

Financial Frictions and the Delay to Entry*

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December 2015

Abstract

I use a tractable dynamic model of occupational choice to show that the existence of financial constraints to the creation of businesses implies a delay to entry into entrepreneurship, which has both individual and aggregate consequences on inequality and welfare. Talented individuals with low collateral would need to work for several years as wage-earners to accumulate enough savings required to start their own firm. Hence, by the time they become entrepreneurs, they are older than they would in a perfect credit market economy. Data from Cameroon are used to study the qualitative and quantitative predictions of the dynamic model. The results show that it takes on average 7 years for a prospective entrepreneur to accumulate enough wealth required to start his own firm. The related inequality and welfare losses are also found to be substantial, averaging 16% Gini and 10% of lifetime consumption, respectively. An empirical test of the model's predictions is performed by providing a cross-country evidence that low levels of financial development are associated with large age gaps between entrepreneurs and wage-earners, a pattern often found in empirical studies of entrepreneurial choice in developing countries.

Keywords: Financial Friction, Entrepreneurship, Occupational Choice, Welfare, Inequality.

JEL Classification: D91, D92, J24, O16, O47.

1 Introduction

Entrepreneurship is the engine of modern economies; it drives innovation and job creation, raises productivity, and promotes and sustains economic growth. Unfortunately, developing economies suffer from an anemic creation and growth of firms and have low

*I am grateful to Emmanuelle Auriol, Alberto Chong, Andrew Feltenstein, John Gibson, Alex Karaivanov and Marc Sleiman for useful feedback. I thank Masood Dastan and Augustine Denteh for excellent research assistance.

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levels of financial development with less access to formal financial services (e.g. bank loans, saving accounts) compared to advanced economies (King and Levine 1993). In this paper, I show that inability to obtain credit does not only help explain the poor performance of entrepreneurs in developing economies as found in many studies, but also delays the decision of many talented people to enter entrepreneurship. A talented individual who wishes to start a business usually has to incur an investment that he cannot typically self-finance. With imperfect credit markets, lenders do not advance the full investment capital, so that the prospective entrepreneur is forced to work for several years as a wage earner to accumulate enough wealth required to make up for the remaining amount. Consequently, for the same ability level, poor individuals start their business later than wealthy individuals as it takes them longer to accumulate the necessary capital. This induces an inefficient timing of entrepreneurial choice which slows down economic growth, worsens inequality, and deteriorates welfare.

The model presented is a tractable dynamic model of occupational choice where agents with standard intertemporal preferences - who are heterogenous in their entrepreneurial skills and initial wealth - choose to be entrepreneurs or workers in each period. As workers, everyone is assumed to provide the same labor service and to receive the same wage. Entrepreneurs on the other hand hire labor and rent capital subject to a collateral constraint that limits the amount of capital input as a function of their current financial wealth. This illustrates the financial frictions in the economy. The main prediction is that less talented individuals remain wageworkers whereas more talented individuals delay their entry decision, but eventually become entrepreneurs. The delay to entry into entrepreneurship increases with the degree of financial frictions and decreases with entrepreneurial skills. However, only in a perfect credit market economy do initially poor but talented individuals become entrepreneurs right away. The model also predicts that saving behavior is not uniform across agents. The saving rates of prospective entrepreneurs are higher than the saving rates of both existing entrepreneurs and those wage-earners who have no intention to become entrepreneurs. Although the underlying limited liability mechanism (see Evans and Jovanovic 1989, Paulson et al. 2006) delivers the implication that wealth is related to the timing of entrepreneurial choice, there might be alternative explanations (e.g. risk aversion) that may share similar implications and yet point to alternative policy advice. Therefore, in this paper I try to disentangle the precise mechanism through which financial frictions affect the time to entry.

The model is calibrated to match the external finance to GDP ratio and the establishment level statistics in Cameroon, an economy with one of the lowest levels of financial development in West Africa. The calibrated model is used to analyze the qualitative and quantitative impact of financial frictions on the time to entry and other aggregates for various levels of policy parameters. I find that the delay to entry into entrepreneurship is around 7 years for prospective entrepreneurs with average entrepreneurial talent and average wealth, and can be slightly mitigated with higher wages. This implies significant welfare costs of borrowing constraints. For example, individuals who could otherwise

earn up to 10% higher income as entrepreneurs will remain workers for about 7 years if they start with the average wealth. Similarly, the consumption of the median wealth entrant into entrepreneurship in the data must be increased permanently by 100% to make him indifferent between living in the Cameroon economy and in an economy with perfect capital markets. Consistent with the literature, I also found that greater access to credit would result in a more rapid economic growth. The model also allows to quantitatively explore the dynamics of income inequality among a cohort of talented individuals with different levels of initial wealth endowments. In particular, I find that inequality follows the well-known Kuznets' inverted U-shaped curve. Initially, entrepreneurship widens the gap between the rich and the poor, but after a number of years when the entire cohort has fulfilled their collateral requirements and completed the entrepreneurship switch, inequality among them drops to a lower level than before, reflecting disparity in skills. Accordingly, relaxing the collateral constraints can reduce inequality by around 16% Gini in the Cameroon data. This implies that policies aiming at favouring credit access to the poor do not only accelerate economic growth through enterprise creation and productivity as found in the literature, but also have the potential to shorten the duration of sharp inequality.

Finally, the predictions of the model provide a theoretical rationale for the evidence that entrepreneurs are often found to be on average significantly older than waged workers in many empirical studies on occupational choice in developing countries (e.g. Bruhn 2013, Falco et al. 2014, Karaivanov 2010, Nguimkeu 2014). This age gap is however usually insignificant in developed countries with advanced financial markets (Evans and Leighton 1989, Wagner 2005, Clemens et al 2015). Indeed, if credit constraints impede talented individuals to start their business as early as desired, then we should expect the age gap between entrepreneurs and waged workers to be larger in countries with relatively worse financing opportunities than in countries with relatively better markets, everything else being equal. I test this prediction using a reduced-form regression analysis and cross-country data from the World Bank and other regional Household/Enterprise surveys. The results show that various indicators of financial frictions (including the external finance to GDP ratio, the domestic credit to private sector, and the strength of legal right index) are negatively associated with the average entrepreneur-waged worker age gap, even when controlling for other country characteristics such as wage rates and interest rates.

The rest of the paper is organized as follows. Section 2 provides a simple theoretical framework that describes the individual's dynamic occupational choice problem and illustrates how wealth disparities translate into different timing of entrepreneurship entry in the presence of financial frictions. Section 3 examines the quantitative importance of the delay to entry as well as the welfare costs and inequality resulting from borrowing constraints as implied by the model. Calibration to the data and simulations are performed. Section 4 presents the results of a regression analysis that empirically assesses the model predictions using cross-country data. Section 5 evaluates the findings and

draws conclusions. Proofs and additional material are gathered in the Appendix.

2 Model

In this section I present a simple dynamic occupational choice model with borrowing constraints that delivers a relationship between wealth, entrepreneurial skills, financial frictions and the time to entry into entrepreneurship. The model builds on the literature recently reviewed by Buera et al. (2015), and it is a substantial extension of Evans and Jovanovic (1989) to a dynamic framework that includes labor demand and utility maximizing agents.

2.1 Occupational Choice and Earnings

The economy is populated by a continuum of individuals who are heterogeneous with respect to their wealth and their entrepreneurial talent. An agent enters the labor market with an initial wealth a_0 and an entrepreneurial ability θ which is constant over time. At the beginning of each period, the agent decides whether to work for a fixed market wage w or to operate his own business. An entrepreneur with talent θ combines k units of capital and l units of labor to produce a single consumption good according to a decreasing return to scale the technology:

$$f(k, l) = \theta k^\alpha l^\beta, \quad (1)$$

where $\gamma = \alpha + \beta < 1$, implying diminishing returns to scale in variable factors at the establishment level as in Lucas (1978).

An entrepreneur can operate only one production unit in a given period. Access to capital is determined by wealth through a simple collateral constraint, motivated by the imperfect enforceability of capital rental contracts. The entrepreneurs capital rental k is assumed to be limited by a collateral constraint, $k \leq \lambda a$, where $a \geq 0$ is the entrepreneur's financial wealth at the time he is seeking credit, and $\lambda \in [1, \infty)$ measures the degree of financial friction. Financial autarky corresponds to $\lambda = 1$ which means that all capital has to be self-financed by entrepreneurs, whereas $\lambda = +\infty$ corresponds to perfect credit markets where the amount of capital rented to the entrepreneur does not depend on his wealth. The same λ applies to everyone in the economy. This specification captures the common prediction from models of limited liability where the amount of credit is limited by an individual's wealth (Evans and Jovanovic 1989, Paulson et al 2006).

