Entrepreneurship, institutional variety and economic development

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Abstract

The *contribution* of entrepreneurship to economic growth varies across countries at different stages of economic development. The *type* of entrepreneurship also varies as countries develop: the ratio of necessity based entrepreneurial firms (new entrepreneurial ventures borne to escape unemployment) relative to opportunity based entrepreneurial firms (new entrepreneurial ventures driven by business opportunities) changes as economies grow. Government has an interest in shaping the institutional environment in a way that supports dynamic entrepreneurial activity and contributes to economic growth. In this paper we endogenise institutional variety into modern evolutionary models of diffusion; variety not only in organizational structures but also in investment financing of entrepreneurial firms. We discuss how our analysis updates understanding of modern evolutionary models of diffusion and we reflect on the practical implications for policy makers to support entrepreneurial activities and stimulate economic growth.

1. Introduction

Entrepreneurship has long been recognised as a driver of economic growth. The explanation for the link between entrepreneurship (and innovation) and economic development differs across schools of thought (Schumpeter, 1934; *c.f.* Kirzner, 1973) but the importance of supporting entrepreneurship for wider economic and societal benefit has been widely acknowledged. The challenge of creating an environment in which entrepreneurship can flourish is not straightforward, however, and there is considerable variation in the contribution of entrepreneurship to economic growth across countries. Studies have shown that this variation is driven partly by a country's

stage of economic development (van Stel *et al.*, 2005; Carree *et al.*, 2007; Valliere and Peterson, 2012). For example, Bosma and Levie (2010) use Porter *et al.*'s (2002) typology of economic development and describe how the contribution of entrepreneurship to economic growth differs across 'factor-driven', 'efficiency-driven' and 'innovation-driven' countries. Emerging countries tend to be characterised as 'factor driven' or 'efficiency-driven', unable to satisfy the ever increasing demand for jobs in high-productivity sectors, which stimulates individuals to start-up their own businesses; developed countries tend to be characterised as 'innovation driven'. Minniti *et al.* (2005) defined two types of entrepreneurial activity: *opportunity entrepreneurs* who want to exploit a perceived business opportunity and *necessity entrepreneurs* who are pushed into entrepreneurship because all other options for work are either absent or unsatisfactory. Autio (2005) adds a third type, *high expectation entrepreneurs*, a sub-category of opportunity entrepreneurs, who create the lion share of jobs across all entrepreneurial activity. Morris (2011) found that high-expectation entrepreneurs represent only 4% of the total entrepreneurs, yet create close to 40% of the total jobs. Based on these classifications, successive Global Entrepreneurship Monitor reports (the latest being Xavier *et al.*, 2013) and academic articles (e.g. Wong *et al.*, 2005, Valliere and Peterson, 2012) have studied the relative contribution of entrepreneurial types to economic growth across countries. They found that levels of necessity entrepreneurship relative to opportunity entrepreneurship (including high expectation entrepreneurship) are much higher in emerging countries where they contribute to employment rather than economic growth. High expectation entrepreneurs – the only type of entrepreneurial activity to enhance knowledge spillovers and drive economic growth in developed countries – are rare in emerging countries and have an insignificant overall effect on economic growth. Take Latin American countries for example. Latin America boasts a high average number of hours worked per employee per year (GGDC, 2007), high levels of entrepreneurial activity (Minniti *et al.*, 2005) and favourable attitudes to entrepreneurship (Bosma and Levie, 2010). But whilst Latin American necessity based entrepreneurial firms make a strong contribution to national employment they tend to be involved in low productivity and low innovation activities such as 'maquilas', natural resources and the low-paid provision of goods and services (Lee *et al.*, 2007). Opportunity based entrepreneurial firms, including high expectation entrepreneurial firms, are engaged in greater value-added and innovative activities, but do not constitute currently a major growth area for employment in Latin America (Hernandez, 2008).

Institutions, which vary greatly across countries, influence entrepreneurial organizations (and vice versa) and economic growth (Bruton *et al.*, 2010; Kalantardis and Fletcher, 2012; Smallbone and Welter, 2012). The influence of institutions on innovation processes is complex but studies have unpacked the effect by conceptualising institutions as 'formal' or 'informal' (Edquist and Johnson, 1997). North (1994) and Edquist and Johnson (1997) had similar early perspectives on the two types, referring to formal institutions as rules, laws, constitutions; informal institutions as socio-cultural norms of behaviour, conventions, self-imposed codes of conduct. One important institutional aspect in which there is significant variety across countries is in access to capital. Sources of capital can be both formal and informal. Formal sources of capital, for example debt finance and equity finance, are more common in developed countries; informal sources of capital, for example venture finance (most often from entrepreneurs themselves), are relatively more important in

emerging countries where access to formal sources of capital is limited (Bygrave and Quill, 2006). To understand the relationship between the institutional financial environment and entrepreneurship, previous research has focused on how information asymmetries between entrepreneurs and formal sources of capital can be ameliorated (O'Halloran *et al.*, 2005). Miozzo and DiVito (2013) explored how newly established science-based firms access and mobilise critical resources, part of which is raising funds from various sources. Other research has examined the effectiveness of inter-organizational collaborations, joint ventures and strategic alliances in stimulating innovation in high technology sectors (Coombs and Metcalfe 2002). This research improves our understanding of the relationship between institutional variety in terms of access to capital and entrepreneurial activity in developed countries, but is less revealing about the situation in emerging countries. Other work in the last decade has investigated how entrepreneurs in emerging countries attract investors by overcoming adverse environments with low levels of capital, low access to knowledge and high barriers to competition (Rodriguez, 2005). O'Halloran *et al.* (2005), for example, discuss how developing countries in Latin America have designed idiosyncratic institutional and financial innovations for business development to overcome barriers to the entry of more technologically sophisticated, scale and capital intensive industries.

