With a sufficiently heterogeneous sample, this may make point estimates in-

significant.[23]

The importance of general equilibrium, in turn, implies important interactions across firms and raises interesting new research questions: How does regulation affecting large firms affect entry decisions by other firms? How do financial constraints to some firms affect the entry of others? How does the interaction of labor market frictions with business risk affect the quality of active firms?

The first question has to some extent been the subject of the empirical literature on determinants of informality, which however mainly focussed on labor market regulation. Some related questions have also been tackled in the recent quantitative literature on size-related distortions. Yet, work in this literature typically has been centred on implications for aggregate productivity and growth, and less on implications for employment and for entry and performance of other firms. Hence, while important work has been done, understanding determinants of entrepreneurial choice across the ability distribution calls for further empirical work.

[23]This is in line with results in Hurst and Lusardi (2004), who find that wealth matters for the probability of business entry only at the top of the distribution. It is also in line with structural work like Cagetti and De Nardi (2006), Buera (2009) and Kaboski and Townsend (2011), which stresses that financial constraints can be overcome and at a given moment in time depend on ability and wealth for any entrepreneur. However, most of this work focusses on the role of wealth, not ability.

A A simple formal model

A.1 The basic framework

Consider an economy consisting of a continuum of households who differ in ability a. Ability differs across individuals, is known by them and their employer, and measures the amount of efficiency units of labor they can supply if working. Let its distribution in the population be $f(a)$. With competitive labor markets, a household's potential labor income is simply ability a times the wage rate w. The wage rate is endogenous and determined by labor market clearing in general equilibrium.

Firms produce with the production function

$$y = sz(n^{\alpha}k^{1-\alpha})^{\gamma}, \alpha, \gamma \in (0,1), \tag{2}$$

where s is a firm-specific productivity term, z is aggregate productivity, and γ is a common span of control parameter. Firms rent capital and labor at rates r and w, respectively. The first order conditions for optimal input choice then are

$$r = MPK = zsn^{\alpha\gamma}\gamma(1-\alpha)k^{\gamma(1-\alpha)-1} \tag{3}$$

$$w = MPL = zsk^{(1-\alpha)\gamma}\alpha\gamma n^{\alpha\gamma-1} \tag{4}$$

Simplifying, this yields

$$k = \frac{1-\alpha}{\alpha}\frac{w}{r}n \tag{5}$$

$$n = \left\{ zs\gamma \left(\frac{1-\alpha}{r}\right)^{(1-\alpha)\gamma} \left(\frac{\alpha}{w}\right)^{1-(1-\alpha)\gamma} \right\}^{\frac{1}{1-\gamma}}. \tag{6}$$

In steady state without aggregate shocks and without growth, the consumers' Euler

equation implies

$$u'(c) = \beta u'(c')(1+r) \quad \Rightarrow \quad \frac{1}{1+r} = \beta. \tag{7}$$

The wage is determined by labor market clearing. Let M be the number of active firms and $\mu(s)$ the *pdf* of s. Let the set of a s.t. households optimally choose entrepreneurship be $\mathcal{E}$ and its complement $\mathcal{E}^c$. Then labor supply is

$$LS = \int_{\mathcal{E}^c} af(a)\mathrm{d}a \tag{8}$$

and labor market clearing requires

$$\begin{aligned} LS &= M \int \mu(s)n(s)\mathrm{d}s & (9)\\ &= M \left\{ z\gamma \left(\frac{1-\alpha}{r}\right)^{(1-\alpha)\gamma} \left(\frac{\alpha}{w}\right)^{1-(1-\alpha)\gamma} \right\}^{\frac{1}{1-\gamma}} \int \mu(s) s^{\frac{1}{1-\gamma}} \mathrm{d}s & (10)\\ &\equiv M \left\{ z\gamma \left(\frac{1-\alpha}{r}\right)^{(1-\alpha)\gamma} \left(\frac{\alpha}{w}\right)^{1-(1-\alpha)\gamma} \right\}^{\frac{1}{1-\gamma}} \bar{s}, & (11) \end{aligned}$$

so that

$$w = \alpha \left\{ \left(\frac{\bar{s}M}{LS}\right)^{1-\gamma} z\gamma \left(\frac{1-\alpha}{r}\right)^{(1-\alpha)\gamma} \right\}^{\frac{1}{1-(1-\alpha)\gamma}}. \tag{12}$$

The elasticity of the wage with respect to z thus is $[1-(1-\alpha)\gamma]^{-1}$. With $\alpha = 1$ (no capital), it is simply 1. With capital, it is larger because of capital accumulation. Finally, w increases in M.

