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DRIVING FORCES BEHIND ENTREPRENEURSHIP: DIFFERENCES ON ENTREPRENEURSHIP RATE LEVEL AND ITS VOLATILITY ACROSS COUNTRIES

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ABSTRACT

This paper analyzes entrepreneurship volatility across a sample of countries participating in the Global Entrepreneurship Monitor (GEM) Project. Entrepreneurship volatility is modeled as a function of a set of institutional variables. Using longitudinal data on necessity-motivated entrepreneurship, we find significant differences in entrepreneurship volatility across lower-middle income countries. Our results suggest that government efficiency and entrepreneurship education and training contribute to reducing entrepreneurship volatility.

INTRODUCTION

An increasing number of studies emphasize the relationship between entrepreneurship (business ownership rates) and economic growth. Modeling these relationships is not easy because of the many factors both entrepreneurial activity and economic growth (Wennekers and Thurik 1999). Moreover, it is particularly difficult to determine the direction of causality between entrepreneurial activities and economic growth at the country level. Some studies emphasize the effect of economic growth on countries' entrepreneurial rates (Amorós and Cristi 2008; Wennekers et al. 2005), while others focus on the effect of entrepreneurial activity on national economic growth (van Stel, Carre and Thurik 2005). Carre et al. (2002, 2007) is one of the few studies developing a simultaneous equation model testing for both economic growth and entrepreneurship rate.

Blau (1987) and Acs et al. (1994) have proposed the existence of a "U-shape" relationship between rates of entrepreneurship (self employment) and economic growth. Carree et al. (2002), Wennekers et al. (2005), Belso-Martínez (2005) and Amorós and Cristi (2008) also find evidence of a "U-shape" curve. Recently, using data for 23 OECD countries, Carree et al. (2007), revisited the "U-shape" relationship and proposed instead an "L-shape" curve to describe the effect of economic growth on entrepreneurial activities.

Thus far, these models have focused on the average level of entrepreneurial activity and have neglected the empirical analyses of countries' "entrepreneurial volatility". Amorós and Cristi (2008) suggest that countries with lower gross domestic product per capita exhibit a higher variance of entrepreneurial activity, though they do not offer an explanation for this finding. Using a sample of countries participating in Global Entrepreneurship Monitor (GEM) Project, Amorós et al., (2008) have suggested that countries with more predictable and consistent policy taxes and government regulation, with sufficient government subsidies available for new and growing firms and with better entrepreneurship education and training exhibit lower volatility. The lack of research on countries' entrepreneurial volatility contrasts with the wealth of literature existing on the volatility of economic growth (Acemoglu et al. 2003; Aghion and Banerjee 2005; Hnatkovska and Loayza 2004; Ramey and Ramey 1995), as well as on the variability of business entry and exit

rates within countries (Bosma et al. 2005; Davis et al. 2006; Reynolds 1999; Reynolds and Maki 1990).

This paper contributes to our understanding of entrepreneurial dynamics by focusing on the heterogeneity of entrepreneurial volatility across countries. To this purpose, we test whether "institutional variables" affect the volatility of entrepreneurial activity proxied by data on new business creation collected by the Global Entrepreneurship Monitor (GEM) project for a group of countries during the period 2001-2008. Data used to proxy institutional variables come from the GEM National Expert Survey (NES)[1] data collected to measure countries *Entrepreneurial Framework Conditions* (EFCs) (Levie and Autio 2008; Reynolds et al. 2005)[2], from the *Worldwide Governance Indicators* (WGI), and from The Index of Economic Freedom. We suggest that these variables affect entrepreneurial activity and are related to concepts that potentially enhance a country's entrepreneurial activity, such as education, government efficiency, regulation quality, and government size.

The next section provides a review of the literature on the variability of entrepreneurship rates. The third section offers some guidelines for the study of entrepreneurship volatility. The fourth section presents a model for the level and volatility of country's entrepreneurial activity. The fifth section describes the data and variables used in the study. The sixth section shows our results. Finally, the concluding section discusses the implications of our results for developing economies with an emphasis on entrepreneurship policy.