Informal institutions that regulate the relations and interactions between individuals within and between organizations (Fischer, 2001) are considered to be at least as important as formal institutions in the innovation process, especially in relation to access to capital in emerging countries (Bygrave and Quill, 2006). Szerb *et al.* (2007) found that across 31 countries there are four recognizable groups of informal sources of capital: (1) informal investors with no business ownership experience who finance close family members' businesses; (2) informal investors with no business ownership experience who finance non-family members' businesses; (3) informal investors with business ownership experience who finance close family members' businesses; and (4) informal investors with business ownership experience who finance non-family members' businesses¹. How much finance is needed for entrepreneurial activity relates to start-up costs – typically lower in emerging countries – but access to capital is different for necessity and opportunity entrepreneurs. Necessity based entrepreneurial firms tend to have an organizational structure with a strong but parochial network of support, often among the first three types of informal investor (families, ethnic groups, or cliques); opportunity based entrepreneurial firms tend to have weaker but broader support networks including the fourth type of investor (Hernandez and Dewick, 2011). Access to formal and informal sources of finance for opportunity based entrepreneurial firms may also be facilitated because opportunity motivation is assumed to be a sign of better planning, sophisticated strategy, and higher-growth expectations (Bosma *et al.*, 2009). As countries undergo economic development, new supplies of formal financial capital become available from the emerging banking sector and the role of foreign direct investment becomes increasingly important in enabling transition to a higher productivity industrial structure. In this way, opportunity based entrepreneurial firms have better access to

¹ This classification is similar to the '4F's' (Bygrave and Quill, 2006) who distinguish between informal investors such as founders, friends, family and 'fool-hardy strangers'. See for example data on formal and informal investment for Hong Kong and Shenzhen in the Global Entrepreneurship Monitor Report (2004).

more varied sources of informal finance and better access to formal sources of finance (Mason, 2007).

This brief review highlights that supporting dynamic entrepreneurial activity requires variety in the institutional environment to promote innovation and generate economic growth. Evolution of the institutional environment shapes governance institutions – the *social structure* that exercises authority, direction and control within firms (Zingales, 1998) – and defines the context within which economic activity of firms develop (Williamson, 1999). Reallocating resources to an institutional environment that supports the appropriate type of entrepreneurship should be a policy imperative, especially in emerging countries. Increasing knowledge on how to design dynamic entrepreneurship support programmes that increase the contribution of entrepreneurial activity to economic growth is an important first step, and this paper aims to contribute to the development of that knowledge base. To that end, our first objective in this paper is to endogenise not only institutional variety in organizational structures but also variety in investment financing among different types of entrepreneurial firm into modern evolutionary models of diffusion. Our second objective is to draw conclusions from our analysis to support entrepreneurial activities and stimulate economic growth.

The paper is structured as follows. In section 2 we provide a brief history of evolutionary and development economic growth models that provided an alternative to neoclassical growth theory. We show how the pioneering evolutionary diffusion model equations became more sophisticated by contrasting the models of Nelson and Winter (1982) and Nelson and Pack (1999). We argue that these models do not account adequately for variety in the institutional environment that characterises economies and effects entrepreneurial activity. In section 3 we extend evolutionary diffusion models by endogenising institutional variety in the financial environment and demonstrate why this matters for economic growth. Section 4 draws conclusions from the analysis about supporting entrepreneurial activity through a diverse and dynamic institutional framework. We reflect on the need for government policy to design programmes to stimulate entrepreneurship and suggest further analogous analyses that would improve our understanding of the relationship between institutions, entrepreneurial activity and economic growth.

2. Evolutionary and development economic growth models

Evolutionary diffusion models were framed at a time when theorists of economic development such as Rosenstein-Rodan (2010 [1963]), Rostow (1990 [1960]), Nurkse (1967), Hirschman (1988 [1958]) and Currie (1974, 1981) dominated thinking in political economy theory. Lewis (1954) proposed the notion of ‘unlimited supplies of labor’ for emerging countries, which, in fact, prevailed also in many ‘North’ economies during the post war period because of massive immigration (temporary or permanent, spontaneous or organized) from the ‘South’. Lewis’ model assumptions led to the idea that as long as the real wage differential between the necessity based sector and the industrial (or opportunity based) sector was maintained, ‘unlimited supplies of labor’ would accrue in the latter sector and average productivity would increase across the economy. Fields (2005), for example, refers to a passive necessity

based sector, supplying labor to the opportunity based sector at a relatively low fixed wage².

Modern evolutionary diffusion models (Nelson 1968; Nelson and Winter 1982; Nelson and Pack 1999) assume “formal” firms (i.e. opportunity based entrepreneurial firms) are larger and more productive. Their (likely) productivity advantage is captured in terms of higher output per worker (and capital). For simplicity they model a fixed coefficient for technology, in which “formal” sector firms are not assumed to be more capital intensive. Greater profitability among firms as a result of more advanced production technologies (i.e. less labor unit costs) allows the re-allocation of resources from firms using traditional technologies to firms using more modern technologies. This modernises industry by releasing human and financial resources previously employed in old techniques and practices, and results in an expansion of opportunity based entrepreneurial firms and a diffusion of new techniques. An increase in the number of opportunity based entrepreneurial firms then leads to a greater average labor productivity, which translates into greater economic growth.

INSERT TABLE 1 HERE

Table 1 summarises the equations of modern evolutionary diffusion models by which the residual and underemployed labor force in the necessity based entrepreneurial firm sector (akin to the ‘survival’ firm sector in Lewis’ model and ‘traditional technology’ firm sector in Nelson’s model) is absorbed increasingly in another, more productive, opportunity based entrepreneurial firm sector (i.e. akin to the ‘industrial employment’ firm sector in Lewis’ model and ‘modern technology’ firm sector in Nelson’s model). These equations demonstrate the role of new technology in the opportunity based entrepreneurial firm sector diffusing and driving the economy towards a higher average productivity level.