Profits are

$$\pi(s) = sz(n^{\alpha}k^{1-\alpha})^{\gamma} - wn - rk \tag{13}$$

$$= (sz)^{\frac{1}{1-\gamma}} w^{\frac{-\alpha\gamma}{1-\gamma}} \left(\frac{1-\alpha}{r}\right)^{\frac{\gamma(1-\alpha)}{1-\gamma}} \alpha^{\frac{\alpha\gamma}{1-\gamma}} \left\{\gamma^{\frac{\gamma}{1-\gamma}} - \gamma^{\frac{1}{1-\gamma}}\right\}. \tag{14}$$

Let the last term be $\tilde{\gamma}$ and insert the wage:

$$\pi(s) = s^{\frac{1}{1-\gamma}} z^{\frac{1}{1-(1-\alpha)\gamma}} \gamma^{\frac{1}{1-(1-\alpha)\gamma}\frac{-\alpha\gamma}{1-\gamma}} \left(\frac{\bar{s}M}{LS}\right)^{\frac{-\alpha\gamma}{1-(1-\alpha)\gamma}} \left(\frac{1-\alpha}{r}\right)^{\frac{(1-\alpha)\gamma}{1-(1-\alpha)\gamma}} \tilde{\gamma}. \tag{15}$$

The elasticity of profits with respect to z thus also is $[1-(1-\alpha)\gamma]^{-1}$, just like that of the wage. Note that this only becomes clear once the general equilibrium effect through labor demand and w on π is taken into account. The elasticity of profits with respect to own productivity s is $1/(1-\gamma)$, which is larger than that with respect to aggregate productivity as long as $\alpha > 0$ (labor is used) and $\gamma > 0$. The reason for this pattern is that the firm has to share increases in z (aggregate productivity) with workers, as wages also rise. One firm's higher individual productivity, in contrast, has a negligible effect on aggregate labor demand and therefore the wage, so that the entrepreneur benefits more. Note also that the result that w and π have equal elasticity with respect to z is not really surprising, as the production function exhibits constant factor shares.

To close the model, the number of firms M needs to be determined. It is convenient to use the following two equilibrium conditions to determine M and w jointly:

1. Optimal occupational choice: agents run firms, given their a and s, if $\pi(s) > wa$ (given M). This yields a set $\mathcal{E}$ of entrepreneurs and a complementary set $\mathcal{E}^c$ of employees.

2. Labor market clearing (11)

Occupational choice outcomes will depend on the shapes of $\pi(s)$ and wa and the

relationship between a and s. A higher propensity for entrepreneurship at the extremes of the wage or education distribution will arise if profits exceed earnings in that range. Evidence suggests that s and a are positively related across individuals. To reflect these two empirical patterns, assume that $s = s(a), s(0) > 0$, and $s' > 0$. To ensure entrepreneurship at the top, also assume that $s''(a)/s'(a) > -\frac{\gamma}{1-\gamma}s'(a)/s(a)$. If s is a constant elasticity function of a with elasticity x, i.e. $s = a^x$, this corresponds to $x > 1 - \gamma$. Thus, high a individuals choose entrepreneurship if s is not too concave in a. This occurs because profits are convex in s, reflecting the benefit to high-ability entrepreneurs of the option to leverage their ability by expanding inputs.

There are various microfoundations that generate such a shape of the profit function, see e.g. Astebro et al. (2011), Ohyama (2012), Poschke (2011, 2013*b*).

Under these assumptions, there are two levels of a at which $\pi(s(a)) = wa$. Let them be $a_x, x = L, H$, $a_H > a_L$. At each of these thresholds,

$$a_x = \frac{1}{\alpha}\left(\frac{s(a_x)}{\gamma}\right)^{\frac{1}{1-\gamma}} \frac{LS}{\bar{s}M}\tilde{\gamma}. \tag{16}$$

Under the assumptions above, the right hand side is strictly convex in a_x, and this equation has two solutions. The equation also shows that in this static setting without uncertainty, the occupational choice thresholds do not depend on aggregate productivity z or on the rental rate of capital r. The right hand side decreases in the average productivity of active firms $\bar{s}$ and in the measure of active firms M, and increases in labor supply. As a consequence a_L (a_H) decreases (increases) in $\bar{s}$ and M and increases (decreases) in LS.

