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The Allocation of Entrepreneurial Talent and Destructive Entrepreneurship

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Abstract

Entrepreneurship is generally regarded as a force of change, innovation, and development in modern economies. Entrepreneurs bring new and better products to markets, restore allocative efficiency through arbitrage and reinvest their profits. However, it has been argued that the same energy and talent can also be allocated to unproductive ends and reduce total welfare. In this paper we present a model that analyzes the allocation of a given entrepreneurial talent over destructive and productive activities.

We show that in this model two stable equilibria can emerge. As Baumol (1990) hypothesized, institutions determine the payoffs to both types of entrepreneurial activity and hence drive this allocation. But we also show that the distribution of initial wealth and entrepreneurial talent play a decisive role. This analysis provides a different perspective on the importance of high quality institutions in developing countries and.../

Keywords: destructive entrepreneurship, allocation of talent, development, institutions

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sheds light on the situation in conflict and post-conflict countries, where both informal and formal institutions arguably have broken down. Under such circumstances, our analysis shows that microcredits can support the transition to a productive equilibrium, because they help to overcome credit constraints without creating incentives for destructive entrepreneurship.

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All remaining errors are ours.

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1 Introduction

Entrepreneurship is widely recognized as a force of good in market economies. Schumpeter (1911) puts the entrepreneur center stage in his theory of innovation and capitalist development and Kirzner (1973) ascribed an important role to profit-driven entrepreneurs to restore market equilibria. Of course the idea that self-interested and even greedy entrepreneurs could do society some good in the pursuit of their own fortunes was already established by Adam Smith and has been a cornerstone in economic thinking since.

Current events in global capital markets, however, illustrate the importance of the institutions that we build to channel this force and the devastation it can cause when left unchecked. As for example Baumol (1990), Murphy, Schleifer, and Vishny (1991), Mehlum, Moene, and Torvik (2003) and Acemoglu (1995) have argued, the same energy and talent can also be allocated to unproductive ends and reduce total welfare. In these models the entrepreneurs can choose between productive ventures that increase total welfare and redistributive practices in which they appropriate (legally or illegally) a share of the productive entrepreneurs' profits. This rent-seeking behavior reduces the incentive to engage in productive ventures and it thereby has a negative impact on aggregate economic activity. As the institutional setting typically rewards such behavior, institutional reform is typically suggested to prevent it. The problem with that strategy is that institutions are not so easily built up or changed. If strong but wrong institutions exist and reward such behavior they are also likely to persist. For example Acemoglu, Johnson, and Robinson (2001) have argued that institutions are largely historically determined and in Acemoglu and Robinson (2008) a model is proposed to explain the persistence of bad institutions, even in democratic regimes.

If the proper institutions are absent or weak it is not easy to just build the proper ones overnight. That situation applies to, for example, (post-conflict) developing countries. In such a context pre-existing institutions have broken down and entrepreneurial talent can turn into a truly destructive force.[1] Without reducing the need for institutional development in the medium and long run, in this paper we focus on strategies to improve the incentive structure under such conditions in the short run. To that end this paper first presents a model of such an economy. That economy is closer to the "stateless society" that for example Bates, Greif, and Singh (2002) presents and we follow Desai, Acs, and Weitzel (2010) in assuming that entrepreneurial talent will be allocated between productive and truly destructive activities, such as stealing and raiding productive inputs.[2] It is assumed that entrepreneurs can employ

[1] This also sets our paper apart from the more traditional economic literature on criminal behavior, e.g. Becker (1968), as that literature studies criminal behavior in the context of well-developed institutions, that fail to eliminate crime. Our entrepreneurial talents are not criminals. They merely find themselves in an institutional vacuum in which they have to choose how to employ their talents.

[2] Thereby we follow the talent allocation literature referred to above in assuming the stock of available entrepreneurial talent in an economy is given exogenously. The institutional setting de-

their talent and resources in a productive venture, but risk being raided when doing so. When raided they do not merely lose a share of their profit flow, as in the models of unproductive entrepreneurship mentioned above, but actually see their venture terminated, the productive assets liquidated, and the proceeds consumed by the raiders. This adds insult to injury and reduces both the incentives and opportunities to engage in productive entrepreneurship in the next rounds.

Obviously institutional recovery helps. A non-corrupt and well-equipped police force that will uphold the rule of law can reduce the payoffs to raiding and hence the probability of being raided. That will improve matters and help the economy move to a productive entrepreneurship equilibrium. The practical problem with such a strategy is that in the initial state there is no tax base from which such an investment might be financed or sustained. Stuck in the destructive equilibrium, such a tax base will also not develop and outside funding for such investments is rarely available. One implication of the model is that wealth redistribution or the provision of microcredits to productive entrepreneurs improves the incentive structure towards more productive activities and away from destructive entrepreneurship without the requirement to successfully develop a macro-institutional environment first. The mechanism in the model that enables such a development strategy hinges on the reduction of credit constraints for many raiding would-be entrepreneurs without producing very attractive new targets or the remaining raiders.

This paper contributes to three related streams in the literature.

Since Becker (1968) and Ehrlich (1973) there is a longstanding tradition in economics to study the determinants and consequences of criminal behavior. This literature relates to our model, because the destructive entrepreneur does not behave differently from a criminal in the economic crime models. However, despite a large number of theoretical and empirical studies, this literature focuses very strongly on the effects of punishment, more particularly, on the incentive and the incarceration effect of prison sentences (see, e.g., Freeman, 1999). The longer a prison term, the more likely it is both to discourage (incentive effect) and to disable (incarceration effect) people from committing a crime. Although the analysis of these effects is crucial for the evaluation of crime policy, they do not fully apply to our setting, where institutions are assumed to be weak and policing is largely absent. Furthermore, as the main focus of many of these models lies on crime deterrence (Cameron, 1998), the theoretical economics of crime literature rarely investigates where the proceeds from criminal activity exactly come from. However, in terms of economic development, there can be a large difference between fraudulently diverting profits and raiding productive inputs if the former is welfare neutral and the latter welfare destroying.