The evolutionary growth models developed by Nelson and Pack (1999), Nelson and Winter (1982) and Nelson (1968) constitute significant steps towards the development of a viable theoretical alternative to the neoclassical growth theory approach. The diffusion analysis of Nelson and his colleagues correctly emphasizes the importance of entrepreneurial attitude across all firms to account for the uncertainty and risk-taking manifest in the adoption of modern technology. But even the most basic “animal spirits” (i.e. thought patterns that animate people’s ideas, feelings and actions) are moulded to some extent by the institutional environment (Akerlof and Schiller 2010, Nelson 2002). Indeed, “...those early evolutionary analyses [as well as their neoclassical counterpart] lacked a way of seeing onto the complex institutional structures that characterize modern economies” (Nelson 2011, p. 44). Moreover, the widespread use of ‘innovation systems’ approaches in academic and policy circles in the 1990s and 2000s (Edquist and Johnson, 1997; Lundvall, 2007; Lundvall, 2011) supports the incorporation of institutions into evolutionary growth models.

Understanding the role and relevance of institutions in innovation systems remain important and of interest to innovation theorists. From an empirical perspective, we

² An alternative perspective, stemming from the International Labor Organization Report on Kenya in 1972, suggests that, far from disappearing, the necessity based entrepreneurial sector could instead provide a basis for employment creation and economic growth in its own right (Rado, 1973; Bennet and Estrin 2007).

observe variety in the sources of financing available to different types of entrepreneur across countries (Bygrave and Quill, 2006; Mason, 2007; Bosma *et al.*, 2007). Thus we argue that institutional frameworks should be endogenised in modern evolutionary growth models and, to that end, our analysis in section 3 represents a first attempt, focusing on variety in the institutional financial environment and its effect on entrepreneurial activity and economic growth.

3. Endogenising institutional variety into modern evolutionary growth models

Based on Metcalfe (1998, 2007) we extend the modern evolutionary diffusion equations by endogenising a measure of institutional change that countries experience with the rise of differing sources of investment for opportunity based entrepreneurs and necessity based entrepreneurs. We know that a financial commitment (i.e. sustained sources of finance) is required for innovation, at least until productive resources generate returns that provide the financial liquidity to allow the enterprise to survive. We assume that variety in the institutional financial environment leads to different investment functions for firms that operate in a formal financial institutional environment and firms that operate in an informal financial institutional environment. In the diffusion analysis of Nelson and Pack (1999) there is no differentiation between types of institutional environment, which is reflected simply in a single entrepreneurial attitude across all firms (i.e. same e – entrepreneurial effectiveness – in equation 3 in Table 1). Our diffusion analysis focuses on the role of variety in the institutional finance environment of firms, including variety in the financing sources of capital from formal and informal type of investors, in determining growth.

In our model there are two types of firms: those that use modern technologies and that can be classed as high labor productivity firms (i.e. opportunity based entrepreneurial firms) and those that use traditional technologies and can be classed as low productivity firms (i.e. necessity based entrepreneurial firms).

Let us assume the necessity based entrepreneurial firm (nb) and opportunity based entrepreneurial firm (ob) are located in one industrial sector of the economy, that they are rivals and have the same capital coefficient (b). Their labor requirement (a_i) is different because labor productivities (θ) are different. Also, let us assume that unit labor costs (h_i , where $i=ob, nb$) are different:

$$a_i = y_i / L_i; \text{ so } \theta_i = 1/a_i \quad (1)$$

$$h_{ob} = \gamma W / a_{ob} \quad (2)$$

$$h_{nb} = W / a_i \quad (3)$$

(W) is the cost of labor and (γ) is a labor quasi-rent in the opportunity based entrepreneurial firm sub-sector, which reflects the opportunity based entrepreneurial firm's need for skilled workers to learn, assimilate and catch up with modern technologies (i.e. $\gamma > 1$). Higher levels of labor productivity, (θ_H), are ascribed to the opportunity based entrepreneurial firm (so that $\theta_H = 1/a_{ob}$) and low levels of labor productivity, (θ_L), are ascribed to the necessity based entrepreneurial firm (so that $\theta_L = 1/a_{nb}$). Hence the labor unit cost of the opportunity based entrepreneurial firm is less

than the necessity based entrepreneurial firm, $h_{ob} < h_{nb}$. We assume γ is never big enough to offset this cost differential.

We attribute higher levels of productivity to opportunity based entrepreneurial firms for both descriptive and analytical reasons. As noted by Naude *et al.* (2008) and highlighted in the equations in Table 1, Nelson and Pack (1999) assign a key role to the ‘effectiveness of entrepreneurship’, which they see as an important determinant of the rate of assimilation of technology. Effectiveness in this case refers to the imitative role of opportunity based entrepreneurial firms, their ability to “master ways of doing things that may have been used for some time in the advanced economies of the world, even though they are new for the country or region catching up” (Nelson, 2011: p.44). By their nature, opportunity based entrepreneurial firms invest when they perceive profitable opportunities, triggering a re-allocation of production factors from the ‘traditional’ to the ‘modern’ sector. This additional capital allows the opportunity based entrepreneurial firm sector to absorb labor from the necessity based entrepreneurial firm sector, attracting it with higher returns to the underexploited production factors. This movement is essentially what drives growth in Lewis’ (1954) model. Since underexploited resources shift towards more productive use, opportunity based entrepreneurial firms not only contribute to an increase in the demand for educated labor but also increase factor productivity. This leads to an overall increase in productivity and human capital in a country, a key foundation of the imitation and adoption of foreign technology proposition of Nelson and Pack (1999: p.423).