ENTREPRENEURSHIP AND VOLATILITY

Recent studies identify "entrepreneurial activities" as a factor contributing to economic growth during last decades of the twenty-century (Audretsh and Keilbach 2004). Other studies, on the other hand, find that entrepreneurial activity has a positive effect on economic growth only in high-income countries (Acs and Amorós 2008; Amorós and Cristi 2008; van Stel et al. 2005; Wennekers et al. 2005). Carree et al. (2007) and Hessels et al. (2008) remark that the relationship between business ownership rates and economic growth changes over time and it depends on the level of economic development. If these variations are extremely accentuated between periods, there could well be an entrepreneurship volatility phenomenon.

The concept of business fluctuations has been linked to Schumpeter's (1912) idea of creative destruction. According to the Schumpeterian tradition, new and independent firms lead the innovation processes that bring about creative destruction. It is precisely this creative destruction that, through the disruption of innovations, may cause fluctuations. Firms that create, adopt and respond better to these innovations are the ones that can prevail and, as a result, contribute to a country's economic growth (Aghion and Howitt 1998). Some empirical evidence supports the Schumpeterian view. Davis et al. (2006 pp. 4), for example, posit that "the large job flows and high firm level volatility reflect the restructuring, experimentation and adjustment processes at the heart of Schumpeterian theories". In Schumpeterian terms, emerging firms can cause significant changes in certain sectors and thus play an important role in wealth distribution (Spencer, Kirchhoff and White 2008).

Schumpeterian volatility warrants that the most efficient entrepreneurs provide the services that the community demands. Nevertheless, volatility can also be caused by institutions' failure and lack of conditions supporting entrepreneurial ventures. This second source of volatility may require public policy aiming at reducing its level. Research in this area includes the analysis of firm-level volatility and the relationship between external and internal business factors (Comin

and Philippon 2005). Other studies instead link industrial diversification, volatility and economic growth (Imbs and Wacziarg 2004; Koren and Tenreyro 2004). Overall, most studies addressing firm-level volatility focus on consolidated businesses and primarily large public firms (Davis et al. 2006). In an alternative, we fill a gap in the literature by focusing on new ventures since little empirical evidence exists on the relationship and cross-country differences in the volatility of early stage entrepreneurial activities and entrepreneurship rates.

INSTITUTIONS AND ENTREPRENEURSHIP VOLATILITY

When studying the relationship between entrepreneurial volatility and institutions,, two main factors need to be considered: First, in addition to the Schumpeterian entrepreneur with a "pull motive" (i.e., desire for independence, increased income, status and recognition), several individuals are "pushed" into entrepreneurship because no better employment options exist.. As Reynolds et al. (2005 pp. 217) point out, "they cannot find a suitable role in the world of work" and "creating a new business is their best available option". Although many studies recognize that most entrepreneurial activity results from opportunities (Bosma et al. 2008; Carter et al. 2003; Feldman and Bolino 2000; Hessels et al. 2008; Kolveried 1996), necessity-motivated entrepreneurship is nonetheless significant in many low and middle income countries. Importantly, in some of these countries, necessity entrepreneurship can be linked to a lack of institutions and policies which probably cause lower productivity and investment, and higher unemployment rates (Caballero 2006).

Second, recent empirical evidence has shows that low and middle-income countries, entrepreneurial activity varies with per-capita GDP levels along with some other endogenous factors that –in many cases─ significantly change total entrepreneurial dynamics (Acs and Amorós 2008; Amorós and Cristi 2008; Wennekers et al. 2005). This phenomenon could be linked to Baumol´s (1990) argument that the allocation of entrepreneurship in the economy is influenced by the structure of rewards in a country (Desai and Acs 2007). Specifically, Baumol (1990 pp. 899) states that "entrepreneurial behavior changes direction from one economy to another in a manner that corresponds to the variations in the rules of the game." Entrepreneurial volatility in each country is likely to be influenced by these endogenous factors.