Denoting by r the interest rate, the expected profit for an entrepreneur with talent θ and wealth a_t at period t is given by:

$$\pi(\theta, \lambda, a_t) = \max_{l_t, k_t} \left\{ \theta k_t^\alpha l_t^\beta - w l_t - r k_t \quad \text{s.t.} \quad l_t \geq 0, \quad 0 \leq k_t \leq \lambda a_t \right\} \quad (2)$$

The optimization constraint on capital then gives rise to two types of entrepreneurs. Those who are financially unconstrained, i.e., their optimal investment capital is an interior solution of the above optimization problem, and those who are financially constrained, i.e., their capital constraint is binding. The interior solutions of the entrepreneur's maximization problem are

$$k_t^* = \theta^{\frac{1}{1-\gamma}} \left(\frac{\alpha}{r}\right)^{\frac{1-\beta}{1-\gamma}} \left(\frac{\beta}{w}\right)^{\frac{\beta}{1-\gamma}} \quad \text{and} \quad l_t^* = \theta^{\frac{1}{1-\gamma}} \left(\frac{\alpha}{r}\right)^{\frac{\alpha}{1-\gamma}} \left(\frac{\beta}{w}\right)^{\frac{1-\alpha}{1-\gamma}} \quad (3)$$

This solution is feasible only if k_t^* is lower than λa_t , which means

$$a_t > \frac{1}{\lambda} \theta^{1/(1-\gamma)} \left(\frac{\alpha}{r}\right)^{(1-\beta)/(1-\gamma)} \left(\frac{\beta}{w}\right)^{\beta/(1-\gamma)} \equiv \bar{a}(\theta, \lambda). \quad (4)$$

The amount $\bar{a}(\theta, \lambda)$ is then the minimum collateral that an entrepreneur with talent θ needs in order to fully express his potential in an economy with financial frictions λ . However, when the constraint is binding the investment capital and optimized labor are given by

$$k_t^* = \lambda a_t \quad \text{and} \quad l_t^* = \theta^{\frac{1}{1-\beta}} \left(\frac{\beta}{w}\right)^{\frac{1}{1-\beta}} (\lambda a_t)^{\frac{\alpha}{1-\beta}}.$$

Hence, the optimal entrepreneur's profit at time t is defined as follows:

$$\pi(\theta, \lambda, a_t) = \begin{cases} (1-\gamma) \theta^{\frac{1}{1-\gamma}} \left(\frac{\alpha}{r}\right)^{\frac{\alpha}{1-\gamma}} \left(\frac{\beta}{w}\right)^{\frac{\beta}{1-\gamma}} & \text{if } a_t > \bar{a}(\theta, \lambda) \\ (1-\beta) \theta^{\frac{1}{1-\beta}} \left(\frac{\beta}{w}\right)^{\frac{\beta}{1-\beta}} (\lambda a_t)^{\frac{\alpha}{1-\beta}} - \lambda r a_t & \text{otherwise.} \end{cases} \quad (5)$$

The entrepreneur's profit takes two possible values according to whether he is unconstrained, that is, $a_t > \bar{a}(\theta, \lambda)$ or he is constrained, that is, $a_t \leq \bar{a}(\theta, \lambda)$. An agent with talent θ and current wealth a_t will choose to become an entrepreneur in period t if his profit as an entrepreneur, $\pi(\theta, \lambda, a_t)$, exceeds his labor income as a wage earner w , and will prefer to remain a waged worker otherwise. In each period, the agent's expected earning from his occupation is therefore given by

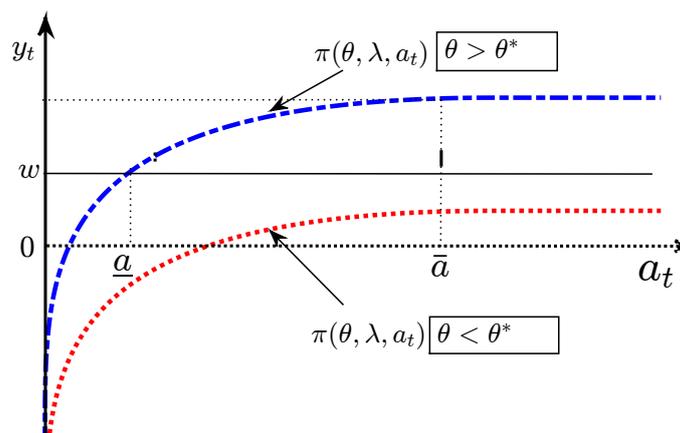
$$y_t = \max \{w, \pi(\theta, \lambda, a_t)\}. \quad (6)$$

Note that when $a_t \geq \bar{a}(\theta, \lambda)$, the earning function of the agent depends neither on his wealth nor on the degree of financial frictions. This means that wealthy individuals' decision to start a business does not depend on their capacity to get starting capital once they have enough, but only on whether they have sufficient ability to successfully run a firm on their own. Define the critical ability level

$$\theta^* = \frac{r^\alpha w^{1-\alpha}}{\alpha^\alpha \beta^\beta (1-\gamma)^{1-\gamma}}. \quad (7)$$

This is a cutoff talent level that determines whether a financially unconstrained agent has the ability to successfully run a firm. Notice that this cutoff does not depend on wealth, but only on technology parameters and market characteristics. In principle, with no financial frictions, any individual with talent above this threshold should instantly choose entrepreneurship. However, with financial frictions only sufficiently wealthy people can do so. We thus have the following result, which is illustrated in Figure 1 and summarized in Proposition 1.

Figure 1: Occupational Earnings



Proposition 1. Consider an agent in period t with ability θ and current wealth a_t .

(i) If $\theta \leq \theta^*$, then $y_t = w$.

(ii) If $\theta > \theta^*$, then there exists a wealth threshold $\underline{a}(\theta, \lambda) \in (0, \bar{a}(\theta, \lambda))$ such that

$$y_t = \begin{cases} w & \text{for } a_t < \underline{a}(\theta, \lambda) \\ \pi(\theta, \lambda, a_t) & \text{otherwise} \end{cases}$$

(iii) The wealth threshold $\underline{a}(\theta, \lambda)$ is decreasing in θ and λ , and vanishes with large values of λ , that is,

$$\frac{\partial \underline{a}(\theta, \lambda)}{\partial \theta} < 0, \quad \frac{\partial \underline{a}(\theta, \lambda)}{\partial \lambda} < 0, \quad \text{and} \quad \lim_{\lambda \rightarrow +\infty} \underline{a}(\theta, \lambda) = 0.$$

Proposition 1 elucidates how ability and wealth affect occupational choice each period. Part (i) states that for less talented individuals, wage-work is always preferable regardless of the availability of capital. Whereas Part (ii) states that for more talented individuals entrepreneurial activity would be preferable when enough capital is available. In other words the agent needs to have accumulated enough wealth to collateralize the

investment capital necessary to start a profitable firm. The amount $\underline{a}(\theta, \lambda)$ is the minimum collateral required for an individual with talent θ who lives in an economy with financial frictions λ to start a (constrained) firm. Part (iii) states that this collateral requirement decreases with entrepreneurial skills and increases with the degree of financial frictions. More importantly, the last statement says that this collateral requirement is not needed in a perfect market economy so that talented individuals always choose entrepreneurship, regardless of their wealth.

I now look at the dynamics of wealth accumulation that precedes the eventual entry to entrepreneurship for talented people.