From an analytical perspective, the same type of labor has higher productivity in the opportunity based entrepreneurial firm sector than in the necessity based entrepreneurial firm sector. This is a departure from the neoclassical paradigm of perfect mobility and equalization of factor returns and signifies that the same marginal product rule of distribution does not apply to the entire economy and that the economy may grow by transferring labor from one sector to another. Two conditions that need to be satisfied for this analytical difference to emerge are: (1) the ‘abundance’ of labor (relative to other inputs, mainly land) in the necessity based entrepreneurial firm sector (this is the most abundant factor in emerging economies like Latin American countries, for example); and (2) few restrictions that prevent a free flow of labor from one sector to the other, at least until the Lewis’ growth process starts (Islam and Yokota, 2008).

Firms are assumed to differ in both their willingness to invest (i.e. $\phi_{ob} \neq \phi_{nb}$) and in their propensities to accumulate (i.e. $\alpha_{ob} \neq \alpha_{nb}$). The difference in propensities to accumulate captures variety in the sources of institutional financing. The influence of institutional variety on firms is expressed in differing parameters (α_i) for each firm $i \neq j$.

This assumption is explained above, but to reprise, in general the sources of financing are relatively less formal and less diversified (in other words, fewer) for the necessity based entrepreneurial firm sector. Hernandez and Dewick (2011) argue that the necessity based entrepreneur is in close contact with a network of individuals (family and/or friends), generating a narrow organizational structure that facilitates strong parochial sources of finance (e.g. from families, friends, etc) whilst excluding other type of finance. In contrast, opportunity based entrepreneurs are engaged in broader, more diverse networks offering wider external sources of finance (*ibid.*). The

assumptions of Hernandez and Dewick (2011) find empirical support in the quantitative research on informal investment (Mason, 2007).

Let (TP) be total profit, (y) be output, and (P) be price in each firm (i) . There are two sources of financing investment at the firm: internal, (IP) , and external, (EF) . The two sources of finance are different for necessity based entrepreneurial firms and opportunity based entrepreneurial firms.

$$TP_i = (P_i - h_i)y_i \quad (4)$$

$$IP_i = \beta_i TP_i \quad (5)$$

$$\dot{K} = \dot{I}_i = IP_i + EF_i = \beta_i (P_i - h_i)y_i + EF_i \quad (6)$$

(β) is the portion of profits invested ($0 < \beta < 1$) and we assume that external financing represents only a proportion of invested profits i.e. $(EF_i = \rho_i IP_i)$, then:

$$\frac{\dot{K}}{K} = \frac{\dot{y}}{y} = \alpha_i (P_i - h_i) \quad (7)$$

$$\text{Where } \alpha_i = \left[\frac{\pi_i (1 + \rho_i)}{b} \right] \quad (8)$$

Equations (4) to (8) show that differences in the necessity based entrepreneurial firm's and opportunity based entrepreneurial firm's willingness to invest (i.e. $\phi_{ob} \neq \phi_{nb}$) and propensity to accumulate (i.e. $\alpha_{ob} \neq \alpha_{nb}$) depend, as in Metcalfe (1998, 2007), on: the capital/output ratio, (b) , which is assumed the same in both firms; the proportion of profits re-invested for the firm's expansion, (β_i) ; and the external sources of finance as a proportion of invested profits, (ρ_i) .

Diversity in financial institutions shapes the organizations' behaviour towards investment. There is a distinction to make between investment in opportunity based entrepreneurial firms and necessity based entrepreneurial firms due to the different financial institutions that govern firm behaviour. Besides having an intra-organizational structure that locks it into a low growth path, the necessity based entrepreneurial firm also has different internal and external sources of finance that do not facilitate a greater commitment to innovative projects. The opportunity based entrepreneurial firms on the other hand have an intra-organizational structure that sets it on a high growth path and internal and external sources of finance that allow them a greater commitment to innovative projects.

Investment is shaped then by financial institutions that lead to a distinction between the opportunity based entrepreneurial firm's and necessity based entrepreneurial firm's investment functions (9) and (10):

$$\left(\frac{I}{Y}\right)_{ob} = -\phi_{ob} + \alpha_{ob}(P_{ob} - h_{ob}) \quad (9)$$

$$\left(\frac{I}{Y}\right)_{nb} = -\phi_{nb} + \alpha_{nb}(P_{nb} - h_{nb}) \quad (10)$$

Given that we know:

$$\left(\frac{I}{Q}\right)_i = \frac{\Delta K_i}{Q_i} = \frac{\Delta K_i}{K_i} \cdot \frac{K_i}{Q_i} = g_i \cdot b \quad (10)'$$

$$\text{where } g_i = \frac{\Delta K_i}{K_i} = \frac{\Delta K}{\Delta t = 1} \quad \text{and} \quad b = \frac{K_i}{Q_i}$$

The subsequent growth rates of the opportunity based entrepreneurial firm and necessity based entrepreneurial firm are:

$$g_{ob} = \frac{1}{b} [-\phi_{ob} + \alpha_{ob}(p_{ob} - h_{ob})] \quad (11)$$

$$g_{nb} = \frac{1}{b} [-\phi_{nb} + \alpha_{nb}(p_{nb} - h_{nb})] \quad (12)$$

Following Metcalfe (1998), we assume that the price of the industrial sector's output, ($\bar{P}$), is set as the average of the prices of the opportunity based entrepreneurial firm (p_{ob}) and necessity based entrepreneurial firm (p_{nb}), weighted by the market share of the opportunity based entrepreneurial firm (s_{ob}):

$$\bar{P} = s_{ob} p_{ob} + (1 - s_{ob}) p_{nb} \quad (13)$$

The growth rate of the opportunity based entrepreneurial firm's demand (g_{Dob}) equals the growth of the demand (g_D) plus the level of competition (λ) multiplied by the difference between the average price of output in the industrial sector ($\bar{P}$) and the opportunity based entrepreneurial firm's price (p_{ob}):

$$g_{Dob} = g_D + \lambda(\bar{P} - p_{ob}) \quad (14)$$

Note that the level of competition (perfect i.e. $\lambda = \infty$, imperfect i.e. $0 < \lambda < \infty$, or monopoly i.e. $\lambda = 0$) determines ultimately the growth of the opportunity based entrepreneurial firm's demand. Metcalfe calls this coefficient the speed of the market selection process. Perfect competition, where all price and quality information is fully diffused to all participants, means an infinite increase in the growth of demand for the opportunity based entrepreneurial firm. Under perfect competition, the opportunity based entrepreneurial firm sets the same price if it is to have any sales at all; under monopolistic regime, the growth of market share of the firm matches the total market growth.