Another related field of research investigates the determinants of conflict. The so-called predator-prey models in this literature primarily study the emer-

termines the allocation of that given amount of talent over activities that we traditionally consider entrepreneurial and those that are considered rent-seeking or even criminal.

gence of conflicts and their resolution. As one of the earliest and most prominent contributors in this field, Hirshleifer (1987) covered a multitude of aspects including the analysis of continuing conflict (Hirshleifer, 1988), the paradox of power (Hirshleifer, 1991a), the technology of conflict (Hirshleifer, 1991b), as well as anarchy and its breakdown (Hirshleifer, 1995), culminating in his Presidential Address to the Western Economic Association in 1993 (Hirshleifer, 1994). These and many other studies in the field cover a broad spectrum (e.g., Bates, Greif, and Singh, 2002; Neary, 1997; Skaperdas, 1992), although their main focus is on the effect of rule of law, enforceable property rights and offense or defense technologies on the tradeoff between productive and coercive activities. As such they provide a very fertile breading ground for economic models on the allocation of entrepreneurial talent.

In fact, the border between the two research streams on conflict and on the allocation of entrepreneurial talent (e.g., Murphy, Schleifer, and Vishny, 1991; Acemoglu, 1995) is rather blurred, as the paper by Mehlum, Moene, and Torvik (2003) on parasitic enterprizes shows. While the former focuses more on the tradeoff between productive and coercive activities, the latter investigates the tradeoff between productive and unproductive activities. However, as in the economics of crime, little attention is spent on the origin of the appropriated proceeds. More specifically, the predatory or rent-seeking activities in both research streams aim at profits, but not, as proposed by Desai, Acs, and Weitzel (2010), at productive inputs, which is not only unproductive, but destructive, and directly reduces productive capacity and thereby welfare. Where most parasitic and predation models focus on the struggle for the golden eggs, in our model the goose actually gets killed. Furthermore, in the existing models the role of the raider or predator is often fixed, whereas, in our model a formerly productive but robbed entrepreneur is likely to turn into a raider himself.

The remainder of the paper first presents the basic structure and the three occupations in the model and derives the behavior of and payoffs to those in these occupations. We then analyze the choice of occupation in a one-generation game to identify what parameters in the model drive the allocation of talent. In the last section the dynamics in a repeated game overlapping generations structure are discussed after which we conclude our analysis.

2 The Occupations: Behavior and Payoff

Our model borrows from the overlapping generations model of endogenous growth with imperfect capital markets as in Galor and Zeira (1993), Barro and Sala-i Martin (2004) and Aghion and Howitt (1998) and models of occupational choice and the allocation of entrepreneurial talent such as Murphy, Schleifer, and Vishny (1991) and Acemoglu (1995). Assume individuals live for two periods and for simplicity abstract from altruism and bequests, such that individuals maximize:

$$U_t^i = \log c_t^i + \rho \log c_{t+1}^i. \tag{1}$$

For the occupational choice model we focus exclusively on that part of the population that has the option to become an entrepreneur. The rest of the population is assumed to provide a perfectly elastic labor supply at a subsistence level wage w_s. The N individuals that have more than one option are endowed with a level of entrepreneurial ability θ^i that is i.i.d. uniformly distributed over the interval $[0, 1]$ and one unit of labor in the first period.[3] As we want to focus on a developing country context we also assume that financial intermediation is absent and no interest bearing financial assets exist. Individuals in group N then have to finance investments with their own wealth and savings do not generate any return unless invested in one's own productive venture. Assume an individual receives a random endowment of initial wealth ω that is uniformly and independently identically distributed (i.i.d) over an interval $[\omega_l, \omega_h]$ and that can be consumed, saved for consumption in period 2, or invested in one's own venture.[4] At the start of the first period an individual i in group N chooses between three available occupations: worker, entrepreneur, or raider, discussed in detail below. That choice is made based on rational expectations about the events in the periods ahead. Once the choice is made, random events are realized and all agents receive their income over period 1. Then they decide to consume goods and services and save or invest. In the second period the individuals consume their savings and receive capital income only. The problem for all individuals in group N is the same and can be formalized by:

$$\begin{aligned} &\max_{c_t^i, c_{t+1}^i, OC_t^i} : U_t^i = \log c_t^i + \rho \log c_{t+1}^i \\ &s.t. : c_{t+1}^i = \omega_t^i + E[Y_t^i | OC_t^i] + E[Y_{t+1}^i | OC_t^i] - c_t^i \\ &s.t. : E[Y_t^i | OC_t^i] + \omega_t^i \geq c_t^i, \end{aligned} \tag{2}$$

where OC_t^i is the occupation chosen by individual i at time t. An individual chooses his occupation first and then solves the problem in equation 2 conditional on his choice and the random events that follow. The occupation is chosen to maximize ex ante expected utility. We therefore first consider the maximum expected utility for individual i in each occupation and then work out who will chose what occupation in section 3.

The individual has three options: worker, entrepreneur, or raider, indexed by OC_t^i= 1, 2, and 3, respectively. Option 1 is to become a worker and receive the market wage for supplying one unit of labor. When an individual chooses

[3]Note that our model therefore has nothing to say about the number of (would-be) entrepreneurs in an economy. We assume an exogenously given number of people are endowed with the required talent, knowledge, and risk attitudes and the rest of the population simply is not. Empirical evidence on entrepreneurial talent and traits shows that this is perhaps a simplistic but not unreasonable assumption. The talent is assumed to be there, the institutions determine if and how it will be used.