2.2 Wealth Accumulation and Time to Entry

As discussed above, the prospective entrepreneur whose initial wealth does not meet the collateral requirement would have to save in hope to eventually make up for this amount. I assume that each period, agents accumulate wealth from their earnings and assets as follows

$$a_{t+1} = y_t - c_t + (1+r)a_t, \quad t = 0, 1, \dots, \quad (8)$$

where c_t represents consumption in period t . Assuming that agents live infinite periods and discount the future at the rate $\frac{1}{1+r}$, their preference over a sequence of consumption $\{c_t\}_{t=0}^{\infty}$ is given by the utility function¹

$$U(c) = \sum_{t=0}^{\infty} \left(\frac{1}{1+r} \right)^t u(c_t), \quad (9)$$

where $u(\cdot)$ is increasing, continuously differentiable and concave. Each period, a worker has to decide whether to operate his own business and how much to save for the following period. More formally, the problem of the agent is to choose the vector of current consumption and next period's wealth $\{c_t, a_{t+1}\}_{t=0}^{\infty}$ and the entrepreneurship entry date T^* to maximize his lifetime utility function. Assuming that an agent chooses the entry date T^* then his earning function can be rewritten as

$$y_t = w\mathbf{1}[t < T^*] + \pi(\theta, \lambda, a_t)(1 - \mathbf{1}[t < T^*]), \quad (10)$$

where $\mathbf{1}[\cdot]$ is a binary indicator function which takes the value 1 if the statement in brackets is true and 0 otherwise. The agent's maximization problem can therefore be written as²

$$\begin{aligned} & \max_{\{c_t, a_{t+1}\}, T^*} \sum_{t=0}^{\infty} \left(\frac{1}{1+r} \right)^t u(c_t) \\ \text{s.t.} \quad & c_t + a_{t+1} = w\mathbf{1}[t < T^*] + \pi(\theta, \lambda, a_t)(1 - \mathbf{1}[t < T^*]) + (1+r)a_t \quad \forall t \geq 0 \\ & a_{t+1} \geq 0, \quad a_0 \text{ given.} \end{aligned} \quad (11)$$

¹This means that I am setting upfront the psychological discount factor to equal the financial discount factor.

² Notice that $w = \lim_{T^* \rightarrow \infty} y_t(T^*)$. Then, by Proposition 1, the time to entry would be infinite for less talented workers (i.e. $\theta \leq \theta^*$) and would be finite only for prospective entrepreneurs (i.e. $\theta > \theta^*$).

Denoting by $u_c(\cdot)$ the first derivative of $u(\cdot)$, the Euler equation of the agent's maximization problem for periods prior to the entry date is

$$u_c(c_t) = u_c(c_{t+1}), \quad \forall t < T^*. \quad (12)$$

This implies an optimal decision where the agent consumes a fixed amount c_0 in each of these periods and therefore saves from his labor income at a fixed rate $s_t = w - c_0 = s$ for all $t < T^*$.³ Plugging this result in the agent's intertemporal budget constraint, the wealth accumulated as a wageworker at the beginning of any period $t < T^*$ is given by

$$a_t = (1+r)^t a_0 + \sum_{j=1}^t (1+r)^{t-j} s_j = (1+r)^t \left(a_0 + \frac{s}{r} \right) - \frac{s}{r}$$

By Proposition 1(ii), an agent with ability $\theta > \theta^*$ would start a business only if $a_t \geq \underline{a}(\theta, \lambda)$. This implies that

$$t \geq \frac{\ln [(s + r\underline{a}(\theta, \lambda))/(s + ra_0)]}{\ln(1+r)}.$$

The time to entry into entrepreneurship is therefore defined by⁴

$$T^*(\theta, \lambda, a_0) = \max \left\{ 0, \frac{\ln [(s + r\underline{a}(\theta, \lambda))/(s + ra_0)]}{\ln(1+r)} \right\}. \quad (13)$$

We then have the following result.

Proposition 2 (Main). *Consider an agent with talent θ and initial wealth a_0 .*

(i) *If $\theta < \theta^*$ then the agent is a lifetime wageworker, regardless of a_0 .*

(ii) *If $\theta \geq \theta^*$, then*

(a) *For $a_0 > \underline{a}(\theta, \lambda)$, the agent is a lifetime entrepreneur.*

(b) *For $a_0 < \underline{a}(\theta, \lambda)$, there is an optimal entry date $T^* = T^*(\theta, \lambda, a_0) > 0$ such that the agent chooses wage-work for periods $t < T^*$ and entrepreneurship for $t \geq T^*$.*

(iii) *The time to entry $T^* = T^*(\theta, \lambda, a_0)$ is decreasing in a_0 , θ and λ , and corresponds to the initial period, 0, for large values of λ . That is*

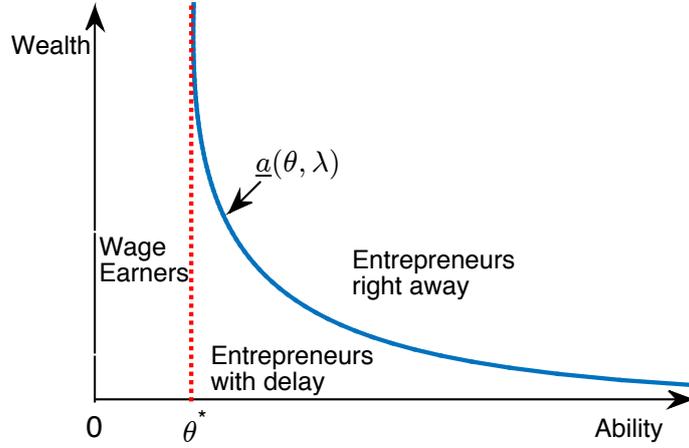
$$\frac{\partial T^*(\theta, \lambda, a_0)}{\partial \theta} \leq 0, \quad \frac{\partial T^*(\theta, \lambda, a_0)}{\partial a_0} \leq 0, \quad \frac{\partial T^*(\theta, \lambda, a_0)}{\partial \lambda} \leq 0 \quad \text{and} \quad \lim_{\lambda \rightarrow +\infty} T^*(\theta, \lambda, a_0) = 0.$$

Figure 2 illustrates the result given in Proposition 2 for a fixed λ . Less talented agents

³With linear utility, the optimal consumption is $c_0 = 0, \forall t < T^*$; that is, it is always better to save the entirety of wage earnings until the collateral requirement is met.

⁴The time to entry must be nonnegative. If T^* is a decimal number, its practical value is its ceiling.

Figure 2: Selection to Occupations



remain wage-earners whereas more talented and wealthier agents enter entrepreneurship right away. The main result of the paper is given in Part (ii) (b) of this proposition: For talented but poor individuals i.e. $\theta > \theta^*$ and $a_0 < \underline{a}(\theta, \lambda)$, we have $T^* = T^*(a_0, \theta, \lambda) > 0$, that is, the entrepreneurship entry decision is delayed. Part (iii) states that the time to entry decreases with increasing talent and wealth. Moreover, it decreases to zero with large values of the collateral constraint so that in perfect credit markets there is no delay to entry for talented individuals. Interestingly, by differentiating the optimal entry time T^* with respect to other factors such as interest rate, r , and wage rate, w , it is possible to see that these factors have ambiguous effects on the time to entry. On the one hand, a higher interest rate and a higher wage make it easier for talented individuals to save the collateral needed to start a profitable business, but, on the other hand, a higher interest rate and a higher wage raise the cost of operating a business and make the option of being a wage earner relatively more attractive. Which of these countervailing effects dominates is therefore an empirical question that I also explore in the following section.

2.3 Welfare Costs

In order to fully understand the welfare costs of financial frictions, it is important to characterize all possible consumption paths and the associated lifetime utilities of agents. So far I described the consumption path of prospective entrepreneurs until the entrepreneurship switch. However, since less talented individuals (i.e. $\theta < \theta^*$) remain wage-earners indefinitely, the Euler equation (12) with $t = 0, 1 \dots, \infty$ implies that for those agents $c_t = c_l = w + ra_0$, $t = 0, 1 \dots, \infty$. As for more talented individuals (i.e. $\theta \geq \theta^*$), recall that the optimal entry date T^* derived in the previous sections is only the earliest time where the prospective entrepreneur can start a constrained firm. To start an unconstrained firm, an agent with ability θ should have accumulated at least $\bar{a}(\theta, \lambda)$ amount of wealth. Denote by $T^{**}(\theta, \lambda, a_0)$ the earliest date where an agent with ability $\theta \geq \theta^*$

and initial wealth a_0 can start an unconstrained firm. Then

$$T^{**}(\theta, \lambda, a_0) = \inf \{t : a_t > \bar{a}(\theta, \lambda)\}.$$

The entry time $T^{**}(\theta, \lambda, a_0)$ has similar properties as $T^*(\theta, \lambda, a_0)$, that is, it is decreasing in all its arguments, θ , λ , and a_0 , and tends to 0 when λ is sufficiently large. The Euler equation of the agent's maximization problem for periods above T^* is given by

$$\frac{u_c(c_t)}{u_c(c_{t+1})} = \begin{cases} 1 + \frac{1}{1+r} \frac{\partial \pi(\theta, \lambda, a_{t+1})}{\partial a_{t+1}} & \text{for } t \in [T^*, T^{**}) \\ 1 & \text{for } t \in [T^{**}, \infty) \end{cases} \quad (14)$$

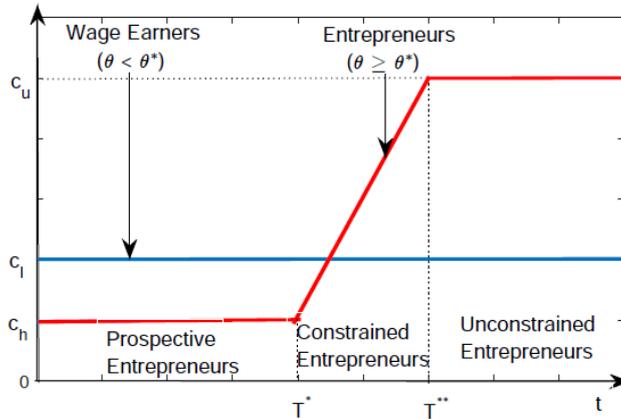
The following corollary has important consequences for welfare.