After several mathematical procedures (see Appendix One), the condition for greater growth of the opportunity based entrepreneurial firm (g_{ob}) vis-à-vis the necessity based entrepreneurial firm (g_{nb}), and hence, for the diffusion of modern technologies in the industry, is:

$$\left((h_{nb} - h_{ob}) - \left(\frac{\phi_{ob}}{\alpha_{ob}} - \frac{\phi_{nb}}{\alpha_{nb}} \right) \right) \left(\frac{\alpha_{nb} \alpha_{ob} (1 - 2s_{ob})}{b(\alpha_{nb} - \alpha_{ob})} \right) > g_D \quad \equiv g_{ob} > g_{nb} \quad \text{Condition (a)}$$

where:

$(h_{nb} - h_{ob})$ is the unitary differential cost (UDC) between firms;

$\frac{\phi_{ob}}{\alpha_{ob}} - \frac{\phi_{nb}}{\alpha_{nb}}$ is the differential of the minimum profit rate for growth (DMRG) between firms

$\frac{\alpha_{nb} \alpha_{ob} (1 - 2s_{ob})}{b(\alpha_{nb} - \alpha_{ob})}$ is determined by propensities to accumulate (α_i), the market share of firm (i, s_i) and the capital/product ratio (b)

g_D is the growth of demand

If we do not allow for variety in financial institutions (i.e. no variety in the propensity to accumulate and the willingness to invest ($\alpha_{ob} = \alpha_{nb} = \alpha$) and ($\phi_{ob} = \phi_{nb} = \phi$)), under no demand growth ($g_D=0$), the condition for greater growth of the opportunity based entrepreneurial firm is the same condition for growth as in the pioneering evolutionary growth models (see Appendix One):

$$h_{nb} > h_{ob} \quad \equiv g_{ob} > g_{nb} \quad \text{Condition(e)}$$

Condition (e) shows that lower unit costs in the opportunity based entrepreneurial firm – due to its better assimilation and learning ability – will provide the incentive to re-allocate resources, generating a greater average level of productivity and, hence, a greater pace of economic growth. This is the ‘*modern technological condition*’ (Nelson, 1968; Nelson and Winter, 1982; Nelson and Pack, 1999) and is only a *special case* under our framework, where variety in the institutional financing environment is not yet included. Under this special case, relative growth of opportunity based entrepreneurial firms is greater due to their capabilities to assimilate, learn and master new ways of working (Nelson, 2011).

However, under our model that includes institutional variety in access to capital, this modern technological condition is no longer sufficient. Our condition (a) – under which the variables and parameters are assumed to be greater than zero and the market share of opportunity based entrepreneurial firm is assumed to be different

from 0.5 – has different implications for economic policy and strategy. Based on this condition, economic growth is not a rational and calculated decision of firms but it is an emergent phenomenon (Metcalf 2007). In other words, certain conditions, internal and external to the firm, determine economic growth and have implications for policies intent on promoting economic development depending on where the country is in terms of the diffusion process. The early phase of the diffusion process is when necessity based entrepreneurial firms constitute the majority of market share and opportunity based entrepreneurial firms are striving to gain market share. This situation is more typical of emerging countries. According to the analysis, the growth of opportunity based entrepreneurial firms and the diffusion of modern technology will depend on a relatively greater propensity and willingness to invest of necessity based entrepreneurial firms ($\phi_{ob} < \phi_{nb}$ and $\alpha_{ob} < \alpha_{nb}$)³. In other words, necessity based entrepreneurial firms have a specific role in investment in (physical and human) capital during the first phase of the diffusion of new technologies in emerging countries. This investment depends on the diversity of the institutional finance environment. In effect, as economies develop and countries shift from being ‘factor-driven’ to ‘efficiency-driven’, informal financial capital available to necessity based entrepreneurial firms from founders and informal “outsiders” (Szerb *et al.*, 2007) lead the process of accumulation. Associated innovations stemming from this type of finance are easy to specify and to replicate by others and by network effects (Nelson *et al.*, 2004). It manifests itself in a vibrant informal economy through which the society learns about, experiments with and adopts/adapts foreign technology. Later, when economies develop beyond ‘efficiency-driven’ to ‘innovation-driven’, the growth of opportunity based entrepreneurial firms and the diffusion of modern technology will depend on the relatively greater propensity to accumulate or a willingness to invest of opportunity based entrepreneurial firms ($\phi_{ob} > \phi_{nb}$ or $\alpha_{ob} > \alpha_{nb}$). During this period, not only informal capital (and greater variety of it), but also formal and production capital leads the process of capabilities accumulation.