[4]It would be a very interesting extension to consider an endogenous distribution of wealth. One could introduce bequests and make initial wealth dependent on parents' wealth. However, that complicates the model and will not help to explain the key mechanism the model intends to uncover. We therefore leave this for future research.

to be a worker he cannot invest his wealth in a productive venture and it can only be held in non-interest bearing assets such as cash or gold.[5] These assets can be consumed at the end of the first or the second period. As the wage is given and the same for all individuals in N, the expected incomes in this occupation are equal to:

$$\begin{aligned} &E[Y_t^i|OC_t^i = 1] = w_t \\ &E[Y_{t+1}^i|OC_t^i = 1] = 0, \end{aligned} \tag{3}$$

where w_t is the wage that clears the labor market at time t.[6] Using the expressions in equation 3 to substitute and solve the problem in equation 2 implies that the ex ante maximum expected utility of this fall-back option can be written as:

$$\begin{aligned} &E[U_t^i|OC_t^i = 1] = \\ &\log\left(\tfrac{1}{1+\rho}\right) + \rho\log\left(\tfrac{\rho}{1+\rho}\right) + \\ &(1+\rho)\log\left(w_t + \omega_t^i\right). \end{aligned} \tag{4}$$

Obviously a higher outside wage implies that more individuals will choose this option. Proposition 1 states this result:

Proposition 1 *A higher outside wage level will, ceteris paribus, cause more entrepreneurial talent to allocate into non-entrepreneurial activity.*

Individuals in group N can also choose option 2 and become productive entrepreneurs, investing their initial wealth in productive assets and hiring labor to produce a homogenous final output y_t^i according to:

$$y_t^i = \theta^i l_t^{i\alpha}\left(k_t^i - k_0\right)^{1-\alpha}, \tag{5}$$

where l_t^i is labor employed, k_t^i is the capital stock of individual i at the start of the period, and k_0 is a fixed start-up cost in capital units. As we assume that there are no financial markets, individuals will only choose this option and set up a productive venture when their initial wealth exceeds k_0. In period 1 the entrepreneur is assumed to supply his labor to his own venture inelastically and hire additional workers if this is optimal. His entrepreneurial ability θ^i operates to increase total factor productivity in the venture. Normalizing the price of the final good to 1 we know that a productive entrepreneur will employ

[5]For simplicity we abstract from inflation. We assume that a risk-free asset with a zero real rate of return is available.

[6]We assume that this wage is known and given to group N. This is a reasonable assumption if group N is small relative to the total population. One can use this variable to see how development and economic growth affect the tradeoffs.

all his initial wealth endowment as capital $k_t^i = \omega_t^i$ and hires labor to maximize the total income from his venture π_t^i.[7]

$$\max_{l_t^i} : \pi_t^i = \theta^i l_t^{i^\alpha} (k_t^i - k^0)^{1-\alpha} - w_t l_t^i. \tag{6}$$

The labor demand for venture i in period t is then given by:

$$l_t^{i^D} = \left(\frac{w_t}{\alpha \theta^i}\right)^{\frac{-1}{1-\alpha}} (k_t^i - k_0). \tag{7}$$

Note that for every individual productive entrepreneur the demand for labor is negative in the wage level. Total demand for labor in the entrepreneurial sector is the sum of these individual demands over all productive ventures and this yields a downward sloping labor demand curve. The total income of a productive entrepreneur in period t is equal to the market wage plus a venture-specific return on his capital. Substituting for capital and labor in equation 4 entrepreneurial income can be written as:

$$\pi_t^{i^*} = (1 + r_t^i)(\omega_t^i - k_0) + w_t, \tag{8}$$

where it can be verified that the venture-specific expected return on capital, $r_t^i = (1-\alpha)\alpha^{\frac{\alpha}{1-\alpha}} \theta_i^{\frac{1}{1-\alpha}} w_t^{\frac{-\alpha}{1-\alpha}} - 1$ is positive in entrepreneurial talent, θ and negative in the wage level w_t. In period $t+1$ the productive entrepreneur cannot supply his own labor as he is old, but he can invest his savings from period t once more into his own venture. He is then entitled to the profit flows in period $t+1$ and his savings from period 1 yield a positive return.

This occupation, however, is not without risk in our model. The productive entrepreneur can be raided by a destructive entrepreneur, who will seize his assets and liquidate them. When raided, the productive entrepreneur looses his venture and can only hope to find a job in period t.[8] He will then earn w_t as a worker but has lost his initial wealth endowment. When there are destructive entrepreneurs in the economy the value of productive entrepreneurship is therefore rated down relative to the other two occupations as the probability of being raided and receiving only the market wage is positive. Assuming that this probability is given by ξ_t^i we can write the expected incomes in occupation 2 as:

$$\begin{aligned} E[Y_t^i | OC_t^i = 2] &= (1 - E[\xi_t^i])((1 + r_t^i)(\omega_t^i - k_0) + w_t) + E[\xi_t^i] w_t \\ E[Y_{t+1}^i | OC_t^i = 2] &= (1 - E[\xi_t^i])(1 + r_{t+1}^i) k_{t+1}^i, \end{aligned} \tag{9}$$

[7] Employing less than the entire available wealth would imply that total income from the venture is below its maximum as long as the return on capital in that venture is positive. This is a result of our simplifying assumption that wealth can be consumed also after use in the venture. A more realistic approach would be to introduce depreciation, but that would add a lot of complexity to the model and create little additional insights.