The GEM research project is an excellent source of data for the study of entrepreneurship variation rates over countries and time. For the 10-year period between 1999 and 2008, GEM collected data in 66 countries with different rates of entrepreneurship. Using adult population surveys, GEM data allow estimates of an *Early-stage Entrepreneurial Activity Index*. That is, the percentage of adult population (people between 18–64 years old) actively involved in starting a new business. GEM's respondents are also divided between *opportunity-based entrepreneurs* and *necessity-based entrepreneurs*. The former are those who have taken actions to create a new venture pursuing perceived business opportunities, while the latter are those who are involved in new ventures because they have no other employment options. In this paper we focus on necessity-based entrepreneurial activity (*NEC*) because low and middle-income countries have a relatively high prevalence of necessity-motivated entrepreneurs (Acs and Amorós 2008; Bosma et al. 2008; Bosma el al. 2009).

MODEL SPECIFICATION

As in Wennekers et al. (2005) and Amorós and Cristi (2008), we model *NEC* as a function of *GDP* per capita. In addition, we hypothesize that the variance of *NEC* depends on a vector of country specific institutional variables, *X*. Thus we obtain:

$$NEC_{it} = f(GDP_{it}, \alpha) + h(X_{it}, \beta)\varepsilon_{it} \quad (1)$$

where *i* denotes the country, *t* is the year, α is an unknown vector of parameters governing the relationship between *NEC* and *GDP*, β is also a vector of unknown parameters, and ε_{it} is a random variable with $E(\varepsilon_{it}) = 0$ and $V(\varepsilon_{it}) = E(\varepsilon_{it}^2) = 1$.[3]

The first term in equation (1) describes the effect of *GDP* on the deterministic (mean) part of *NEC*, whereas the second term describes the effect of the set of variables X_{it} on the stochastic (variance) part of *NEC*. That is, $E(NEC_{it}) = f(GDP_{it}, \alpha)$ and $V(NEC) = \left[h(X_{it}, \beta)\right]^2$. The latter indicates that the volatility of necessity entrepreneurship in each country depends on the country's specific institutional variables, *X*.

Using *NEC* as the dependent variable reduces the probability of endogeneity on the regressor (*GDP* per capita). In fact, empirical evidence shows that opportunity-based entrepreneurial activity has a positive effect on economic growth (van Stel et al. 2005), while the same cannot be said for necessity-based entrepreneurial activity.[4]

DATA

For *NEC* we use data from a sample of 50 countries participating in GEM during the period 2001-2008. We exclude countries with only one observation. As proxy for institutional variables we use quality of entrepreneurship education in colleges and universities, , government effectiveness, government regulatory quality, and government size, The list of the 50 countries and a detailed description of all variables is presented in the Appendix.

Entrepreneurship Education

As Levie and Autio (2008, p. 243) point out, entrepreneurship education and training are different from general education because they are aimed at improving students' cognitive abilities toward opportunity recognition, instrumental skills for new venture creation, and cultural attitudes favorable to entrepreneurial behavior (Honig 2004; DeTienne and Chandler 2004; Peterman and Kennedy 2003). Some evidence exists that entrepreneurial education increases individuals' willingness to engage in entrepreneurial activity (Lee and Wong 2003; Peterman and Kennedy 2003), thereby contributing to the creation of new firms. This is the case because this type of education provides the tools necessary to handle more effectively the shocks associated with new businesses. Unlike other international measures of general education (i.e., UNESCO dataset, Global Competitive Report subset of education and training variables, etc.), GEM data provide information specific to higher level *entrepreneurship education*. Specifically, the variable is constructed using a specific question from the National Expert Survey (NES) conducted annually by the GEM project to complement the APS data from which our measurements for *NEC* is taken.[5] Specifically, higher education (*HighEdu*) is measured by a 5 point Likert scale applied to the answers to the question: "In my country, colleges and universities provide good and adequate preparation to start up and to develop new firms." Consistently with Amorós et al. (2008), we hypothesize that as the entrepreneurial education in a country improves, the volatility of its entrepreneurial activity decreases.

Government Quality

As in the case of education, the multifaceted nature and complexity of governmental policy and programs across countries makes it difficult to to measure how government influences entrepreneurial activity (Valliere 2008). We use World Bank's governance indicators and the Heritage Foundation´s Index of Economic Freedom since they provide consistent and comprehensive measures for our period of interest.