4. Discussion and conclusions

Our model is an evolutionary approximation to the relationship between internal organizational mechanisms and external institutions (Dosi, 2001) such as those governing the finance market and level of technological diffusion of modern technology in an economy. In our model, the growth of the economic system does not depend only on firms’ internal organizational mechanisms (i.e. firms’ technological advantage via an assimilation process, propensity to accumulate and willingness to invest) but also depends on the growth of the market size and the firms’ relative market share. In addition, and importantly, our model allows for variety in the institutional environment that yields a difference in the intra-organizational structure and in the finance sources of both necessity based entrepreneurial firms and opportunity based entrepreneurial firms. At a more fundamental level, our analysis underpins the findings of recent empirical studies exploring the relationship between entrepreneurship and economic growth (e.g. Valliere and Peterson, 2009) and institutions and entrepreneurship (e.g. Kalantaridis and Fletcher, 2012). It updates our understanding of modern evolutionary models of diffusion in the context of

³ We reach this result by using the methodology of simplification strategies by elimination valid under complex environments under bounded rationality (Tversky, 1972; Sunstein and Thaler, 2008).

entrepreneurship, institutional variety and economic growth in both developed and emerging countries. It also has some important practical implications for policy makers, for whom designing programmes to stimulate entrepreneurship and economic growth remains a key concern.

Our model highlights the need for policy makers to design programmes to stimulate entrepreneurship and economic growth in light of dynamic entrepreneurial activity and evolving institutional conditions. There is much evidence suggesting that entrepreneurship has a significant role to play in the growth and transition of economies. There is a high level of employment in necessity based entrepreneurial firms in emerging countries. But as economies develop and more high-productive, scale intensive industries emerge and sustain higher employment, the ratio of necessity based entrepreneurial activity declines relative to opportunity based entrepreneurial activity in a process of creative destruction, itself supported by increased wealth and new financial institutions facilitating access to external sources of capital. Our model suggests a re-evaluation may be necessary of what is considered common knowledge about government policy, particularly in the case of entrepreneurial firms in emerging countries. The focus of policy to support innovation and economic growth should depend to some extent on the market share of necessity based entrepreneurial firms in relation to opportunity based entrepreneurial firms. This means that innovation policies must be adaptable to varied and changing institutional environments or they risk being ineffectual or counter-productive, hindering technological diffusion and industrial growth. Taking the long-view, this message is clear and other studies, for example Kelley *et al.* (2011), argue that emerging economies need to develop solid foundations – access to infrastructure, physical, financial and knowledge; education and healthcare to improve the labor force – before industrial policy will have a significant effect on employment (via necessity based entrepreneurial firms) or growth (via opportunity based entrepreneurial firms). As emerging economies grow, other aims for industrial policy – e.g. encouraging economies of scale, facilitating access to the ‘formal economy’ – will accentuate the impact of opportunity based entrepreneurial activity. To that end, Valliere and Peterson (2009) refer to a ‘threshold effect’, a level which must be reached before economic growth can be accelerated. History demonstrates this vividly. As Japan took on-board more advanced technologies in the early years of the twentieth century, and as Korea and Taiwan did in later years, the economic structures of their countries were transformed; new firms and whole new industries emerged and necessity based entrepreneurial firms were replaced by opportunity based entrepreneurial firms. Some argue that we can see the same happening now in economies like China (Nelson 2011, Kim and Nelson 2000). In the short to medium term, data from the Global Entrepreneurship Monitor suggests that the long-term trend from a necessity based to opportunity based economy is not a straightforward linear one. Bosma and Levie (2010) report an average global rise in necessity based entrepreneurship and a decrease in opportunity based entrepreneurship in 2009; Kelley *et al.* (2011) highlight the recessionary impact on the ratio of necessity based entrepreneurial firms to opportunity based entrepreneurial firms in Ireland between 2002 and 2010. This means that in the short to medium term, policy effectiveness must be kept under review with the business cycle. Successful policies (e.g. technological, organizational, and financial) required in an economy’s ‘upswing’ (i.e. period of high growth) are different to those required in the ‘downswing’ (i.e. periods of low – including short periods of negative – growth).

Access to financing is particularly important in this regard. Just as Germany began more than a century ago to close the gap with the UK as a result of institutional changes attributed partly to innovations in the financing sources for development, in emerging countries there are indications that new institutional instruments are being developed to facilitate entrepreneurship and accelerate economic growth (UNIDO, 2005). We know that informal sources of finance are more important for necessity based entrepreneurial firms, stemming first from the founders and then others as outlined above. Pecking order theory tells us that the main source of finance for owner managed firms is their own profits. One could argue therefore that governments should not tax profits re-invested in businesses, without necessarily specifying the types of investment that should be made with these untaxed resources (Chittenden *et al.*, 1999). For friends and family the drivers are less clear: economic theories do not explain well the social and emotional motivations behind investment from friends and family (Kropp *et al.*, 2011). Better understanding of informal financing from friends and family will help shape policy to encourage what is a very significant enabler of entrepreneurial activity in emerging countries.

Although facilitating variety in access to capital is an important demand side institutional approach to stimulate entrepreneurship, we acknowledge that it is not a 'silver bullet' and that initiatives may be helped or hindered by the co-evolution of other industrial policy. For example, change to the prevailing institutional framework supporting supply side initiatives – labour relations, health, education and training, cultural perception of entrepreneurs in society – will have synergistic and/or antagonistic effects for emerging countries. Moreover, we acknowledge that the relationship between institutions and entrepreneurial activity should not be seen as uni-directional (Malerba, 2002): indeed, Kalantaridis and Fletcher (2012) remind us that the initiative can come from entrepreneurs to shape institutional change. Further analysis of the relationship between these aspects of the institutional framework and the entrepreneurs' behavioural profile are needed before a more sophisticated understanding is developed of how institutional variety can synergistically increase the contribution of entrepreneurship to economic growth.