Corollary 1. (i) *The consumption of prospective entrepreneurs is lower than the consumption of individuals who remain wage earners.*

(ii) *Consumption increases after individuals become constrained entrepreneurs and reaches a maximum when they become unconstrained.*

Figure 3 presents the consumption paths of both wage-earners and prospective entrepreneurs, and illustrates Parts (i) and (ii) of Corollary 1 (in the figure, c_h is the early consumption of entrepreneurs i.e. high entrepreneurial skills, whereas c_l is the lifetime consumption of wageworkers i.e. low entrepreneurial skills). This result shows that

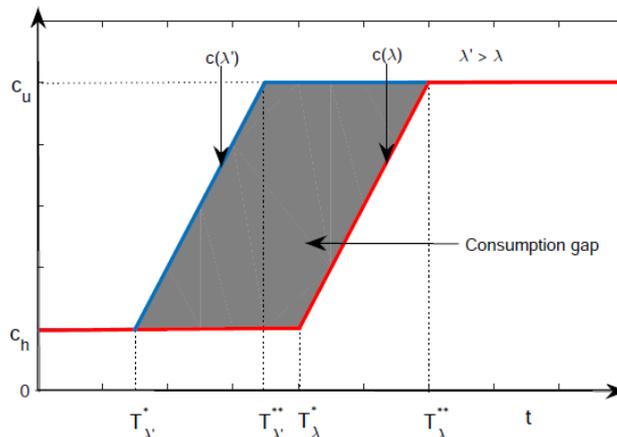
Figure 3: Consumption Paths



prospective entrepreneurs save at a higher rate than both existing entrepreneurs and individuals who have no intention to become entrepreneurs. Entrepreneurship provides higher levels of consumption, and consumption is the highest for financially unconstrained entrepreneurs with similar skills. As a consequence, higher financial frictions imply higher welfare losses for talented people. The welfare cost of financial frictions can be computed in units of permanent consumption compensation necessary to make

an individual indifferent between the status quo, that is the economy with λ , and an economy with better capital markets indexed by λ' such that $\lambda' > \lambda$. Simulation results performed in the following section allow to quantify these losses in the Cameroon data. The change in the share of consumption for an agent with ability θ and initial wealth a_0

Figure 4: Consumption Paths of High Talents for Different Degrees of Financial Friction



when the economy moves from λ to λ' is $\Delta c(\lambda', \lambda) = c(\theta, \lambda', a_0) - c(\theta, \lambda, a_0)$, where

$$c(\theta, \lambda, a_0) = (1 + r)a_0 + \sum_{t=0}^{\infty} \frac{\max\{\pi(\theta, \lambda, a_t(\theta, a_0)), w\}}{(1 + r)^t}.$$

The lifetime consumption gap for talented agents resulting from the improvement of credit markets is illustrated in Figure 4. With better credit markets (indexed by λ') talented individuals become entrepreneurs earlier than they would in a worse credit markets state (indexed by λ) and their consumption quickly reaches the highest unconstrained consumption c_u . Their lifetime consumption therefore increases with increasing levels of λ , implying that this improvement would be associated with welfare gains (or with welfare losses otherwise).

The model described above has some theoretical limitations because of the simplifying assumptions that are made to obtain tractable analytical results. First, I assumed that wages are fixed and are not affected by skills. Although this is a common assumption in several related studies (e.g. Buera 2009, Ordoñez 2014, Moll 2014), allowing for wages to vary with skills may play a role to some extent. For example, it would raise the critical ability threshold, θ^* , required to become entrepreneur for high skills, and possibly lower the degree of inequality discussed in Section 4 below, but the main predictions of the model would remain unchanged. Second, entrepreneurial ability is assumed to be constant throughout the agent's life. This can be a substantive assumption if entrepreneurial ability significantly appreciates over time, for example through industry human capital accumulation (Schjerning 2005), or depreciates over time, for example if

θ captures entrepreneurial ideas or investment opportunities that could become obsolete or unavailable after some time (Bassetto et al. 2015, Buera and Shin 2013).

3 Quantitative Exploration

As a first step to quantify the theoretical results, I calibrate a set of structural parameters related to technology and the distribution of entrepreneurial ability, and then conduct simulations to assess the effect of financial frictions.

3.1 Calibration

Existing studies have calibrated occupational choice models similar to the one presented here by focusing on the U.S. economy (e.g. Buera and Shin 2011, Moll 2014, Bah and Fang 2015). In these papers, the U.S. is assumed to be a perfect credit market economy and the financial friction-free scenario in these models is used as a benchmark to assess how deviations affect the equilibrium. In the present study, however, the specific characteristics of a developing economy like Cameroon (e.g., the possibly differences in ability and technology, and the presence of informal enterprises) suggest that it would be unwise to use the same approach. Following standard practice, I assume a time period in the model to be one year and a CRRA (logarithmic) utility function for agents. I calibrate technology parameters to match key aspects of the Cameroon economy. The target moments pertain to standard macroeconomic aggregates and firm size distribution.

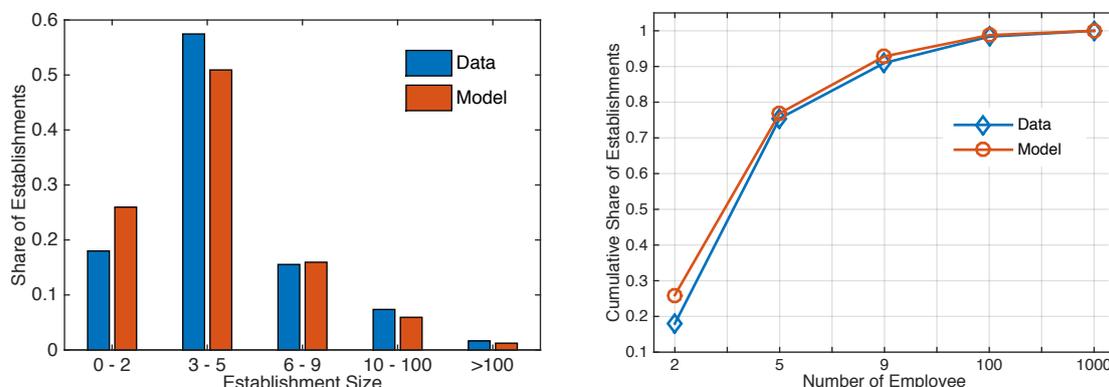
Table 1: Calibration Targets and Parameter Values

Target moments	Data	Model	Parameter	Value
Mean establishment size	2.17	2.23	Log ability mean	$\mu = 0.73$
St. dev. establishment size	0.87	0.87	Log ability St. dev.	$\sigma = 0.37$
More than 100 employees	0.01	0.01	Total share	$\gamma = 0.67$
External Finance to GDP ratio	0.09	0.09	Fin. friction	$\lambda = 1.1$

First, I set the ratio α/γ , the aggregate capital income share, to 0.33. This choice is made to match the estimates recently obtained by Nguimkeu (2015) from the Cameroon data, and appears to be a value that is consistent with studies related to other countries (e.g. Buera and Shin 2011, Ordóñez 2014, Bah and Fang 2015). I set the interest rate to 3.3% which is the average discount rate for Cameroon (IMF’s International Financial Statistics). The degree of financial friction, which is high, implies a low parameter value $\lambda = 1.1$, computed to match the Cameroon’s external finance-to-GDP ratio, a common measure of financial development used in the empirical literature (e.g. Moll 2014, Buera, Kaboski and Shin 2011).⁵

⁵Following Moll 2014 (see also Buera, Kaboski and Shin 2011), External debt to GDP ratio, D/Y , can be directly linked to the model by noticing that in equilibrium $D/K = (1 - 1/\lambda)$. Hence, $D/Y = \frac{D}{K} \frac{K}{Y} = (1 - 1/\lambda)K/Y$. Since $K/Y = \alpha/r$, we have $\lambda = (1 - \frac{D}{Y} \frac{r}{\alpha})^{-1}$. For Cameroon, $D/Y = 0.09$.