The World Bank's Project on Governance constructs the *Worldwide Governance Indicators* (WGI) since 1999 (Kaufmann, Kraay and Zoido-Lobatón 1999; Kaufmann, Kraay and Mastruzzi 2008). WGI has developed aggregate and individual governance indicators for 212 countries and territories. The WGI covers six dimensions of governance: Voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption. Accordingly to the WGI´s definitions, the two proxies more directly related to entrepreneurship activities are government effectiveness and regulatory quality (Kaufmann, Kraay and Mastruzzi 2008: 7-8).

Government effectiveness (*GovEff*) measures the perceptions of the quality of public services, the quality of civil service and the degree of its independence from political pressures, the quality of *policy formulation and implementation*, and the credibility of the government's commitment to such policies. Regulatory quality (*RegQua*) measures the perceptions of the ability of the government to formulate and implement sound policies and regulations that allow and *promote private sector development*. Both variables have a theoretical range from -2.5 to 2.5.

Government Size *(GovSiz)* is taken from The Index of Economic Freedom, an annual report produced by The Wall Street Journal and The Heritage Foundation that tracks economic freedom around the world. The Index covers 10 freedoms –from property rights to entrepreneurship– in 183 countries.[6] Government size is measured as a function of the percentage of *GDP* used in government expenditure.. Large governments receive very low scores. The Index methodology uses a scale from 0 to 100, where 100 indicate highest degrees of freedom. Government size is relevant to new business creation because, as the Index of Economic Freedom document states (Miller and Holmes 2009)"a government's insulation from market discipline leads to inefficiency, bureaucracy, and lowered productivity. Government expenditures necessarily compete with private agents and interfere in market prices by overstimulating demand and potentially diverting resources through a crowding-out effect. The government's appetite for private resources affects both economic freedom and economic growth." (p. 13)

Government effectiveness, government size, and quality of regulations have a mayor impact on the business environment faced by entrepreneurial firms. The relationship between public programs and policies and startup rates has been widely analyzed (Stevenson and Lundström 2005; Storey 2005; Amorós 2009). Here, we link government size, government effectiveness and quality of regulation to entrepreneurial volatility and hypothesize that when government regulations are applied in a predictable and consistent way the volatility of entrepreneurial activity decreases.

RESULTS

Estimation of the vectors of parameters α and β is accomplished by rewriting equation (1) as:

$$NEC_{it} = f(GDP_{it}, \alpha) + v_{it} \qquad (2)$$

were

$$v_{it} = h(X_{it}, \beta)\varepsilon_{it} \quad (3)$$

Notice that our previous assumptions about ε_{it}, $E(\varepsilon_{it}) = 0$ and $V(\varepsilon_{it}) = 1$, and equation (3) imply that $E(v_{it}) = 0$ and. $V(v_{it}) = E(v_{it}^2) = \left[h(X_{it}, \beta)\right]^2$

For empirical purposes, we then assume non linear specifications for $f(GDP_{it}, \alpha)$ and $h(X_{it}, \beta)$:

$$f(GDP_{it}, \alpha) = \alpha_0 GDP_{it}^{\alpha_1} \quad (4)$$

$$h(X_{it}, \beta) = X_{1it}^{\beta_1} X_{2it}^{\beta_2} X_{3it}^{\beta_3} X_{4it}^{\beta_4} \quad (5)$$

where X_1, X_2, X_3, X_4. represent *HighEdu, GovEff, RegQua,* and *GovSiz,* respectively.

Equation (2) is estimated using pooled Nonlinear Least Squares (NLS). This provides a consistent estimator of α, $\widehat{\alpha}$, and of the error term v_{it}, $\hat{v}_{it}$, under a broad range of conditions (see Just and Pope, 1978). Nevertheless, because of equation (3), this estimation can be considered as a heteroskedastic regression. To test the latter we use the $\hat{v}_{it}$'s obtained from the regression in equation (2).[7] Plotting $\hat{v}_{it}$ against GDP (Figure 1) we observe that the lower a country's GDP is, the greater the dispersion of $\hat{v}_{it}$.