To find the equilibrium M and w, it is convenient to graph a free entry condition (FEC) and a labor market clearing (LM) line in (M, w)-space (see Figure 4).

- FEC: $\pi(a_x) = wa_x$. This implies that M and w are negatively related. If w rises,

more people choose entrepreneurship, so that M falls.

- LM: $LS = LD$. This implies a positive relationship between M and w. If M increases, the wage needs to rise to equilibrate the labor market.

Entrepreneurship may thus dominate the value of employment at both extremes of the ability distribution. The vertical dotted lines in Figure 3 show the levels of ability at which the optimal occupational choice switches. Denote the lower such threshold by a_L and the higher one by a_H.

A.2 The effect of policies

A.2.1 Aggregate productivity

See above.

A.2.2 Long-run growth

Suppose that more able entrepreneurs benefit more from new technologies. (Poschke (2011) calls this "skill-biased change in entrepreneurial technology.") This can be represented by replacing the term zs in the production function by the function $z(t, s)$, with $\partial z/\partial t > 0$, $\partial z/\partial s > 0$ and $\partial^2 z/(\partial t \partial s) > 0$. The comparison of occupational choice at two points in time under this specification is qualitatively the opposite of the comparison of two economies without and with productivity-dependent taxes. Technical change improves all firms' productivity, and raises wages. There is a level of a at which potential earnings in both occupations change by the same proportion. Denote this by $\tilde{a}_z$. For higher (lower) a, potential earnings in entrepreneurship (employment) increase more. The shifts in thresholds again depend on how $\tilde{a}_z$ compares to a_H and a_L. If $\tilde{a}_z < a_L$, a_L rises and a_H falls. If $\tilde{a}_z \in (a_L, a_H)$, both thresholds fall. If $\tilde{a}_z > a_H$, a_L

falls and a_H rises. Again, the last case is empirically most plausible for most countries, and is the one depicted in Figure 6.

A.2.3 Productivity-related taxes

Consider a tax on firms' profits at a rate $\tau(s), \tau' > 0$. Define $\bar{s}_\tau = \int \mu(s)[s(1 - \tau(s))]^{\frac{1}{1-\gamma}} \mathrm{d}s$. When taxes are uniform, thresholds do not change because profits and wages change by the same proportion. This is different with size-dependent taxes. Because labor earning are proportional to ability, taxes induce the same proportional change in labor income for all individuals. However, profits must change by different proportions for individuals at the two thresholds if $\tau(s)$ is strictly increasing. It thus must be that either a_H rises and a_L falls, both rise, or both fall. The proportional change in the wage equals $(1 - \gamma)/(1 - (1 - \alpha)\gamma)$ times the proportional change in $\bar{s}M/LS$ due to the change in taxes. Profits change by the same proportion for a unique level of s. Denote this by $\tilde{s}_\tau$. For s above (below) that, they fall more (less). Changes in the thresholds depend on where $\tilde{s}_\tau$ lies relative to them, which in turn depends on the productivity distribution. If $\tilde{s}_\tau$ lies between $s(a_L)$ and $s(a_H)$, both thresholds shift up. If $\tilde{s}_\tau < s(a_L)$, a_H shifts up and a_L shifts down. If $\tilde{s}_\tau > s(a_H)$, a_H shifts down and a_L shifts up. This case is the one depicted in Figure 6. Given the high skewness of firm size distributions in the data, this is empirically the most likely case.

A.2.4 The probability of failure

Suppose that a new firm succeeds with probability p. Then the expected value of entry is $p\pi(s)/r$. A failed entrepreneur in the frictionless model will try a new project in the following period. If the exit probability for successful firms is λ, the law of motion of the measure of firms, M, is $M' = (1 - \lambda)M + pe$, where e is the measure of entrants. This implies that in a steady state, $M = pe/\lambda$. If p does not affect e, it thus affects

M proportionally. In this case, the elasticity of the wage rate with respect to p equals that with respect to M and is $(1-\gamma)/(1-(1-\alpha)\gamma)$. The elasticity of firm value with respect to p then is $1-\frac{\alpha\gamma}{1-\gamma}\frac{1-\gamma}{1-(1-\alpha)\gamma}=\frac{1-\gamma}{1-(1-\alpha)\gamma}$, where $-\alpha\gamma/(1-\gamma)$ is the elasticity of profits with respect to the wage rate. Hence, if e is not affected by p, changes in p move earnings and profits by the same proportion. This implies that the thresholds a_L and a_H are not affected by p.