In conclusion, our model highlights that economic growth is nourished by institutional diversity and the complexity of development does not allow the luxury to have only one type of institution and organization. We need institutional innovation that can adapt to changing environments in which learning, change and variety are the priority. We argue that this may be especially true for emerging countries where necessity based entrepreneurship is more prevalent; learning and evolution of policy and strategy is required to facilitate a variety of institutions that increase the contribution of entrepreneurship to economic growth. A complex framework is required that goes beyond that provided by conventional theories of growth. Our model, combining evolutionary and institutional growth models of diffusion, indicates a way forward for the study of the relation between institutional heterogeneity, entrepreneurial activity and technological diffusion, and, consequently, for the design of the government policy to stimulate economic development.

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Appendix One

Replacing (13) and (14), we obtain the expression:

$$g_{Dob} = g_D + \lambda(1 - s_{ob})[p_{nb} - p_{ob}] \quad (15)$$

If we assume that the opportunity based entrepreneurial firm sets its price to the level where its capacity to grow or expand matches exactly the growth or expansion of the market, then:

$$g_{ob} = g_{Dob} \quad (16)$$

From equations (12) and (11) we obtain the following two equations:

$$\text{From (12)} \quad p_{nb} = h_{nb} + \frac{bg_{nb} + \phi_{nb}}{\alpha_o} \quad (17)$$

$$\text{From (11)} \quad p_{ob} = h_{ob} + \frac{bg_{ob} + \phi_{ob}}{\alpha_{ob}} \quad (18)$$

By replacing equations (16), (17) and (18) in equation (15), we obtain:

$$g_{ob} = g_D + \lambda(1 - s_{ob}) \left[\frac{bg_{nb} + \phi_{nb}}{\alpha_{nb}} - \frac{bg_{ob} + \phi_{ob}}{\alpha_{ob}} + (h_{nb} - h_{ob}) \right] \quad (19)$$

Assuming that the growth of market is set as the sum of the growth rates of the opportunity based entrepreneurial firm, g_{ob} , and necessity based entrepreneurial firm g_{nb} , weighted by the market share of the opportunity based entrepreneurial firm, s_{ob} , we account for this as follows:

$$g_D = s_{ob}g_{ob} + (1 - s_{ob})g_{nb} \quad (20)$$

Re-arranging equation 19 yields:

$$g_{ob} = \frac{\alpha_{ob}}{(\alpha_{ob} + \lambda b(1 - s_{ob}))} \left\{ \frac{\lambda b[1 - s_{ob}]}{\alpha_{nb}} g_{nb} + g_D + \lambda(1 - s_{ob})(h_{nb} - h_{ob}) + \left(\frac{\phi_{nb}}{\alpha_{nb}} - \frac{\phi_{ob}}{\alpha_{ob}} \right) \right\} \quad (21)$$

g_{ob} and g_{nb} in equation (20) can be expressed distinctively in the following two equations:

$$\text{From (20)} \quad g_{ob} = \frac{g_D - (1 - s_{ob})g_{nb}}{s_{ob}} \quad (22)$$

$$\text{From (20)} \quad g_{nb} = \frac{g_D - s_{ob}g_{ob}}{(1 - s_{ob})} \quad (23)$$

Finally, by replacing equations (22) and (23) in (19) we obtain the equations of growth for both opportunity based entrepreneurial firms (24) and necessity based entrepreneurial firms (25):

$$g_{ob} = \frac{\alpha_{ob}(\alpha_{nb} + \lambda b)}{\mu} g_D + \frac{\alpha_{nb}\alpha_{ob}\lambda(1 - s_{ob})}{\mu} \left[(h_{nb} - h_{ob}) + \left(\frac{\phi_{nb}}{\alpha_{nb}} - \frac{\phi_{ob}}{\alpha_{ob}} \right) \right] \quad (24)$$

$$g_{nb} = \frac{\alpha_{nb}(\alpha_{ob} + \lambda b)}{\mu} g_D - \frac{\lambda\alpha_{ob}\alpha_{nb}s_{ob}}{\mu} \left[(h_{nb} - h_{ob}) + \left(\frac{\phi_{nb}}{\alpha_{nb}} - \frac{\phi_{ob}}{\alpha_{ob}} \right) \right] \quad (25)$$

Where:

$$\mu = \alpha_{nb}[\alpha_{ob} + \lambda b(1 - s_{ob})] + s_{ob}\alpha_{ob}\lambda b$$

Special cases restrict the assumptions of variety in propensities to accumulate and in willingness to invest. But before we start with these cases, the system, when $g_D=0$, yields greater growth of the opportunity based firm under the following condition:

$$h_{nb} - h_{ob} > \frac{\phi_{ob}}{\alpha_{ob}} - \frac{\phi_{nb}}{\alpha_{nb}} \quad \equiv g_{ob} > g_{nb} \quad \text{Condition(b)}$$

Condition (b) tells us that any investment advantage of the necessity based entrepreneurial firm must not offset the technological advantage of the opportunity based entrepreneurial firm when the market size or scale does not increase.

Now, if we restrict assumptions and suppose that there is no variety in propensities to accumulate, $\alpha_{ob} = \alpha_{nb} = \alpha$, then the condition for a greater growth of the opportunity based entrepreneurial firm is:

$$h_{nb} - h_{ob} > \frac{1}{\alpha}(\phi_{ob} - \phi_{nb}) \quad \equiv g_{ob} > g_{nb} \quad \text{Condition(c)}$$

If we restrict assumptions and suppose there is no variety in the willingness to invest ($\phi_{ob} = \phi_{nb} = \phi$), the condition for a greater growth of the opportunity based entrepreneurial firm is:

$$h_{nb} - h_{ob} > \phi \left[\frac{\alpha_{nb} - \alpha_{ob}}{\alpha_{nb}\alpha_{ob}} \right] \quad \equiv g_{ob} > g_{nb} \quad \text{Condition(d)}$$

And if we restrict assumptions to neither variety in propensities to accumulate nor in the willingness to invest, $\alpha_{ob} = \alpha_{nb} = \alpha$ and $\phi_{ob} = \phi_{nb} = \phi$, the condition for a greater growth of the opportunity based firm is the same condition for growth as in Nelson & Pack (1999) and Nelson & Winter (1982):

$$h_{nb} > h_{ob} \quad \equiv g_{ob} > g_{nb} \quad \text{Condition}(e)$$

Condition (e) shows that lower unit costs in the opportunity based entrepreneurial firm – due to its technological advantage – will provide the incentive to re-allocate resources, generating a greater average level of productivity and, hence, a greater pace of industrial growth. This is the “*pioneering technological condition*” of Nelson (1968), Nelson and Winter (1982) and Nelson and Pack (1999) and is only a *special case* under our framework, when there is no variety in the institutional (financial) environment.