[8] We eliminate the possibility that he chooses to become a destructive entrepreneur for now.

where $k^i_{t+1} = (1 + r^i_t)(\omega^i_t - k_0) + w_t - c^i_t$ is the amount invested in the venture at the end of period 1 and $r^i_{t+1} = (1-\alpha)\alpha^{\frac{\alpha}{1-\alpha}}\theta_i^{\frac{1}{1-\alpha}} w_{t+1}^{\frac{-\alpha}{1-\alpha}} - 1$ is the period 2 rate of return on capital. $E[\xi^i_t]$ is the expected probability that venture i is raided in period t and will be endogenized below. We assume for simplicity that a productive venture that survives the first period can be maintained without the risk of being raided in the next period. Using these expressions in equation 2 and solving the problem yields the expected utility for occupation 2:

$$\begin{array}{l} E[U^i_t | OC^i_t = 2] = \\ \log\left(\frac{1}{1+\rho}\right) + \rho \log\left(\frac{\rho}{1+\rho}\right) \\ E[\xi^i_t](1+\rho)\log(w_t) \\ (1 - E[\xi^i_t])\left((1+\rho)\log\left((1+r^i_t)(\omega^i_t - k_0) + w_t\right) + \rho \log\left(1 + r^i_{t+1}\right)\right). \end{array} \tag{10}$$

From this equation one can immediately derive propositions 2 and 3:

Proposition 2 *A higher level of entrepreneurial talent will, ceteris paribus, increase the attractiveness of productive entrepreneurship.*

Proposition 3 *A higher level of initial wealth will, ceteris paribus, increase the attractiveness of productive entrepreneurship.*

From equation 10 using the definitions of r^i_t, r^i_{t+1}, and π^{i*}_t one can also derive that higher wage levels do not unambiguously make productive entrepreneurship more or less attractive. They increase the wage income and the utility value of the fall-back option when the venture is raided, but higher wages also reduce the return on capital invested. The sign of the effect depends on the raiding probability ξ^i_t and the output elasticity of labor α. Also, it should be noted that ceteris paribus will not hold when we endogenize the raiding probability below.

Occupation 3 in the model is the destructive entrepreneur or raider who confiscates and liquidates the assets of productive entrepreneurs. We assume that destructive entrepreneurs select one victim from the pool of productive entrepreneurs. When selecting a victim they do not perceive the amount of assets employed in a venture perfectly. Destructive entrepreneurs are therefore assumed to select their victim at random but the probability of being selected and raided is assumed to be proportional to the level of productive assets employed in the venture. To operationalize these assumptions we simply assume that each unit of capital is equally likely to be raided. The probability that any given venture being hit is then given by:

$$\xi^i_t = \frac{N_3(k^i_t - k_0)}{\int_{n_1}^{n_1+n_2}(k^i_t - k_0)di}, \tag{11}$$

where we index the individuals in the group N from 0 to n such that individuals 0 to n_1 are the N_1 individuals that choose to be workers. Individuals n_1 to n_2 are the N_2 productive entrepreneurs and individuals n_2 to n are N_3 destructive entrepreneurs and $N_1 + N_2 + N_3 = N$. This also implies that the total amount of assets the destructive entrepreneurs are expected to seize is given by:

$$\int_{n_1}^{n_2} \frac{N_3(k_t^i - k_0)^2}{\int_{n_1}^{n_2}(k_t^i - k_0)di} di. \tag{12}$$

We assume that destructive entrepreneurs are all equally likely to select a given productive venture and therefore the expected level of assets seized is equal to the total level of assets seized in equation 12 divided by the number of destructive entrepreneurs N_3. Assuming that a talented destructive entrepreneur is better able to liquidate the captured assets and sell them off, the income received in this occupation is then a share $0 < \lambda(\theta^i) < 1$, of captures assets:

$$\begin{aligned} &E[Y_t^i | OC_t^i = 3] = \lambda(\theta^i) \frac{\int_{n_1}^{n_2}(k_t^i - k_0)^2 di}{\int_{n_1}^{n_2}(k_t^i - k_0)di} \\ &E[Y_{t+1}^i | OC_t^i = 3] = 0. \end{aligned} \tag{13}$$

It can be verified in equation (13) that the expected period 1 income for raiders is equal to a share $\lambda(\theta^i)$ of the average level of capital employed, only when all productive entrepreneurs have an equal amount of capital installed. As was derived above, productive entrepreneurs will invest their entire initial wealth, such that this result would only materialize when the initial wealth distribution is equal among those that choose productive entrepreneurship. If the initial wealth distribution among productive entrepreneurs is not flat, however, then the average destructive entrepreneur expects to seize above average assets. Solving the consumer's problem in equation 2 using these expected incomes yield the ex ante expected utility of occupation 3:

$$\begin{aligned} &E[U_t^i | OC_t^i = 3] = \\ &\log\left(\tfrac{1}{1+\rho}\right) + \rho \log\left(\tfrac{\rho}{1+\rho}\right) + \\ &(1+\rho)\log\left(\lambda(\theta^i]) \frac{\int_{E[n_1]}^{E[n_2]}(\omega_t^i - k_0)^2 di}{\int_{E[n_1]}^{E[n_2]}(\omega_t^i - k_0)di} + \omega_t^i\right). \end{aligned} \tag{14}$$

This allows us to formulate propositions 4, 5, and 6:

Proposition 4 *More concentrated productive assets, ceteris paribus, make destructive entrepreneurship more attractive.*

Proposition 5 *Higher entrepreneurial talent, ceteris paribus, makes destructive entrepreneurship more attractive.*

Proposition 6 *Higher initial wealth, ceteris paribus, makes destructive entrepreneurship more attractive.*

The proofs follow directly from equation 14.