References

Almeida, R. and Carneiro, P. (2011), 'Enforcement of labor regulation and informality', *IZA Discussion Paper* **5902**.

Antunes, A., Cavalcanti, T. and Villamil, A. (2008), 'The Effect of Financial Repression and Enforcement on Entrepreneurship and Economic Development', *Journal of Monetary Economics* **55**(2), 278–297.

Astebro, T., Chen, J. and Thompson, P. (2011), 'Stars and Misfits: Self-Employment and Labor Market Frictions', *Management Science* **57**(11), 1999–2017.

Autor, D. H., Kerr, W. R. and Kugler, A. D. (2007), 'Do Employment Protections Reduce Productivity? Evidence from U.S. States', *Economic Journal* **117**(521), F189–F217.

Banerjee, A. V. and Duflo, E. (2005), Growth Theory through the Lens of Development Economics, *in* P. Aghion and S. N. Durlauf, eds, 'Handbook of Economic Growth', Vol. 1A, Elsevier, Amsterdam, pp. 473–552.

Banerjee, A. V. and Newman, A. F. (1993), 'Occupational Choice and the Process of Development', *Journal of Political Economy* **101**(2), 274–298.

Bartelsman, E. J., Haltiwanger, J. and Scarpetta, S. (2009), Measuring and analyzing cross-country differences in firm dynamics, *in* T. Dunne, J. B. Jensen and M. J. Roberts, eds, 'Producer Dynamics: New Evidence from Micro Data', University Of Chicago Press for the National Bureau of Economic Research, Chicago.

Bartelsman, E., Scarpetta, S. and Schivardi, F. (2003), 'Comparative Analysis of Firm Demographics and Survival: Micro-Level Evidence for the OECD Countries', *OECD Economics Department Working Paper* **348**.

Beaudry, P. and DiNardo, J. (1991), 'The Effect of Implicit Contracts on the Movement of Wages Over the Business Cycle: Evidence from Micro Data', *Journal of Political Economy* **99**(4), 665–688.

Beck, T., Demirgüç-Kunt, A. and Levine, R. (2000), 'A New Database on the Structure and Development of the Financial Sector', *World Bank Economic Review* **14**, 597–605.

Berniell, L. (2012), 'Microempresarios, emprendimientos de subsistencia y productividad en América Latina', *mimeo, CAF* pp. 1–40.

Bhattacharya, D., Guner, N. and Ventura, G. (2013), 'Distortions, endogenous managerial skills and productivity differences', *Review of Economic Dynamics* **16**(1), 11–25.

Bloom, N., Sadun, R. and Van Reenen, J. (2012), 'Americans do IT better: US multinationals and the productivity miracle', *American Economic Review* **102**(1), 167–201.

Borjas, G. J. and Bronars, S. G. (1989), 'Consumer Discrimination and Self-Employment', *Journal of Political Economy* **97**(3), 581–605.

Botero, J. C., Djankov, S., La Porta, R., Lopez-De-Silanes, F. and Shleifer, A. (2004), 'The Regulation of Labor', *Quarterly Journal of Economics* **119**(4), 1339–1382.

Buera, F. J. (2009), 'A Dynamic Model of Entrepreneurship with Borrowing Constraints', *Annals of Finance* **5**(3-4), 443–464.

Buera, F. J., Kaboski, J. P. and Shin, Y. (2011), 'Finance and development: A tale of two sectors', *American Economic Review* **101**(5), 1964–2002.

Caballero, R. J., Cowan, K. N., Engel, E. M. R. A. and Micco, A. (2013), 'Effective labor regulation and microeconomic flexibility', *Journal of Development Economics* **101**, 92–104.

Cagetti, M. and De Nardi, M. (2006), 'Entrepreneurship, Frictions, and Wealth', *Journal of Political Economy* **114**(5), 835–870.

Calvo, G. A. and Wellisz, S. (1980), 'Technology, entrepreneurs, and firm size', *The Quarterly Journal of Economics* **95**(4), 663–677.