This result provides some support for our hypotheses that equation (2) can be considered a heteroskedastic regression and leads us to hypothesize that the variance of v_{it} depends on the country's idiosyncratic shocks as in equation (3). A more rigorous test for the behavior of v_{it} is obtained from the estimation of equation (3). To accomplish this we use the following relationship:

$$v_{it}^2 = \left[h(X_{it}, \beta)\right]^2 \mu_{it} = \quad (6)$$

where $E(\mu_{it}) = 1$ by definition of expectations.[8]

Taking logarithms of equation (6) and replacing in it the proposed functional form for $h(X_{it}, \beta)$, as in equation (5), we obtain the following equation:

$$\ln v_{it} = \beta_0 + \beta_1 \ln X_{1it} + \beta_2 \ln X_{2it} + \beta_3 \ln X_{3it} + \beta_4 \ln X_{4it} + \mu_{it}^* \quad (7)$$

where $\beta_0 = E\left(\frac{\ln \mu_{it}}{2}\right)$ and $\mu_{it}^* = \frac{\ln \mu_{it}}{2} - E\left(\frac{\ln \mu_{it}}{2}\right)$. The latter implies that $E(\mu_{it}^*) = 0$.

Although a more general specification of equation (7) could be obtained by adding an error term time specific to investigate time effects common to all countries that may be affecting the variance of entrepreneurial activity, we leave that extension for future research.

Because *GovEff , RegQua,* and *GovSiz* are highly correlated, estimation of equation (7) faces a problem of multicolineality. To solve this problem, we use a principal component analysis to

capture most of the variance (Hair et al. 1995) of government variables and calculate a new variable that we call Government Quality (*Govq*).

For estimation purposes, we replace $\ln \nu_{it}$ with $\ln |\hat{v}_{it}|$ in equation (7) as the dependent variable, where the $\hat{v}_{it}$'s are obtained from the NLS regression in equation (2). Estimation of equation (7), using Ordinary Least Squares (OLS), provides a consistent estimator of β, say $\hat{\beta}$, under the same conditions for the consistent estimator of α in equation (2). This allows us to verify the hypothesis of heteroskedasticity for ν_{it} by analyzing the statistical significance of the parameters in β. It also allows us to compute the variance of entrepreneurial activity in each country as $\left[h\left(X_{it}, \hat{\beta}\right)\right]^2$.

Finally, we re-estimate equation (2) using NLS weighted regression with weights $1/\sqrt{\left[h\left(X_{it}, \hat{\beta}\right)\right]^2}$ to obtain an estimation of α that takes into account the heteroskedastic nature of that model and the effect of X_{it} upon countries´ entrepreneurial volatility.

Consistency of our estimation process also requires that no endogeneity problems with the regressor *GDP* in equation (2) exist. Thus, we perform a residual-based form of the Hausman test which is asymptotically equivalent to the original Hausman test (Wooldridge 2002 chapter 6.2), and involves estimating an auxiliary regression for GDP per capita on a constant, the exogenous variables of the model, *Govq* and *HighEdu* , and regressor specific instruments. As instrument we use the 10 measurers of economic freedom of The Index of Economic Freedom. The test is performed using OLS in a log-log model using those variables. The regression of the natural log of GDP_{it} on the natural log of NEC_{it}, including the residuals from the auxiliary regression for *GDP* as an additional explanatory variable is then estimated by OLS. The statistical significance of the coefficient associated with the residuals is evaluated. If that parameter is not statistically significant then the Hausman test does not reject the hypothesis of exogeneity of the regressor.[9] In our case, the coefficient associated with the residuals has a p-value of 0.29, which indicates that there no endogeneity problem with *GDP* is present.

Parameter estimates for the deterministic and stochastic components of necessity-based entrepreneurship are shown in Table 1.