3 Choosing among Occupations

This section will analyze which individuals will choose what occupation by comparing the ex ante expected utility levels in equations 4, 10, and 14. As the propositions have shown, there are variables that affect the absolute utility level of one or more occupations in different or the same direction. In this section the relative attractiveness of occupations is considered. First consider the choice between wage labor and destructive entrepreneurship. An individual is indifferent between these occupations when the ex ante expected utility levels are equal. Equations 4 and 14 show that an individual will choose to engage in destructive entrepreneurship when:

$$w_t < \lambda(\theta^i)\zeta_t, \tag{15}$$

where we have defined $\zeta_t \equiv \frac{\int_{n_1}^{n_2}(\omega_t^i - k_0)^2 di}{\int_{n_1}^{n_2}(\omega_t^i - k_0) di}$. Note that this variable is the same for all individuals i and represents the inequality in the initial wealth distribution among those that choose productive entrepreneurship. Assuming λ can be inverted we can derive the threshold level of entrepreneurial talent $\bar{\theta}$ for which individuals are indifferent between work and raiding. Above that threshold level of entrepreneurial talent individuals will choose for raiding:

$$\bar{\theta} = \lambda^{-1}\left(\frac{w_t}{\zeta_t}\right). \tag{16}$$

Note that the threshold level depends negatively on the wage level and positively on the inequality of the initial wealth distribution among productive entrepreneurs but does *not* depend on the level of initial wealth of individual i.

Now consider the choice between productive entrepreneurship and wage labor. Those with initial wealth levels below k_0 will choose occupation 1 over 2 at all levels of talent because they simply cannot start a venture. Starting at initial wealth level k_0, however, there is a positive level of entrepreneurial talent that is required to make entrepreneurship the preferred option, even without

the threat of being raided. This threshold level in entrepreneurial talent can be derived by setting equations 4 and 10 equal and assuming ξ=0. We then obtain:

$$1 + r(\tilde{\theta}, w_{t+1}) = \left(\frac{\omega_t^i + w_t}{(1 + r(\tilde{\theta}, w_t))(\omega_t^i - k_0) + w_t} \right)^{\frac{1+\rho}{\rho}}, \tag{17}$$

which defines the threshold level $\tilde{\theta}$ for entrepreneurial talent, below which all individuals would choose employment over productive entrepreneurship. This threshold level is increasing in initial wealth as the right hand side of equation 17 is decreasing in the level of initial wealth. The intuition for this result is that, at higher levels of wealth, the consumption of employees rises one for one, whereas for the entrepreneur diminishing returns to capital kick in. To compensate for that, a higher level of entrepreneurial talent is required. However, if there is a positive probability of being raided and that probability depends positively on the level of wealth, as we have assumed above, then the tradeoff changes and an even higher level of threshold talent is required. Using equations 4 and 10 without restrictions on ξ we can show that an individual will choose to engage in productive entrepreneurship if:

$$\xi^i < \frac{\overset{+}{\Omega}(\overset{+}{\omega_t^i}, \overset{+}{\theta^i}) - (1+\rho)\log\left(\omega_t^i + w_t\right)}{\overset{+}{\Omega}(\overset{+}{\omega_t^i}, \overset{+}{\theta^i}) - (1+\rho)\log\left(w_t\right)}, \tag{18}$$

where $\overset{+}{\Omega}(\overset{+}{\omega_t^i}, \overset{+}{\theta^i}) \equiv \rho\log(1 + r_{t+1}^i) + (1+\rho)\log\left(w_t + (1 + r_t^i)(\omega_t^i - k_0)\right)$ is defined to save on notation. This function is positive in the second argument due to the positive relationship between the rates of return on entrepreneurial ventures, r_t^i and r_{t+1}^i, and entrepreneurial talent, θ^i. Equation 18 allows us to state propositions 7 and 8:

Proposition 7 *For every individual i, endowed with entrepreneurial talent $\theta^i > \tilde{\theta}$, there exists a unique level of initial wealth $\tilde{\omega}_t^i > k_0$ for which that individual is indifferent between occupations 1 and 2. At wealth levels below this threshold level he will prefer entrepreneurship over wage labor.*

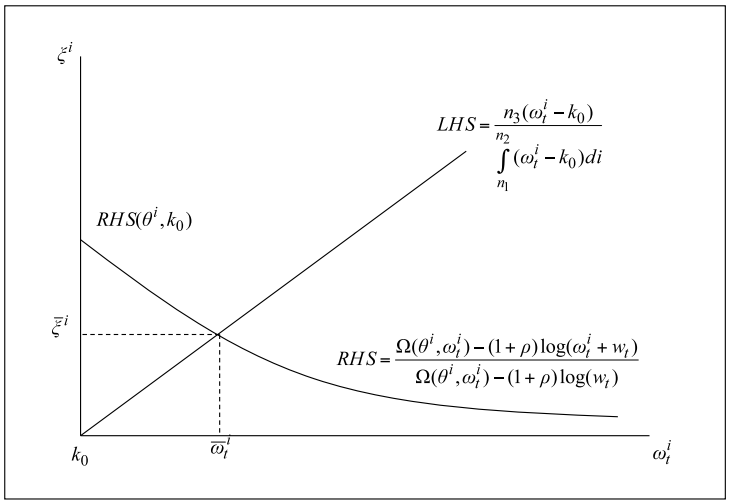
Proposition 8 *The threshold wealth level in proposition 7 depends positively on the level of entrepreneurial talent.*

The proof for both propositions follows from the properties of equation 18. An individual prefers entrepreneurship over wage labor when the probability of being raided is low. That probability is given on the left hand side and it was assumed to be linear in ω_t^i and zero when the initial wealth level is equal to k_0. On the right hand side is the raiding probability for which the two occupations give the same ex ante expected utility. It can be verified in equation 18 that the right hand side is strictly decreasing in the initial wealth level and is positive for an initial wealth of k_0. Moreover, the limit of the right hand side for initial

wealth going to infinity is equal to 0. The expression in equation 18 has no closed form solution, but when we draw the left hand and right hand side into a ω_t^i, ξ^i -plane we find the unique threshold wealth level in Figure 1.