De Mel, S., McKenzie, D. and Woodruff, C. (2010), Who are the Microenterprise Owners? Evidence from Sri Lanka on Tokman v. De Soto, *in* J. Lerner and A. Schoar, eds, 'International Differences in Entrepreneurship', University of Chicago Press, Chicago, IL.

Evans, D. S. and Jovanovic, B. (1989), 'An Estimated Model of Entrepreneurial Choice under Liquidity Constraints', *Journal of Political Economy* **97**(4), 808–827.

Evans, D. S. and Leighton, L. S. (1989), 'Some Empirical Aspects of Entrepreneurship', *American Economic Review* **79**(3), 519–535.

Foster, L., Haltiwanger, J. and Krizan, C. J. (2001), Aggregate Productivity Growth: Lessons from Microeconomic Evidence, *in* C. R. Hulten, E. R. Dean and M. J. Harper, eds, 'New Developments in Productivity Analysis', NBER Studies in Income and Wealth, University of Chicago Press, Chicago.

Foster, L., Haltiwanger, J. and Krizan, C. J. (2006), 'Market Selection, Reallocation, and Restructuring in the U.S. Retail Trade Sector in the 1990s', *Review of Economics and Statistics* **88**(4).

Gabler, A. and Poschke, M. (2013), 'Experimentation by Firms, Distortions, and Aggregate Productivity', *Review of Economic Dynamics* **16**(1), 26–38.

Gindling, T. H. and Newhouse, D. (2012), 'Self-employment in the developing world', *World Bank Policy Research Working Paper* (6201).

Gluzmann, P., Jaume, D. and Gasparini, L. (2012), 'Decisiones Laborales En América Latina: El Caso De Los Emprendedores', *CAF Working Paper* **2012/06**.

Gollin, D. (2007), 'Nobody's business but my own: Self-employment and small enterprise in economic development', *Journal of Monetary Economics* **55**(2), 219–233.

Guner, N., Ventura, G. and Xu, Y. (2008), 'Macroeconomic Implications of Size-Dependent Policies', *Review of Economic Dynamics* **11**(4), 721–744.

Haltiwanger, J., Jarmin, R. and Miranda, J. (forthcoming), 'Who Creates Jobs? Small vs. Large vs. Young', *Review of Economics and Statistics* .

Hamilton, B. H. (2000), 'Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment', *Journal of Political Economy* **108**(3), 604–631.

Heston, A., Summers, R. and Aten, B. (2009), 'Penn World Table Version 6.3', *Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania* .

Holmes, T. J. and Schmitz, J. A. (1990), 'A theory of entrepreneurship and its application to the study of business transfers', *Journal of Political Economy* **98**, 265–294.

Hopenhayn, H. (1992), 'Entry, Exit, and Firm Dynamics in Long Run Equilibrium', *Econometrica* **60**(5), 1127–1150.

Hopenhayn, H. and Rogerson, R. (1993), 'Job Turnover and Policy Evaluation: A General Equilibrium Analysis', *Journal of Political Economy* **101**(5), 915–938.

Hsieh, C.-T. and Klenow, P. J. (2009), 'Misallocation and Manufacturing TFP in China and India', *Quarterly Journal of Economics* **124**, 1403–1448.

Hurst, E. and Lusardi, A. (2004), 'Liquidity Constraints, Household Wealth, and Entrepreneurship', *Journal of Political Economy* **112**(2), 319–347.

Hurst, E. and Pugsley, B. W. (2011), 'What Do Small Businesses Do?', *Brookings Papers on Economic Activity* .

Jovanovic, B. (1994), 'Firm Formation with Heterogeneous Management and Labor Skills', *Small Business Economics* **6**, 185–191.

Kaboski, J. P. and Townsend, R. M. (2011), 'A Structural Evaluation of a LargeâScale QuasiâExperimental Microfinance Initiative', *Econometrica* **79**(5), 1357–1406.

Kihlstrom, R. and Laffont, J.-J. (1979), 'A General Equilibrium Entrepreneurial Theory of Firm Formation Based on Risk Aversion', *Journal of Political Economy* **87**(4), 719–748.

King, R. G. and Levine, R. (1993), 'Finance and Growth: Schumpeter Might Be Right', *Quarterly Journal of Economics* **108**, 717–737.