Results for the variance of *NEC* (stochastic component), equation (7), indicate that the parameters for *Govq* and *HighEdu* are significant at 5% of significance level. Moreover, *Govq* and *HighEdu* have a negative marginal effect on *NEC* variability. These results are consistent with Amorós et al. (2008) and Levie and Autio (2008). Amorós et al. (2008) use a set of variables of government activity that affect entrepreneurial volatility obtained from GEM data to show that governments play a key role on entrepreneurial volatility. In that paper, given a completely different source of data, results provide some evidence that government quality reduces entrepreneurial volatility. This shows that the result of government on entrepreneurial volatility is quite robust.

With respect to education quality, Levie and Autio (2008) test the relationships between EFCs and different types of entrepreneurial activity and found evidence that the EFCs are related to high growth entrepreneurial framework conditions.[10] Their main results show that entrepreneurship

education and training at institutions of higher education and entrepreneurship policy (regulation and taxation) have a positive and significant effect on high-potential entrepreneurship.

Estimates for the deterministic component of necessity-based entrepreneurial activity, equation (6), show that *GDP* has a negative effect on the average level of *NEC*. This result is consistent with Wennekers et al. (2005), Carree et al. (2007), Hesseles et al. (2008) and Acs and Amorós (2008).

CONCLUSIONS AND POLICY IMPLICATIONS

In this paper, using GEM data, we show that entrepreneurial volatility can be a problem for middle-and-low income countries. As an example, in Figure 2 we illustrate this phenomenon using the cases of Venezuela, India, Brazil and Argentina.

Because of the lack of understanding about entrepreneurial volatility, policymakers have focused on how to move from necessity-based entrepreneurial activity towards opportunity-based entrepreneurial activity but made hardly any effort to stabilize entrepreneurial activity. In this paper we use the concept of entrepreneurship volatility and show the existence of significant fluctuations in the necessity-based entrepreneurship across countries.

Countries with a low income face high rates of necessity-based entrepreneurial activity because a large part of the population is not been able to find other sources of employment and, as a result, starts new ventures because of the lack of alternatives.. In fact, necessity-based entrepreneurship is often the result of a country's environment in which entrepreneurship framework conditions do not contribute to improving opportunities or high potential innovative activities. Moreover, these necessity-based entrepreneurs operate often out of the formal markets and are not regulated by formal business laws (Yamada 1994). It is possible, though not necessarily desirable, that clear institutions may help improve the general business environment and, therefore, reduce the incidence of necessity-based entrepreneurship. The transition from formal to informal activities is an interesting topic for future research.

By focusing on countries' necessity-based entrepreneurial activity we help policymakers in their efforts to reduce entrepreneurial volatility. Our results imply that better focused entrepreneurship education programs can improve opportunity recognition and help potential entrepreneurs to reduce their constraints and eventually transform their isolated business or self-employment initiatives into value-adding and competitive firms (Levie and Autio 2008). Entrepreneurship education, together with entrepreneurship policy can create a "societal-readiness" to improve entrepreneurship activities across countries (Stevenson and Lundström 2005). Indeed, our results illustrate how government institutions and policies, and education could work together to restructure and adjust entrepreneurial framework conditions which, in turn, could enhance productivity, generate investment and, as a consequence, provide a more stable environment for new ventures.