By the fact that $\Omega(\overset{+}{\omega_t^i}, \overset{+}{\theta^i})$ is positive in θ^i and appears in the numerator and denominator on the right hand side we can derive that the right hand side depends positively on the level of entrepreneurial talent. It is then clear that a more talented entrepreneur is willing to take a higher risk of being raided as he is compensated by higher returns on the venture.

Figure 1: Graphical Derivation of $\bar{\omega}_t^i$



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As individuals with a wealth level below k_0 do not have the option to become productive entrepreneurs, even if they would prefer to be, proposition 4 implies that only those at intermediate levels of initial wealth, between k_0 and $\tilde{\omega}_t^i$ will choose entrepreneurship over labor. The poor cannot set up a venture and the very rich will not risk their wealth.

The tradeoff between productive and destructive entrepreneurship can be analyzed in a similar fashion. From equations 10 and 14 we can derive that an individual will choose productive over destructive entrepreneurship if:

$$\xi^i < \frac{\Omega(\overset{+}{\omega_t^i}, \overset{+}{\theta^i}) - (1+\rho)\log\left(\omega_t^i + \zeta_t \lambda(\theta^i)\right)}{\Omega(\overset{+}{\omega_t^i}, \overset{+}{\theta^i}) - (1+\rho)\log\left(w_t\right)}. \tag{19}$$

This expression allows us to state propositions 9 and 10:

Proposition 9 *For every individual i, endowed with entrepreneurial talent $\theta^i > \bar{\theta}$ there exists a unique level of initial wealth $\bar{\omega}_t^i > k_0$ for which that individual is indifferent between occupations 2 and 3. At wealth levels below this threshold level he will prefer productive over destructive entrepreneurship.*

Proposition 10 *The threshold wealth level in proposition 9 depends negatively on the level of entrepreneurial talent.*

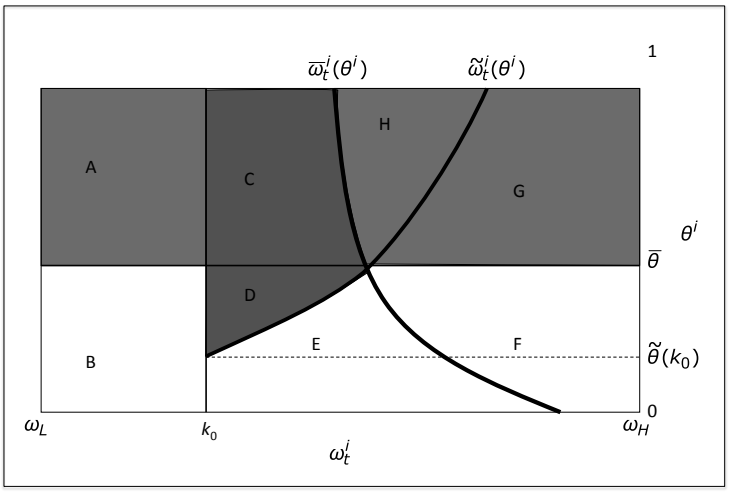
The proof again follows the same logic and depends on the different properties of the right hand side in equation 19. The right hand side takes a value between 0 and 1 at initial wealth level k_0 when occupation 3 is preferred over occupation 1 (see equation 15). The right hand side is once more downward sloping and has an asymptote at 0 as the raider does not risk his initial wealth and the productive entrepreneur does. And again there is a unique point of intersection that determines the threshold initial wealth level for which an individual is indifferent. Above that level the probability of being raided exceeds the acceptable level and individuals choose to become raiders themselves. The corresponding graph would be similar to the one in Figure 1, although of course the threshold initial wealth levels are not. Also, this time the right hand side of equation 19 depends negatively on entrepreneurial talent as that talent also increases the payoff to raiding. This implies that the threshold level of initial wealth will decline as the talent increases.

We can now draw the derived threshold levels of θ^i and ω_t^i into a box-diagram that has θ^i on the vertical axis, running from 0 to 1 and ω_t^i on the horizontal one, running from ω_l to ω_h.

The allocation of individuals over the various occupations can now be determined by drawing the thresholds levels $\bar{\theta}$, $\tilde{\omega}_t^i(\theta^i)$, $\tilde{\theta}(\omega_t^i)$, and $\bar{\omega}_t^i(\theta^i)$ into the box. It can be verified in the underlying equations that $\tilde{\omega}_t^i(1) > \bar{\omega}_t^i(1)$ when we assume that the most talented entrepreneur will prefer raiding to labor and $\bar{\theta}$ is less than 1. From equations 18 and 19 we know that the two ω-curves will intersect at $\bar{\theta}$ and the box has 8 areas. These areas are labeled A to H in Figure 2 above.