Glossary for Model Equations

- a**: labour requirement
- b**: capital- product ratio
- EF**: external sources of financing investment
- g_D**: growth of demand
- h**: unit labour costs
- I**: Investment
- IP**: internal sources of financing investment
- K**: capital
- L**: Labour
- nb**: necessity-based
- ob**: opportunity-based
- P**: price
 - P**: average price of the product in the industrial sector
- s**: market share
- TP**: total profit
- W**: cost of labour
- y**: output
- α**: propensities to accumulate
- β**: portion of profits invested
- γ**: labour quasi-rent in the opportunity-based firms
- θ**: labour productivity
- φ**: willingness to invest
- ρ**: external sources of finance as a proportion of invested profits
- λ**: level of competition (perfect $\lambda=\infty$, imperfect $0<\lambda<\infty$, or monopoly $\lambda=0$)
- π**: invested profits

Table 1: Pioneering evolutionary diffusion models equations

Nelson and Pack (1999)		Nelson and Winter (1982), revised version of the Nelson (1968) model	
$\frac{Q}{L} = a_t + (a_m - a_t) \frac{L_m}{L}$	(1)	$\frac{L}{Q} = l_t \left(\frac{K_t}{K} \right) + \alpha l_t \left(\frac{K_m}{K} \right)$	(1')
$\Delta C = w \left(\frac{1}{a_t} - \frac{g}{a_m} \right)$	(2)	$\frac{K}{Q} = \lambda (P - r - w l_i)$	(2')
$\frac{d}{dt} \left(\log \frac{K_m}{K_t} \right) = e w \left(\frac{1}{a_t} - \frac{g}{a_m} \right)$	(3)	$w = L(w)$	(3')
$\frac{d}{dt} \left(\log \frac{K_m}{K_t} \right) = e w \left(\frac{1}{a_t} - \frac{g}{a_m} \right) \left(1 - \frac{K_m}{K} \right)$	(4)	$\frac{d}{dt} \left(\log \frac{K_m}{K_t} \right) = \frac{\dot{K}_m}{K_m} - \frac{\dot{K}_t}{K_t} = \lambda w (l_t - l_m) = \lambda w (1 - \alpha) l_m$	(4')
$S_k = \left(\frac{Q_t}{Q} - \frac{Q_t}{Q} \frac{w}{a_t} \right) + \left(\frac{Q_m}{Q} - \frac{Q_m}{Q} \frac{g w}{a_m} \right)$ $S_k = \left(1 - \frac{w}{a_t} \right) + w \left(\frac{1}{a_t} - \frac{g}{a_m} \right) \frac{Q_m}{Q}$	(5) (6)	$S_k = \frac{1}{P} \left[P - w l_t \left(\frac{K_t}{K} \right) - w l_m \left(\frac{K_m}{K} \right) \right] =$ $= \frac{1}{P} \left[r \left(\frac{K_t}{K} \right) + r \left(\frac{K_m}{K} \right) + (P - w l_t - r) \left(\frac{K_t}{K} \right) + (P - w l_m - r) \left(\frac{K_m}{K} \right) \right] =$ $= \frac{1}{\lambda P} \left(\frac{r}{P} \right) + \left(\frac{\dot{K}}{K} \right) \quad \text{from (2')}$	(5')

Notes to Table 1:

In Table 1 aggregate labor productivity is an average of both necessity based entrepreneurial firm and opportunity based entrepreneurial firm sectors and productivity in the necessity based entrepreneurial firm sector is less than in the opportunity based entrepreneurial firm sector (equations (1) and (1')). Equation (2) and (4)' describe the cost differential of the opportunity based entrepreneurial firm sector's unit costs being less than in the necessity based entrepreneurial firm sector, so that profitability incentives shift resources from the latter to the former sector. The logistic function has changed from (4)' (1982 version) to (3) and (4) (1999 version) so that it includes two new parameters: entrepreneurial effectiveness (**e**), the driving force of development determining the strength of response, and the premium for education parameter (**g**). Beside (**e**), the growth rate (Km/Kt) has the productivity of labor as the second driving force (equations 3 and 4). In 1982, (λ), re-named the entrepreneurial effectiveness in 1999, and the productivity of labor (using the opportunity based firm technology) relative to the necessity based firm technology were the driving forces. The price (**P**) in 1999 is set as numerator. The first term of the right hand side in (6) is the capital's share in the necessity based entrepreneurial firm sector and the second term is the amount by which the capital's share in the opportunity based entrepreneurial firm sector exceeds its share in the necessity based entrepreneurial firm sector, multiplied by the relative size of the opportunity based entrepreneurial firm sector.

Glossary for 1982 and 1999 equations:

Q: output

a: output per unit of labor

t: traditional

m: modern

L: labour

K: capital

w: wages

e: effectiveness of entrepreneurship

g: education premium

s_k : share of capital in total income

P: price

λ : fraction of re-invested excess profits in 1982, renamed in 1999 as **e**

r: cost of capital services

l: fraction of unit labour input of traditional technology

α_l : fraction of unit labour input of new technology.