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NOTES

1. For the complete GEM project measurements and methodology see Reynolds et al. (2005), and the introduction and appendix in Minniti et al. (2006)
2. For the complete GEM's NES measurements and methodology see Reynolds et al. (2005). For NES results and linkage of EFCs with other international measurements see Bosma et al. (2008). NES captures qualitative data on exogenous factors that have an impact on entrepreneurial activity in a given national context. NES employs multi-item scales to provide measurements of EFCs. Levie and Autio (2008) provide an extensive review of Leibenstein's theories of entrepreneurship and economic development (1968, 1978, 1995) and link their propositions to EFCs.
3. This type of specification has been widely used in the theory of agricultural production where not only the output average is a function of the inputs used by a farmer, but also the variance of output. In the agricultural literature, this specification was originally proposed by Just and Pope (1979) who pointed out that no generality is lost in assuming $V(\varepsilon_{it})=1$, since if $V(\varepsilon_{it})=\sigma_{\varepsilon}^2$ then the $h(X_{it},B)$ could simply be modified by a multiplicative factor σ_{ε}^2.
4. There is not a clear relationship between necessity-based entrepreneurial activities and Baumol´s (1990) distinction between unproductive or destructive entrepreneurship because some necessity-based activities could be productive depending on the context.
5. For the complete GEM's NES questions see Reynolds et al. (2005).
6. For complete information about the Index and his methodology see: http://www.heritage.org/Index/Default.aspx
7. $\hat{v}_{it} = NEC_{it} - f(GDP_{it}, \hat{\alpha}) +$
8. Because $E(v_{it}^2)=\left[h(X_{it},\beta)\right]^2$ we can write $v_{it}^2=\left[h(X_{it},\beta)\right]^2 \mu_{it}$ with $E(\mu_{it})=1$
9. Wooldridge (2002 chapter 6.2.1) point outs that a valid test for the significance of that parameter associated with the residuals requires an efficient estimation of this equation. Because of this we estimate the variance-covariance matrix with the Huber/White/sandwich estimator.
10. For more information about high-potential entrepreneurs using GEM methodology see Autio (2005, 2007).

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APPENDIX

List of countries in the sample:

Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Croatia, Denmark, Dominican Republic, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, India, Ireland, Israel, Italy, Jamaica, Japan, Korea, Latvia, Mexico, Netherlands, New Zealand, Norway, Peru, Poland, Portugal, Romania, Russia, Serbia, Singapore, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Uganda, United Arab Emirates, United Kingdom, United States, Uruguay and Venezuela.

Variables Description.

Variable	Description	Source	Mean	Max.	Min.	SD.
NEC	% of adult population who are involved on Necessity-based entrepreneurial activity	GEM Adult Population Survey	2.22	14.40	0.09	2.54
GDP	Gross Domestic Product in USA dollars adjusted by purchase power parity	IMF Database v. October 2008	2088	55199	690	12370
HighEdu	Higher level entrepreneurship education	GEM National Expert Survey	2.57	3.51	1.64	0.36
GovEff	Government effectiveness	World Bank's Worldwide Governance Indicators (WGI)	0.94	2.41	-0.96	0.91
RegQua	Regulatory quality	World Bank's Worldwide Governance Indicators (WGI)	0.85	2.01	-1.56	0.78
GovSiz	Government Size	Wall Street J. & Heritage Foundation Index of Economic Freedom,	56.20	94.12	0	25.33
Govq	Government Quality	Variable constructed by principal component analysis.	0.14	2.94	-2.29	0.98

Table 1: Estimates of the Deterministic and Stochastic components of necessity-based entrepreneurial activity

Model	Constant	*GDP*	*LnGovq*	*LnHighEdu*	R^2	*N*
Estimates of the determinist component using NLS	815** (221)	-.604** (.031)			0.71	274
Estimates of the stochastic component using OLS	11.42** (1.73)		-4.26** (.733)	-1.85** (.477)	0.23	180
Estimates of the Deterministic component using a weighted NLS regression	1790** (519)	-.705** (.032)			0.74	180

Numbers in parentheses are standard errors. ** $p \leq 0.05$ significance level.

Figure 1: Dispersion of Error Term of Necessity Entrepreneurial Dynamics (v_{it}) versus GDP per capita