We have assumed i.i.d. uniformly distributed endowments so the relative size of the areas in the box represent the proportions of the population that will choose one occupation over another. By considering the bilateral comparisons in each of the enclosed areas in the box we can derive which area chooses what occupation. In all figures in area A there is too little wealth to become a productive entrepreneur, but enough talent to be successful as a raider. In area B there is too little wealth to start a venture and too little talent to become a successful raider. So these individuals choose employment. Those in area C and D have sufficient wealth to engage in a productive venture but not so much that they must fear raiding. They choose productive entrepreneurship. Those in areas

Figure 2: The Choice of Occupations



Source: Own Compilation

E and F have too much wealth to want to become productive entrepreneurs for fear of raiders, but lack the talent to be successful raiders themselves. So they too choose employment. Those in areas G and H choose destructive entrepreneurship over employment and productive entrepreneurship. The areas of productive entrepreneurship are dark-shaded in Figure 2 whereas the light shaded areas are those for which entrepreneurial talent allocates into destructive activities.

4 Comparative Statics: What Drives the Talent Allocation?

4.1 The Entry Barrier k_0

It is clear from the figures that lower initial capital requirements k_0 will reduce the size of the rectangular areas A and B in all figures. From equation 17 we can also observe that for a reduction in k_0, $\tilde{\theta}$ will fall, causing the areas C, D, and E to increase. The $\bar{\omega}$ and $\tilde{\omega}$-curves will also respond. The reduction in k_0 will reduce the probability of being raided for individual ventures if the venture is above average size, whereas it will increase that probability for the smaller than average ventures. This implies the $\tilde{\omega}$ and $\bar{\omega}$ curves will rotate

clockwise. The negative effect of k_0 on the Ω-functions defined above implies that for every level of talent the $\tilde{\omega}$ curve will shift up for a decrease in k_0, whereas for the $\bar{\omega}$ curve the threshold level of talent decreases for every level of initial wealth and the curve shifts down. Their intersection point will move horizontally to the right as long as $\bar{\theta}$ is not affected, causing areas C and D to grow further at the expense of areas H and E. There are no first order effects on $\bar{\theta}$, but because a possible larger spread in the size of entrepreneurial ventures will increase the attractiveness of raiding through ζ, $\bar{\theta}$ may shift down. As these effects are second order effects, however, it can be concluded that the shifts in $\tilde{\omega}$, $\tilde{\theta}$, and the k_0 line all work towards increasing the number of productive entrepreneurs.

The shift in the $\bar{\omega}$-curve has an ambiguous effect. A reduction in the costs of setting up a venture, or, alternatively, reducing the financing constraints on small productive ventures, will produce less destructive entrepreneurship of the talented poor (area A smaller) and induce more people to switch from employment into productive entrepreneurship (area E to D). This positive effect of decreasing k_0 may be offset by a possible increase in areas H and G. One implication from this is that microcredits can help to make the transition to a productive equilibrium. Microcredits could provide an incentive to switch into productive entrepreneurship at the individual level by helping to overcome the credit constraints. As the productive assets that they finance are not easily captured, these assets are unlikely to create enough incentives for a switch to destructive entrepreneurship at the aggregate level.

4.2 Initial Wealth ω_L, ω_H

A spread preserving increase in the mean level of initial wealth will shift the box to the right and simply add to the light area on the right what is lost on the left. Such a shift would only start to have an impact on the relative size of the occupations when ω_L exceeds k_0, in which case there are no more credit constraints. As that is not a very interesting case we consider shifting the lower and upper bound separately.

If only ω_L increases, then areas A and B become smaller as above. This time, however, there is no further impact on any of the curves as the minimum level of initial wealth has no first order impact on any of the tradeoffs. However, as the number of raiding entrepreneurs falls, the incentives to engage in productive entrepreneurship increase. The fall in N_3 will reduce the probability of being raided, thereby lowering the level of talent for every level of wealth for which an individual prefers productive entrepreneurship over labor. The $\tilde{\omega}$-curve will shift down and to the right, increasing the number of productive entrepreneurs. This effect is partially offset by the downward shift in the $\bar{\omega}$ curve.

Increases in ω_H will have the opposite effects. The number of destructive entrepreneurs will increase and the curves shift in the opposite direction.

4.3 Wages w_t, w_{t+1}

The current wage level w_t affects all curves in the graphs. The direct impact of w_t on $\tilde{\theta}$ is negative. The current wage w_t has an ambiguous effect on the $\tilde{\omega}$-curve. On the one hand both wages drive the Ω-functions down, which increases the right hand side of equation 18 and thus shifts the curve to the right. On the other hand, an increasing wage level reduces the right hand side, as the relative importance of initial wealth levels is reduced. As both effects work in opposite direction, it is unclear how the curve will shift. In the comparison with destructive entrepreneurship the effect of an increase in the wage level is unambiguously positive on the right hand side, causing the $\bar{\omega}$-curve to shift up and to the right. Finally, $\bar{\theta}$ is positive in the current wage level. The net first order effect of an increase in the wage level is then an increase in the number of employees, as areas B, E, and F will increase and area D increases one for one at the expense of C. The shift in the $\bar{\omega}$-curve increases the number of productive entrepreneurs in area C as they have the current wage as their fall-back position. The ambiguous effect on $\tilde{\omega}$ may offset this positive effect on the number of productive entrepreneurs, but the number of destructive entrepreneurs will unambiguously fall as G+H+A will be smaller.

The future wage only affects the rate of return on productive entrepreneurship in our one-generation one shot model. Hence, larger future wages decrease the attractiveness of productive entrepreneurship vis-à-vis the alternatives. $\tilde{\theta}$ increases, $\tilde{\omega}$ shifts up but rotates down because the lower returns need to be offset with higher initial investments. The tradeoff between employment and destructive entrepreneurship is not affected, so $\bar{\theta}$ stays where it is. $\bar{\omega}$ will shift to intersect $\tilde{\omega}$ at $\bar{\theta}$. It is a priori unclear if the intersection point moves horizontally to the right or left.