Figure 5: Distribution of establishments by employment: model vs. data



I assume that the distribution of entrepreneurial talent, θ , which determines the size distribution of establishments, follows a truncated log normal distribution with parameters μ and σ^2 . These parameters along with γ are chosen such that the moments of the distribution of the establishment size with a range of skills are set to match the range of employment in the data.⁶ The targeted moments are well matched as confirmed in Table 1 presenting the data and model targets as well as the parameter values. The calibration yields parameters that also replicates well several moments that were not explicitly targeted. Moreover, as shown in Figure 5, the model closely replicates the average establishment size of a number of disaggregated size categories and the associated cumulative distribution function.

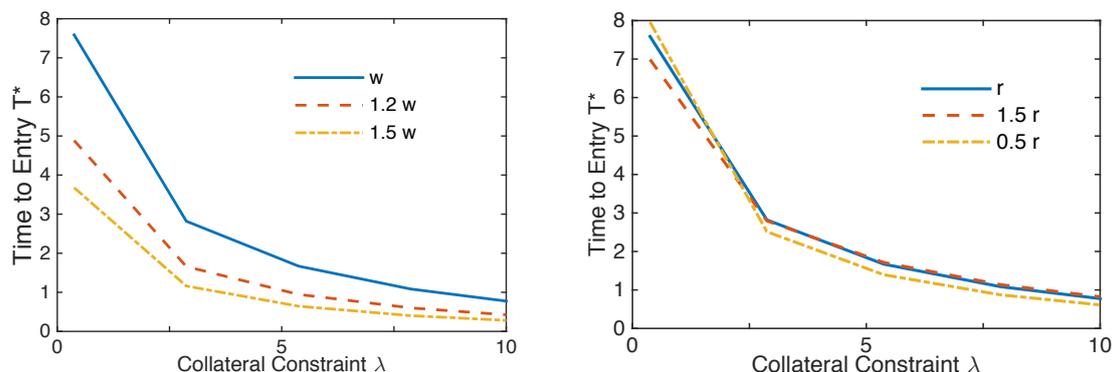
3.2 Aggregate Dynamics and Simulations

Once the model is calibrated to the Cameroon economy, I can investigate the negative effects of borrowing constraints using the calibrated economy as a benchmark.

I start by simulating the time to entry into entrepreneurship. I plot the entry date T^* as a function of the financial friction parameter, λ , where entrepreneurial talent and initial wealth are fixed at their mean value. The horizontal axis gives different possible values of λ starting from the calibrated value, 1.1, and the vertical axis measures the time to entry corresponding to these values. The left panel of Figure 6 depicts the impact of financial frictions on the time to entry to entrepreneurship when the wage rate is set to the data average w as well as for a 20% and a 50% wage increases. The results show that in the statu quo there is a delay of about 7 years for a mean wealth agent, and this delay decreases progressively with increased improvement of the level of financial development. Interestingly, higher levels of wages correspond to shorter delays, implying

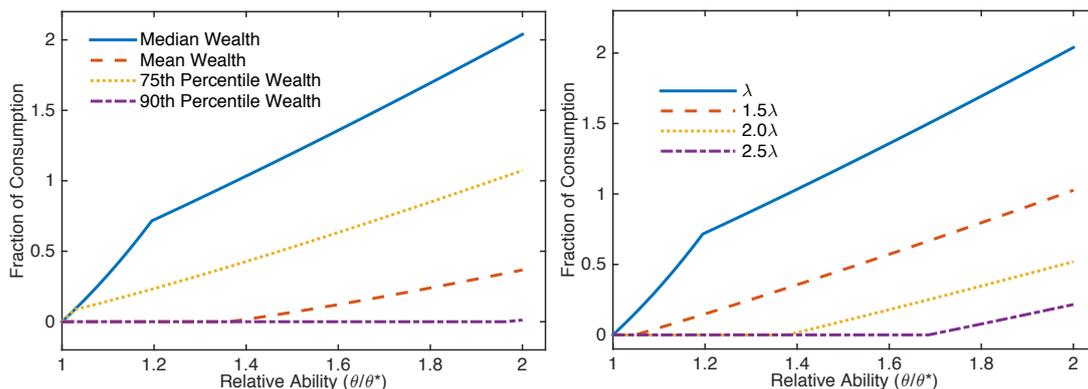
⁶I also assumed a Pareto distribution for entrepreneurial ability and found similar results.

Figure 6: Impact of Financial Frictions on Entry Time



that higher wages enable talented people to save more and start their business sooner. This suggests that in the data, the benefits from high wages more than offset their costs for entrepreneurial choice. However, as the financial market improves, less saving is required to start a business so that higher wages do not have a significant impact on the entrepreneurship entry time. The right panel of Figure 6 shows the impact of financial frictions for various values of interest rate, starting with the current average rate r in the data. Unlike the wage rate, changes in the interest rate do not seem to affect the entry date in a particular direction or significantly. This can be explained by the countervailing forces surrounding interest rates as discussed earlier. On the one hand, an increase in interest rate would increase savings and wealth so that the prospective entrepreneur would tend to start his business sooner. On the other hand, high interest rates imply high costs of investment capital so that the prospective entrepreneur would tend to delay entry in order to save more and minimize these costs.

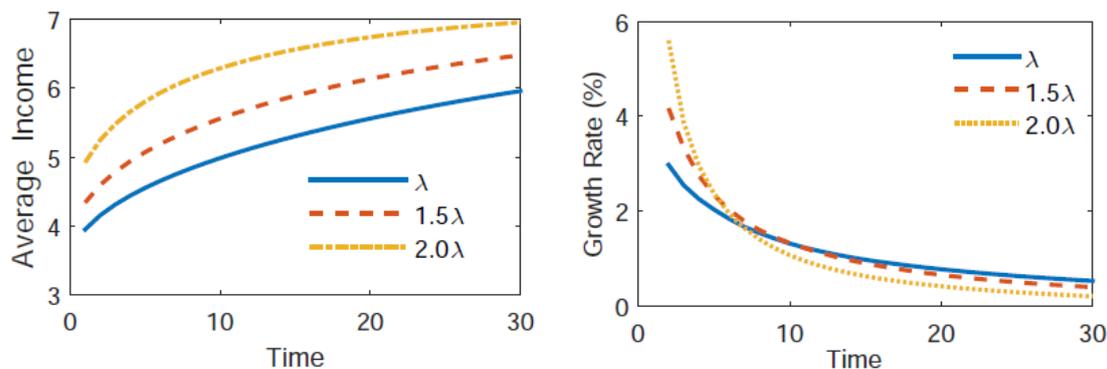
Figure 7: Consumption equivalent compensation for various levels of initial wealth (left) and various degrees of financial frictions for people who start with median wealth (right)



The delay to entry suggests important welfare losses. I illustrate these losses in Figure 7 where I plot the fraction by which the path of consumption must be increased to

make an individual of a given relative ability, who is born with a given level of wealth (e.g. median, mean, 75th or 90th percentile), indifferent between living in the Cameroon economy and in an economy with perfect capital markets (left panel). As the time to entry suggests, there are potential enormous welfare losses due to borrowing constraints. In particular, the consumption of an individual with mean talent and mean wealth in the data would need to be increased by 10% to match his consumption in a perfect credit market economy. Likewise, the consumption of the median-wealth entrant into entrepreneurship in the data must be increased permanently by 100% to match his consumption in an economy with perfect capital markets.⁷ This consumption equivalent compensation decreases with decreasing levels of borrowing constraints (right panel). Interestingly, the results show that only individuals who are born with wealth above the 90th percentile of the current wealth distribution are indifferent between living in the Cameroon economy and in an economy with perfect capital markets.