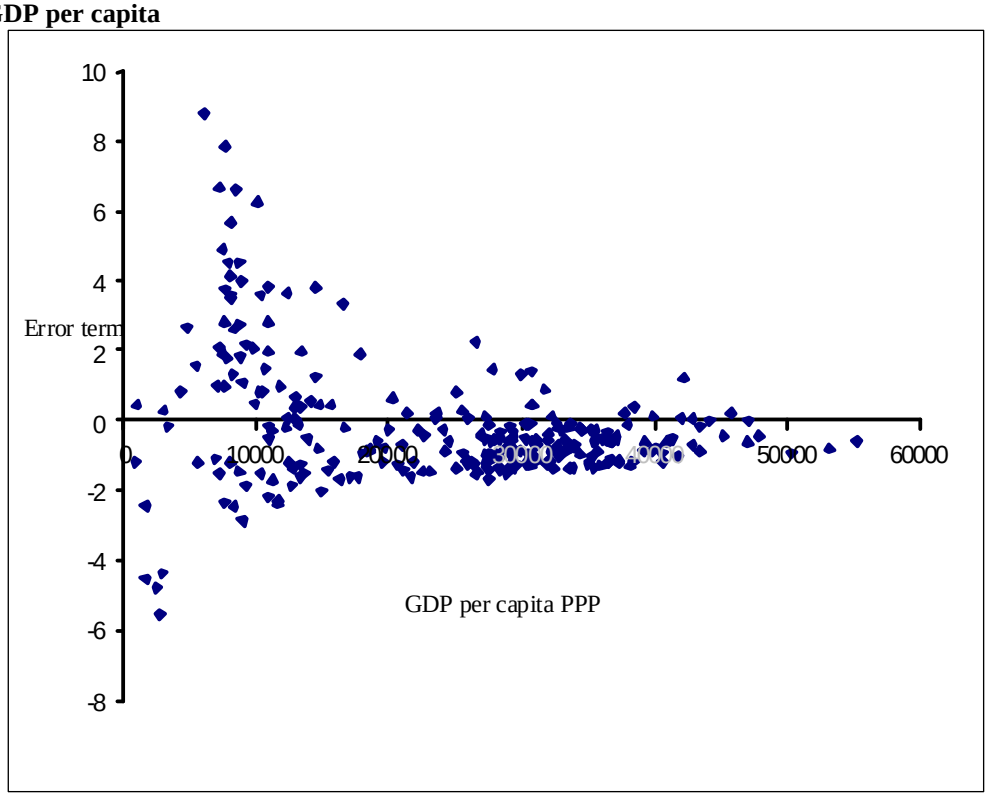
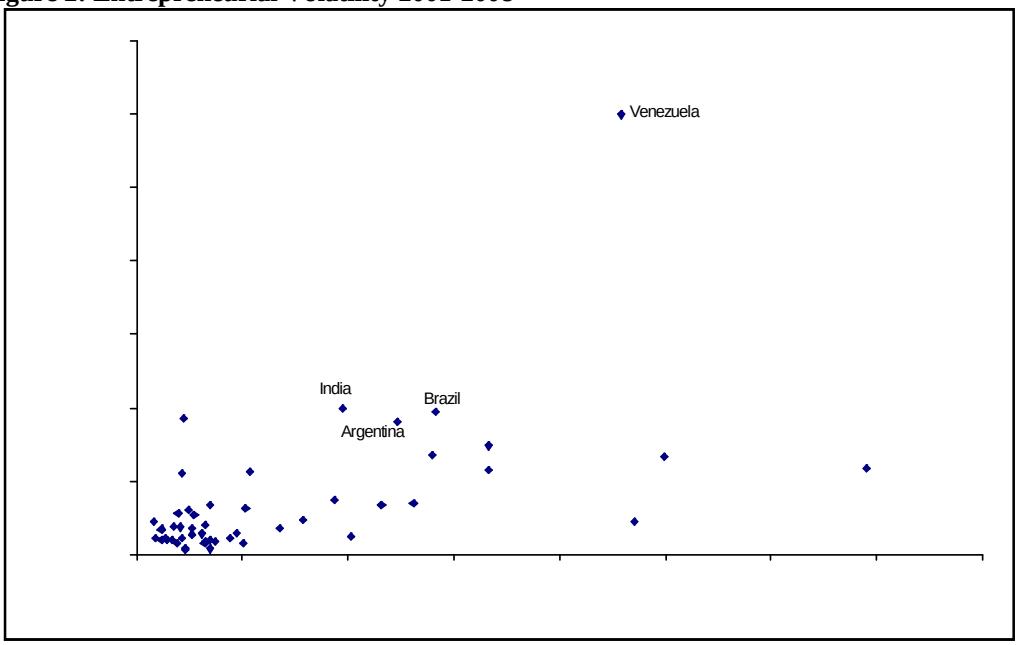


Figure 2: Entrepreneurial Volatility 2001-2008



The variance has been computed using $h(X_{it}, B)^2$