The effects of both wages together imply that in an economy with high growth in wage levels, employment will be increasingly attractive and productive entrepreneurship is less attractive relative to employment and destructive entrepreneurship.

4.4 Inequality ζ_t

Finally, we can consider the impact of a larger initial wealth inequality among productive entrepreneurs. This variable is, however, not an exogenous variable in our model. The width of the area C-D in the graph gives the spread of initial wealth in the population of productive entrepreneurs. If it were to increase exogenously then $\bar{\theta}$ would shift down and cause more employees to switch to destructive entrepreneurship. As that happens the ω-curves will shift/rotate down as well but $\tilde{\theta}$ would not fall. This is because the zero raid probability level of talent for which an individual is indifferent between employment and entrepreneurship does not depend upon the probability of being raided. As the $\bar{\omega}$-curve shifts to the left, however, the spread of initial wealth for the productive entrepreneurs is squeezed and this provides an offsetting force. As the spread of initial wealth for productive entrepreneurs is an endogenous vari-

able, determined by the position of the various curves, all this exercise shows is that the allocation is inherently stable. A similar argument holds for variables N_1, N_2, and N_3. The comparative static effects of shifts in the parameters of the model α and ρ are complex and hard to interpret in terms of policy implications. In the final subsection we will therefore consider the impact of stronger institutions as captured in $\lambda(\theta)$.

4.5 Institutions $\lambda(\theta)$

Institutional strength in our model implies that a government enforces property rights and protects the productive entrepreneurs from the destructive ones. To capture this in the model, we assume that these government officials can reduce the returns to a given level of entrepreneurial talent by reducing the part of captured assets that can be consumed by the raider. This reflects the fact that it is always possible to raid a productive venture, but strong institutions prevent one from enjoying the proceeds. Strong institutions therefore shift the function $\lambda(\theta)$ to the right and down, implying that a higher level of talent is now required to consume the same share of assets captured as before. In the graph such a shift would cause $\bar{\omega}$ to shift to the right. Also $\bar{\theta}$ would move up. As there is no impact on the other curves it is clear that this reduces the incentives for the rich and the poor to engage in destructive entrepreneurship. When institutions are strong enough to push the $\bar{\omega}$ curve to the point where $\bar{\theta}$=1, all destructive entrepreneurship is eliminated. All economies with institutional strength below that level have a group of poor destructive entrepreneurs and some very rich ones. This, we believe, gives an adequate description, even for most developed countries.

5 Extension to Overlapping Generations and Concluding Remarks

When the model is analyzed in an overlapping generations dynamic repeated game setting, the results will be different. A full blown analysis of such a model is beyond the scope of this paper. For now, we speculate on the outcomes of such an analysis using the propositions and properties that were derived in the static model above.

The essence of an overlapping generations model is that two cohorts coexist in the model and the decisions of the old affect the choices of the young. If one abstracts from inheritance and still has a random distribution of initial wealth for every generation, the model should take into account that productive entrepreneurial ventures can now be raided in both time periods. In an overlapping generations structure the incentive to raid is therefore, ceteris paribus, higher for every individual in every cohort. This is a relatively straightforward extension to the static, one-generation model above and it increases the likelihood that any individual chooses destructive entrepreneurship. As

a result, a larger proportion of the total population will engage in destructive entrepreneurship, reducing the levels of productive activity.

The analysis becomes much more complicated when we assume that the young inherit their initial endowments from their parents and individuals act to maximize the utility of their dynasty. In that case high levels of raiding will reduce the inherited wealth and the box will tend to move to the left, causing more and more raiding until all initial wealth is below k_0. As the number of productive entrepreneurs falls, however, so will the incentives to raid and the economy would then end up in an all employment equilibrium. In such an equilibrium, however, wealth starts to accumulate and the box shifts to the right again. There is a priori no reason to exclude dynamic equilibria that have repetitive cycles or even a chaotic system that cycles but never repeats itself.

As the model above does not specify how entrepreneurship contributes to economic growth, there can be no predictions on the growth regimes that may result. But it is relatively easy to see that, if productive entrepreneurship positively affects growth, the mechanism described above implies that various possibilities exist. Depending on the parameters of the model an economy may be stuck in a no growth equilibrium, a high growth equilibrium, or a continuous cycle of booms and busts. Such economic growth would feed back into the model through higher growth rates of wages in employment, causing an even more complex dynamic process.

What is clear from the static analysis above is that stronger institutions will help an economy switch to productive entrepreneurship in the long run, but as such policies are hard to implement, strategies to reduce credit constraints by setting up financial intermediation and the provision of microcredits may be a promising way to start.

The impact of more traditional forms of development aid can also be discussed in the context of our model. Such aid from the outside, in kind or financially, will shift the incentives to raid or engage in productive entrepreneurship in favor of the raiding, because aid, especially if it enters the country through a few bottlenecks in the distribution chain, will create additional targets for raiding and reduce the returns from, for example, farming food or producing necessities. Our model does not account for the possibility that such aid will also draw entrepreneurial talent from both raiding and productive ventures into rent-seeking and aid maximizing activities, which may render the economy aid dependent and stuck in a non-productive zero-growth equilibrium that is not characterized by the booms and busts in raiding. This issue remains on the agenda for further research as proper analysis of this mechanism requires substantial extensions to our current model. Nevertheless, we may conclude from our model that institutional improvements constitute a medium to long run growth strategy, whereas the reduction of credit constraints, without attracting destructive raiders (or unproductive rent-seekers) in the process, is a sensible short term development strategy.

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