Figure 8: Impact of Financial Frictions on Aggregate Income and Growth



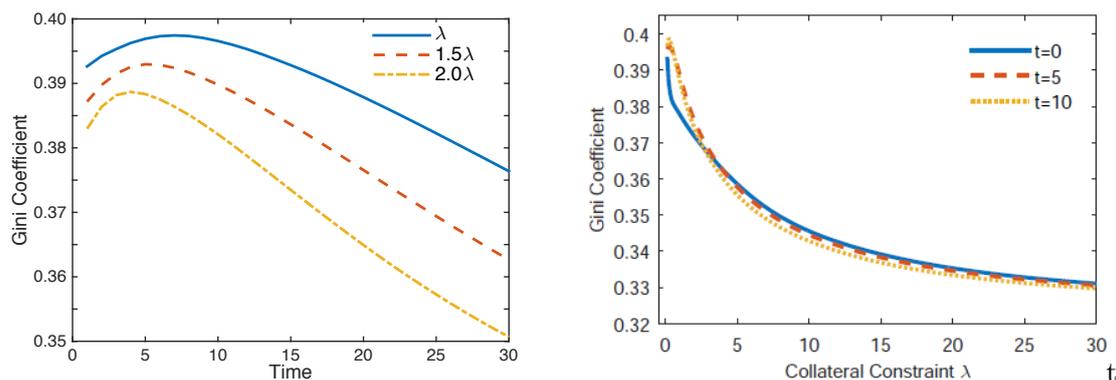
Counterfactual simulations also confirm that with better access to finance, aggregate income grows faster (Levine 1997, Restuccia and Rogerson 2013). Figure 8 depicts the dynamics of aggregate income and growth over time for various degrees of the financial friction, where λ is the calibrated value. The results show that regimes with better financial markets experience higher income, compared to regimes to the statu quo λ (left panel). The higher income allow these economies to grow faster (see right panel). This is particularly true at the early stages (first 10 years) of the development.

Finally, the delay to entry also suggests important dynamics for income inequality. I analyze this by considering a cohort of young individuals in the data (less than 26 years old). The distribution of their wealth is then taken as the initial wealth distribution in the economy (see Figure A1 in Appendix). The dynamic model is used to simulate their occupation and earning paths over a period of 30 years, starting from the statu quo, for various degrees of financial friction λ , and at various point in time. Figure 9 plots

⁷The large discrepancy in welfare loss between the mean wealth and the median wealth agents comes from the extremely skewed distribution of wealth in the data, as depicted in Figure A1.

the corresponding patterns of income inequality as measured by the Gini index. The left panel shows that inequality follows the well-known Kuznets' inverted U-shape over time (see, e.g. Greenwood and Jovanovic 1990, Claessens and Perotti 2007). Because the return to capital is larger above a certain wealth threshold, those with higher initial wealth will be able to get disproportionately higher earnings sooner, which creates a temporary widening of inequality. However, after a number of years when the less wealthy prospective entrepreneurs in the cohort reach the threshold, they are able to close the income disparity gap. Moreover, with better financial markets, the decrease in inequality happens in a shorter time span. The right panel of Figure 9 shows that with better financial markets, inequality can drop by around 16% Gini from the current initial wealth distribution. The flattening of the curves at high values of the collateral constraint shows that as more prospective entrepreneurs become unconstrained entrepreneurs, the income disparity within the cohort shrinks towards a value that reflects the disparity in entrepreneurial skills. This limiting value of inequality does not depend on the starting time. These results corroborate those presented in Figure 8.

Figure 9: Impact of Financial Frictions on Inequality



The above findings suggest that financial deepening and policies aimed at favouring credit access to the poor do not only accelerate economic growth through a timely enterprise creation, but also have the potential to shorten the duration of sharp inequality. Related policy interventions can take various forms. First, governments can play a central role in the financial inclusion effort by creating the associated legal and regulatory framework such as protecting creditor rights, regulating business conduct, educating and protecting consumers. Microfinance programs have also been advocated as a channel of promoting entry and expansion of businesses in developing countries. These programs are funded through governments and NGOs, and make small amounts of collateral-free credit available to the broad population, including the poorest households. Nguimkeu (2014) simulated the impact of microfinance in Cameroon and found a positive impact on entrepreneurship and earnings. Finally, if the poor have high returns but lack sufficient resources to invest, one possible solution is to increase their resources through

grants. Asset grant programs targeting the ultra poor have thus become an increasingly common policy to help them escape poverty traps (e.g. the Ultra Poor Program in Bangladesh, Ethiopia, Ghana, Haiti, India). This policy could also be effective in the context of Cameroon where, as found in the simulations results presented in Figure 6, an increase in wages have positive impact on entrepreneurship entry.

4 An Empirical Test

It is difficult to empirically identify the delay to entry into entrepreneurship using cross-sectional survey data. However it is possible to use macro-data to empirically test some of its main implications at the aggregate level. In this section, I take this step and assess the impact of financial frictions on the age gap between entrepreneurs and wageworkers across countries. As discussed in the previous sections, for the same ability level poor access to credit further delays entrepreneurship entry. Hence, we expect the difference between the average age of entrepreneurs and wageworkers to be higher in countries with weaker financial markets.

4.1 Cross-Country Data

To test the implication that financial frictions widen the age gap between entrepreneurs and wage-earners, I use data from various sources including the World Bank Enterprise Survey and the European Quality of Life Survey. Specifically, these data are used to compute the average age gap between entrepreneurs and wageworkers (denoted *Gap*) for several countries. Other country specific data such as real interest rates and real wage rates are extracted from the International Financial Statistics and the World Development Indicators. All the data used here are those that have been collected between 2009 and 2011 in a total of 63 countries including both developed and developing countries. The main explanatory variable of interest is the measure of financial development that determines access to credit (denoted *Access* in the regression equation specified below). For this variable, I consider three different possible measures of financial frictions.

(i) *External Finance to GDP ratio* (denoted External finance below) is a common measure of financial friction in the literature. It has been used in quantitative work, such as Amaral and Quintin (2010), Buera et al. (2011) and Midrigan and Xu (2014) to pin down the cross-country variation in financial development. It ranges from 0.01 to 2.56 in the data, with a sample mean of 0.56. Low values of this variable indicate high levels of financial frictions.

(ii) *Domestic Credit to the Private sector* (denoted Domestic credit) is the total amount of financial resources provided to the private sector by financial corporations, given as a fraction of GDP (see International Financial Statistics). This variable is also a traditional measure of financial development and has been used in empirical work such as Rajan and Zingales (1998). It ranges from 0.04 to 2.47 in the data, with lower values

indicating higher levels financial frictions. The sample mean is 0.68.

(iii) *Strength of the Legal Rights Index* (denoted Legal rights) measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending (see World Bank, Doing Business 2011). It ranges from 0 to 12, with higher scores indicating that these laws are better designed to expand access to credit. Unlike the previous two, this index can be arguably seen as a rather indirect measure of financial frictions; it does not measure financial development directly, but assesses the conditions that are favourable for such development.

Table 2: Correlation matrix of the main explanatory variables

	External finance	Domestic credit.	Legal rights	Interest rate	Wage rate
External finance	1.000				
Domestic credit	0.842	1.000			
Legal rights	0.108	0.105	1.000		
Interest rate	-0.252	-0.316	0.016	1.000	
Wage rate	0.518	0.557	0.100	-0.165	1.000

The summary statistics of these variables can be found in Table A3 in the Appendix. Table 2 presents the correlation matrix of the explanatory variables considered. The two direct measures of financial development (External Finance Finance and Domestic) are highly correlated, but are less correlated with the indirect measure (Legal rights).

4.2 Regression Results

To measure the effect of financial constraints on the age gap between entrepreneurs and wageworkers, I run the following cross-country regression:

$$Gap_i = \psi_0 + \psi_1 Access_i + \Psi' X_i + \varepsilon_i$$

where, as previously discussed, Gap_i is the average age gap between entrepreneurs and wage earners in country i , $Access_i$ is the measure of financial development in country i , and X_i includes a set of country characteristics that vary depending on the specification. In particular, X_i contains real interest rates and real wage rates in purchasing power parity (PPP). The regression is run using ordinary least squares and Table 3 presents the estimated parameters with the heteroskedasticity-robust standard errors.⁸ All the regressions results show that all measures of financial access used are negatively and significantly correlated with the entrepreneur-wageworker age gap, although the legal right index is only weakly significant as one would expect (given that it is an indirect measure). Columns (1), (3) and (5) provide regression estimates for the simple linear

⁸I also estimated the regression with bootstrapped standard errors and the results were similar to the heteroskedasticity-robust case.