Kugler, A. and Pica, G. (2008), 'Effects of employment protection on worker and job flows: Evidence from the 1990 Italian reform', *Labour Economics* **15**(1), 78–95.

La Porta, R., Lopez-De-Silanes, F., Shleifer, A. and Vishny, R. (1998), 'Law and Finance', *Journal of Political Economy* **106**, 1113–1155.

Little, I. M. D., Mazumdar, D. and Page, Jr., J. M. (1987), *Small Manufacturing Enterprises: A Comparative Analysis of India and Other Economies*, Oxford University Press for the World Bank, New York, NY.

Lloyd-Ellis, H. and Bernhardt, D. (2000), 'Enterprise, Inequality and Economic Development', *Review of Economic Studies* **67**(1).

Lucas, R. E. (1978), 'On the size distribution of business firms', *Bell Journal of Economics* **9**, 508–523.

Micco, A. and Pagés, C. (2006), 'The Economic Effects of Employment Protection: Evidence from International Industry-Level Data', *IZA Discussion Paper* **2433**.

Millán, A. (2012), 'The Choice to Become Self-employed: Acknowledging Frictions', *mimeo, U Carlos III Madrid* pp. 1–34.

Mondragón-Vélez, C. and Peña, X. (2010), Business Ownership and Self-Employment in Developing Economies: The Colombian Case, *in* J. Lerner and A. Schoar, eds, 'International Differences in Entrepreneurship', University of Chicago Press.

Ohyama, A. (2012), 'Entrepreneurship and Advanced Technical Knowledge', *mimeo, University of Illinois at Urbana-Champaign* .

Poschke, M. (2011), 'The firm size distribution across countries and skill-biased change in entrepreneurial technology', *CIREQ Working Paper* **08-2011**.

Poschke, M. (2012), 'The labor market, the decision to become an entrepreneur, and the firm size distribution', *CIREQ Working Paper* **11-2012**.

Poschke, M. (2013*a*), '"Entrepreneurs out of necessity": a snapshot', *Applied Economics Letters* **20**(7), 658–663.

Poschke, M. (2013*b*), 'Who Becomes an Entrepreneur? Labor Market Prospects and Occupational Choice', *Journal of Economic Dynamics and Control* **37**, 693–710.

Rauch, J. E. (1991), 'Modelling the informal sector formally', *Journal of Development Economics* **35**(1), 33–47.

Restuccia, D. and Rogerson, R. (2008), 'Policy Distortions and Aggregate Productivity with Heterogeneous Establishments', *Review of Economic Dynamics* **11**(4), 707–720.

Rissman, E. R. (2003), 'Self-Employment as an Alternative to Unemployment', *Federal Reserve Bank of Chicago Working Paper* **2003-34**.

Rissman, E. R. (2007), 'Labor market transitions and self-employment', *Federal Reserve Bank of Chicago Working Paper* **2007-14**.

Røed, K. and Skogstrøm, J. F. (2010), 'Creative Unemployment', *IZA Discussion Paper* **5373**.

Schivardi, F. and Torrini, R. (2008), 'Identifying the effects of firing restrictions through size-contingent differences in regulation', *Labour Economics* **15**(3), 482 – 511.

Schoar, A. (2010), The Divide between Subsistence and Transformational Entrepreneurship, *in* J. Lerner and S. Stern, eds, 'Innovation Policy and the Economy', Vol. 10, University of Chicago Press, pp. 57–81.

Summers, R. and Heston, A. (1991), 'The Penn World Table (Mark 5): An Expanded Set of International Comparisons: 1950-1988', *Quarterly Journal of Economics* **56**, 327–368.

Udry, C. (2012), 'Misallocation, Growth and Financial Market Imperfections', *Keynote speech, Society of Economic Dynamics Annual Meeting* .

van der Sluis, J., van Praag, C. and Vijverberg, W. (2008), 'Education and entrepreneurship selection and performance: A review of the empirical literature', *Journal of Economic Surveys* **22**(5), 795–841.

van der Sluis, J., van Praag, M. and Vijverberg, W. (2005), 'Entrepreneurship Selection and Performance: A Meta-Analysis of the Impact of Education in Developing Economies', *World Bank Economic Review* **19**(2), 225–261.

Wiboonchutikula, P. (2002), 'Small and medium enterprises in Thailand: Recent trends', *Small Business Economics* **18**(1), 211–224.