Table 3: Determinants of Age Gap

Variables	Dependent Variable: Age Gap					
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	6.516*** (0.610)	6.673*** (0.677)	7.159*** (0.629)	7.088*** (1.007)	7.077*** (0.885)	7.007*** (1.040)
External finance	-2.275*** (0.536)	-1.508*** (0.504)				
Domestic credit			-2.424*** (0.570)	-1.672** (0.665)		
Legal rights					-0.279* (0.149)	-0.150* (0.086)
Interest rate		-0.001 (0.059)		0.002 (0.056)		0.025 (0.051)
Wage rate		-0.123*** (0.039)		-0.113*** (0.032)		-0.184*** (0.061)
Observations	53	51	62	58	61	57
R^2	0.149	0.198	0.185	0.222	0.054	0.184
R^2_{Adj}	0.132	0.166	0.1712	0.198	0.038	0.138
F -stat	18.04	7.27	18.08	8.82	3.37	3.98

Robust Standard Errors in Parentheses
Significance Codes: '***' 1%, '**' 5%, '*' 10%.

relationship between the average country age gap and each of the financial friction measure, respectively. In columns (2), (4) and (6), real interest rates and real wage rates (in PPP) are added to the regressions. In each of these regressions the coefficient of financial friction remains negative and significant. Interestingly, the coefficient on wage rate is persistently negative and significant while the one on interest rate remains insignificant. This is consistent with the the counterfactual simulations performed above. In fact, they confirm that in the data, wages may have a negative impact on the average age gap via the decrease in the time to entry into entrepreneurship, while the impact of interest rate is ambiguous as the theory predicts. These results show that the cross-country variation in financial development can explain nearly 20 per cent of the cross country age gap between entrepreneurs and wagedworkers.

5 Conclusion

The purpose of this paper was to examine to what extent financial frictions delay the entry into entrepreneurship and the related consequences in terms of income inequality and welfare loss. I present a tractable dynamic model of occupational choice where individuals who are heterogeneous in their entrepreneurial talent and initial wealth choose the optimal time to switch from wage-work to entrepreneurship. The model yields an

entry time that is increasing with higher degrees of financial frictions and decreasing with higher entrepreneurial skills and initial wealth. Talented individuals who are initially wealthy enter entrepreneurship right away, whereas the poor ones must work for several years as wage-earners to accumulate enough wealth to meet the collateral required by lenders.

I calibrate the model to the Cameroon data, study the associated dynamics and investigate the effects of improving the level of financial development. I find that the delay to entrepreneurship entry is around 7 years for the average-talented entrepreneur who start with the average wealth, and can be slightly mitigated by higher wages. The associated welfare loss is also significant. Individuals who could otherwise earn up to 10% higher income as entrepreneurs will remain workers for about 7 years if they start with the average wealth. Similarly, the consumption of the median-wealth entrant into entrepreneurship in the data must be permanently increased by 100% to make him indifferent between living in the Cameroon economy and in a perfect capital market economy. Only individuals who are born with wealth above the 90th percentile are indifferent between living in the former and the latter. The results also confirm that aggregate income grows faster in regimes with less financial frictions and inequality follows well-known Kuznets' inverted U-shaped curve. In fact, better access to finance can reduce inequality by around 16% Gini in the Cameroon data.

Finally, an empirical test of the model predictions is performed using a sample of cross-country data. It provides evidence that lower levels of financial development are associated with larger age gaps between entrepreneurs and wage-earners, which is a pattern found in many empirical studies of occupational choice in developing countries. Put together, these findings suggest that financial deepening and policies favouring credit access to the poor do not only result in accelerated economic growth but can shorten the duration of sharp inequality while improving welfare. In the context of Cameroon, such policies may include, for instance, government intervention to strengthen the associated legal and regulatory framework, microfinance programs and asset grants programs. While this paper shows the role of financial frictions and wealth accumulation in the transition and timing of entrepreneurial choice, the possible dynamics of entrepreneurial ideas or talent needed to run a business is not modeled. However, the accumulation of entrepreneurial human capital or the depreciation of entrepreneurial ideas over time may have potentially interesting and subtle interactions with borrowing constraints. This is an important consideration that is left for further research.

A Appendix

A.1 Proof of Proposition 1

Proof. (i) The function $\pi(\theta, \lambda, a_t)$ is clearly increasing in θ and in a_t and reaches its maximum at $\bar{a} = \bar{a}(\theta, \lambda)$. Notice that we can write

$$\pi(\theta, \lambda, \bar{a}) - w = (1 - \gamma)\theta^{\frac{1}{1-\gamma}} \left(\frac{\alpha}{r}\right)^{\frac{\alpha}{1-\gamma}} \left(\frac{\beta}{w}\right)^{\frac{\beta}{1-\gamma}} - w = \left(\left[\frac{\theta}{\theta^*} \right]^{\frac{1}{1-\gamma}} - 1 \right) w$$

Hence, for $\theta \leq \theta^*$, $\pi(\theta, \lambda, \bar{a}) - w \leq 0$ and therefore $\pi(\theta, \lambda, a_t) - w \leq 0$ for all a_t .

(ii) Suppose $\theta > \theta^*$; Then from the above equation, we see that $\pi(\theta, \lambda, \bar{a}) - w > 0$. On the other hand, we have $\pi(\theta, \lambda, 0) - w = -w < 0$. By the intermediate value theorem, there exists $\underline{a}(\theta, \lambda) \in (0, \bar{a})$ such that $\pi(\theta, \lambda, \underline{a}) - w = 0$. It follows from the monotonicity of $\pi(\theta, \lambda, a_t)$ that $\underline{a}(\theta, \lambda)$ is unique, and $\pi(\theta, \lambda, a_t) - w \leq 0$ for all $a_t \leq \underline{a}(\theta, \lambda)$ and $\pi(\theta, \lambda, a_t) - w \geq 0$ for all $a_t \geq \underline{a}(\theta, \lambda)$.

(iii) We know that $\pi(\theta, \lambda, \underline{a}) - w = 0$. If we differentiate this equation with respect to θ , we have $\frac{\partial \pi}{\partial \theta} + \frac{\partial \pi}{\partial a_t} \frac{\partial \underline{a}(\theta, \lambda)}{\partial \theta} = 0$, which implies $\frac{\partial \underline{a}(\theta, \lambda)}{\partial \theta} = -\frac{\partial \pi / \partial \theta}{\partial \pi / \partial a_t} < 0$ (by the monotonicity of π in θ and a_t).

Likewise, differentiating with respect to λ gives $\frac{\partial \pi}{\partial \lambda} + \frac{\partial \pi}{\partial a_t} \frac{\partial \underline{a}(\theta, \lambda)}{\partial \lambda} = 0$. This implies $\frac{\partial \underline{a}(\theta, \lambda)}{\partial \lambda} = -\frac{\partial \pi / \partial \lambda}{\partial \pi / \partial a_t}$. The remaining step is then to show that $\partial \pi(\theta, \lambda, a_t) / \partial \lambda > 0, \forall a_t \in (0, \bar{a})$. Notice that we can write

$$\partial \pi(\theta, \lambda, a_t) / \partial \lambda = \alpha \theta^{\frac{1}{1-\beta}} \left(\frac{\beta}{w}\right)^{\frac{\beta}{1-\beta}} \lambda^{\frac{\gamma-1}{1-\beta}} a_t^{\frac{\alpha}{1-\beta}} - r a_t = r a_t \left(\left[\frac{\bar{a}}{a_t} \right]^{\frac{1-\gamma}{1-\beta}} - 1 \right) > 0, \quad \forall a_t < \bar{a}.$$

Hence, $\frac{\partial \underline{a}(\theta, \lambda)}{\partial \theta} < 0$. Finally, since $\lim_{\lambda \rightarrow \infty} \bar{a}(\theta, \lambda) = 0$ and $0 < \underline{a}(\theta, \lambda) < \bar{a}(\theta, \lambda)$, then it must be the case that $\lim_{\lambda \rightarrow \infty} \underline{a}(\theta, \lambda) = 0$ □

A.2 Proof of Proposition 2

Proof. (i) This follows from Proposition 1(i). Since for $\theta < \theta^*$, $\pi(\theta, \lambda, a_t) < w$ for any period $t = 0, 1, \dots, \infty$, this implies that the agent is a lifetime wageworker.

(ii) Suppose $\theta > \theta^*$. Notice that $\{a_t\}_{t=0}^{\infty}$ is an increasing sequence of assets.

(a) If $a_0 \geq \underline{a}(\theta, \lambda)$, then by the monotonicity of the sequence of assets, we have $a_t > \underline{a}(\theta, \lambda)$, for all $t = 0, 1, \dots, \infty$. By Proposition 1(ii), this means that $y_t = \pi(\theta, \lambda, a_t), \forall t \geq 0$ and the agent is a lifetime entrepreneur.

(b) If $a_0 < \underline{a}(\theta, \lambda)$, then we know from the preceding discussion that $a_t < \underline{a}(\theta, \lambda)$ for all $t < T^*$, and $a_t \geq \underline{a}(\theta, \lambda)$ for all $t \geq T^*$. The result then follows from Proposition 1(ii)

(iii) Let's start by deriving the limit of $T^*(a_0, \theta, \lambda)$ when λ is large. We have

$$\begin{aligned} \lim_{\lambda \rightarrow \infty} T^*(a_0, \theta, \lambda) &= \max \left\{ 0, \lim_{\lambda \rightarrow \infty} \frac{\ln [(s + r\underline{a}(\theta, \lambda))/(s + ra_0)]}{\ln(1 + r)} \right\} \\ &= \max \left\{ 0, \frac{\ln [s/(s + ra_0)]}{\ln(1 + r)} \right\}, \quad \text{since } \lim_{\lambda \rightarrow \infty} \underline{a}(\theta, \lambda) = 0 \\ &= 0, \quad \text{because the second term in the max\{\} is negative.} \end{aligned}$$

Now, let's look at the remaining properties. If $T^* = 0$, all partial derivatives are 0. Suppose that T^* is positive and defined by $T^*(a_0, \theta, \lambda) = \frac{\ln [(s + r\underline{a}(\theta, \lambda))/(s + ra_0)]}{\ln(1 + r)}$.

Then,

$$\begin{aligned} \frac{\partial T^*(a_0, \theta, \lambda)}{\partial a_0} &= -\frac{r}{(s + ra_0) \ln(1 + r)} < 0, \\ \frac{\partial T^*(a_0, \theta, \lambda)}{\partial \theta} &= \frac{r}{(s + r\underline{a}(\theta, \lambda)) \ln(1 + r)} \frac{\partial \underline{a}(\theta, \lambda)}{\partial \theta} < 0, \quad (\text{since } \frac{\partial \underline{a}(\theta, \lambda)}{\partial \theta} < 0) \\ \frac{\partial T^*(a_0, \theta, \lambda)}{\partial \lambda} &= \frac{r}{(s + r\underline{a}(\theta, \lambda)) \ln(1 + r)} \frac{\partial \underline{a}(\theta, \lambda)}{\partial \lambda} < 0, \quad (\text{since } \frac{\partial \underline{a}(\theta, \lambda)}{\partial \lambda} < 0) \end{aligned}$$

This achieves the proof that

$$\frac{\partial T^*(a_0, \theta, \lambda)}{\partial \theta} \leq 0, \quad \frac{\partial T^*(a_0, \theta, \lambda)}{\partial a_0} \leq 0, \quad \frac{\partial T^*(a_0, \theta, \lambda)}{\partial \lambda} \leq 0 \quad \text{and} \quad \lim_{\lambda \rightarrow +\infty} T^*(a_0, \theta, \lambda) = 0.$$

□

A.3 Proof of Corollary 1

Proof. Part (i) follows from the fact that wage-earners consume the entirety of their income each period, whereas prospective entrepreneurs save in period $[0, T^*)$ to eventually fulfill the collateral requirement (see Proposition 2). To see this, assume that $a_0 < \underline{a}(\theta, \lambda)$ so that the agent is not an entrepreneur at $t = 0$. Then, the consumption of the prospective entrepreneur in period $t \in [0, T^*)$ is $c_t = c_h = w + r \frac{(1 + r)^{T^*} a_0 - \underline{a}}{(1 + r)^{T^*} - 1}$.

Notice that $c_h \leq w + ra_0 = c_l$.

As for Part (ii), the first order conditions shows that $u_c(c_t) > u_c(c_{t+1})$ for $t \in [T^*, T^{**})$. Since $u_c(\cdot)$ is decreasing (by the concavity of $u(\cdot)$), this implies that $c_t \leq c_{t+1}$ for all $t \in [T^*, T^{**})$. For $t \geq T^{**}$, the first-order conditions, $u_c(c_t) = u_c(c_{t+1})$, imply that consumption is constant. Since the entrepreneur is unconstrained, his earnings are given by $\pi^u = \pi(\theta, \lambda, \bar{a})$ each period. This implies a per-period consumption of $c_t = c_u = \pi(\theta, \lambda, \bar{a}) + r\bar{a}$, $\forall t > T^{**}$. Since $\bar{a} \geq a_0$ and $\pi(\theta, \lambda, \bar{a}) \geq w$, then $c_u \geq c_l \geq c_h$, that is, consumption is maximum during those later periods. □

A.4 Data used for the Calibration

Here, I describe in details the data used to calibrate the model. These data come from the Cameroon Survey on Employment and the Informal Sector (EESI) conducted in 2005 by the National Institute of Statistics of Cameroon in partnership with the World Bank. It is a nationwide cross-sectional survey that collects a comprehensive set of information

Table A1: Characteristics of Individuals by Occupations

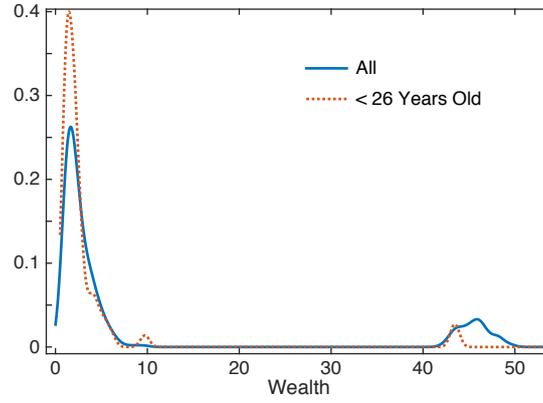
Characteristics	Occupations	
	Entrepreneurs	Wageworkers
Num. of obs.	489	5 623
% of sample	8.0%	92.0%
Average age	41.7	36.1
Years of schooling		
0-6 years	43.3%	48.4%
7-12 years	39.5%	36.2%
13+ years	17.2%	15.4%
Av. monthly income*	139.2	75.3
Av. wealth*	7 594.8	3 007.4

*In thousands of local currency (CFA); 1,000 CFA \sim \$2 US (in 2005)

about households characteristics and the characteristics of the firms that they run or work for. The survey identified a total of 6112 active individuals heads of households aged 15 and above, consisting of 489 entrepreneurs and 5623 wageworkers/subsisters.⁹ Table A1 presents the characteristics of individuals by occupation. Entrepreneurs represent 8% of the total workforce surveyed. Entrepreneurs are more educated, wealthier and on average older than wageworkers. The average age gap between entrepreneurs and wageworkers is about 6 years. The distribution of individual wealth is pictured in Figure A1 where I have distinguished between the wealth of individuals who are less than 26 years old and the total wealth distribution. The wealth variable was builded by computing the market value of households total initial belongings (that is, their belonging prior entering their current activity), in an effort to get a measure of initial wealth that is fairly exogenous. This measure of wealth is positively correlated with various measures of the quality of habitat such as the type of housing, the type of walls, roof and floor material of the house, and access to clean water. Figure A1 suggests that the wealth distribution is a bimodal distribution with both modes situated at the bottom and top percentiles of the distribution, respectively. This explains why there is a large gap between the mean and the median. These data also allow to construct the distribution of establishments and employment by size, as reported in Table A2. A comparison of current versus previous occupations using retrospective questions show an exit rate of

⁹To simplify the analysis, I do not explicitly distinguish between formal and informal entrepreneurs, since both types face borrowing constraints. But informal firms are usually of smaller sizes.

Figure A1: Distribution of Wealth



about 1%. While it is possible that some households engage in two or more forms of activity at the same time, the primary activity is taken as their main employment.

Table A2: Distribution of establishment by size

Category	Establishments	Employment	Mean size
0-2	88	104	1.182
3-5	281	1005	3.576
6-9	76	544	7.158
1-100	36	2547	70.75
> 100	8	4013	501.63
Total	489	8213	16.795

A.5 Summary Statistics for the Regression Analysis

The Summary statistics of the cross-country data used in the regression analysis are given in Table A3.

Table A3: Summary Statistics of the Cross-Country Data used in the Regression

Variable	Obs	Mean	Std. Dev.	Min	Max
Gap	62	5.506	3.086	0.23	16.1
External finance	53	0.516	0.524	0.01	2.56
DOmestic credit	62	0.68	0.547	0.04	2.47
Legal rights	61	5.311	2.527	0.00	11.00
Interest rate (%)	60	5.465	8.46	-17.12	40.9
Wage rate (USD in PPP)	61	4.129	3.593	0.08	13.23

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