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André van Stel
EIM Business and Policy Research and
Max Planck Institute for Research into Economic Systems

Martin Carree
University of Maastricht

Roy Thurik
Erasmus University Rotterdam, EIM and
Max Planck Institute for Research into Economic Systems

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For editorial correspondence,
please contact: egppapers@mpiew-jena.mpg.de

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Max Planck Institute for
Research into Economic Systems
Group Entrepreneurship, Growth and
Public Policy
Kahlaische Str. 10
07745 Jena, Germany
Fax: ++49-3641-686710

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André van Stel (EIM Business and Policy Research and Max Planck Institute Jena)
Martin Carree (University of Maastricht)
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ABSTRACT:
The increased importance of knowledge as a source of competitiveness for modern economies suggests that the organization of industries most conducive to innovative activity and unrestrained competition will be linked to higher growth rates. Entrepreneurial activity is generally assumed to be an important aspect of this organization. In the present paper we investigate whether a new and promising concept, *Total Entrepreneurial Activity*, influences GDP growth for 36 countries in a recent period. We will also test whether this influence depends upon the level of economic development measured as GDP per capita. With this test we aim to investigate to what extent the role of entrepreneurship has changed in the last decades of the 20th century. Although the limited number of observations does not allow for many competing explanatory variables, we will examine the role of the so-called *Growth Competitiveness Index*. This variable captures a range of alternative explanations for achieving sustained economic growth. In addition, we incorporate the initial level of economic development to correct for convergence. We find that entrepreneurial activity indeed affects economic growth, but that this effect depends upon the level of per capita income. This suggests that entrepreneurship plays a different role in countries in different stages of economic development.

JEL-CODES: L16, M13

KEYWORDS: Entrepreneurship, economic growth, economic development

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CONTACT: André van Stel, EIM, P.O. Box 7001, 2701 AA Zoetermeer, The Netherlands; ast@eim.nl; (T) 0031 79 341 3634; (F) 0031 79 341 5024.

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1. INTRODUCTION

There are many factors that influence the speed of economic progress. Such factors may include climate, education, property rights, saving propensity, presence of seaports, etc. The empirical growth literature has suggested a large number of economic and non-economic variables that may influence economic growth (Sala-i-Martin, 1997 and Bleaney and Nishiyama, 2002). Entrepreneurship has failed to enter this list of variables (Table 1 in Bleaney and Nishiyama, 2002). On the one hand, this is surprising since many economists would claim that entrepreneurial activity is vital to economic progress.[1] They will, for example, refer to the demise of communist economies where entrepreneurial activity was about absent and contributions by Schumpeter (1934) and (neo-)Austrian economists (like Kirzner, 1973).[2] On the other hand, it is less surprising since the measurement of the factor 'entrepreneurship' is far from easy. Most factors contributing to economic progress can be measured using existing secondary sources for a wide variety of countries. However, aside from self-employment measures, which are questionable measures of entrepreneurial activity, there were no sources up till recently to compare this activity across countries. The *Global Entrepreneurship Monitor* (GEM) has changed this.

There are various ways in which entrepreneurship may affect economic growth. Entrepreneurs may introduce important innovations by entering markets with new products or production processes (Acs and Audretsch, 1990 and 2003). They may increase productivity by increasing competition (Geroski, 1989; Glaeser et al., 1992; Nickel, 1996; Nickel et al., 1997). This may go together with turbulence due to start-up and exit behavior (Reynolds, 1999; Acs and Armington, 2003; Audretsch and Fritsch, 1996). They may enhance our knowledge of what is technically viable and what consumers prefer by introducing variations of existing products and services in the market. The resulting learning process speeds up the discovery of the dominant design for product-market combinations. Knowledge spillovers play an important role in this process (Audretsch and Feldman, 1996; Audretsch and Stephan, 1996; Audretsch and Keilbach, 2003). Lastly, they may be inclined to work longer hours and more efficiently as their income is strongly linked to their working effort.[3]

There have been efforts to empirically investigate the importance of the impact of entrepreneurship on economic performance, especially at the firm, region or industry level (e.g. Audretsch, 1995, Audretsch and Fritsch, 2002 and Caves, 1998). However, contributions at the level of the nation state (Blanchflower, 2000; Carree et al., 2002) are limited. See Carree and Thurik (2003) for a survey of studies of the impact of entrepreneurship on growth at various levels of observation. In this paper, we will use recent and new material provided by the Global

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[1] The recognition of the importance of entrepreneurial activity has been absent for a while in mainstream (theoretical) economics. Baumol (1968) already complained that entrepreneurship, being hard to capture into mathematical equations, disappeared from mainstream (neo-classical) economics. Kirzner (1973) observed that the neo-classical model constrained the decision making of the entrepreneur, in terms of product quality and price, technology, within limits wholly alien to the context in which real world entrepreneurs characteristically operate. Also see Barreto (1989) and Kirchhoff (1994, p. 30).

[2] Schumpeter (1950, p. 13): "The function of entrepreneurs is to reform or revolutionize the pattern of production by exploring an invention, or more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way… To undertake such new things is difficult and constitutes a distinct economic function, first because they lie outside of the routine tasks which everybody understands, and secondly, because the environment resists in many ways."

[3] See Carree and Thurik (2003) and Audretsch and Thurik (2001) for a more elaborate treatment of the intervening variables between entrepreneurship and growth. See also Acs and Audretsch (2003) and Audretsch and Thurik (2003).

Entrepreneurship Monitor (GEM). It contains the so-called Total Entrepreneurial Activity (TEA) rate measuring the sum of nascent entrepreneurs and business owners of young firms for a range of countries.

An important element in our analysis is to consider whether entrepreneurial activity plays a similar growth-stimulating role in highly developed economies and in developing countries. Carree and Thurik (1999), for example, indicate that the presence of small firms in manufacturing industries benefits growth for the richest among EU-countries, but not for EU-countries with somewhat lower GDP per capita, like Portugal and Spain. This is in line with the regime shift introduced by Audretsch and Thurik (2001). They argue that there has been a shift from a model of the 'managed economy' towards that of the 'entrepreneurial economy'. In particular, Audretsch and Thurik argue that the model of the managed economy is the political, social and economic response to an economy dictated by the forces of large-scale production, reflecting the predominance of the production factors of capital and (unskilled) labor as the sources of competitive advantage. By contrast, the model of the entrepreneurial economy is the political, social and economic response to an economy dictated not just by the dominance of the production factor of knowledge – which Romer (1990, 1994) and Lucas (1988) identified as replacing the more traditional factors as the source of competitive advantage – but also by a very different, but complementary, factor they had overlooked: entrepreneurship capital, or the capacity to engage in and generate entrepreneurial activity.[4]

In this paper we investigate whether *Total Entrepreneurial Activity* (TEA) influences GDP growth for 36 countries. We will test whether this influence depends upon the level of economic development measured as GDP per capita. With this test we aim to investigate to what extent the role of entrepreneurship has changed as hypothesized by Audretsch and Thurik (2001). Although the limited number of observations does not allow for many competing explanatory variables, we will examine the role of the so-called *Growth Competitiveness Index* (GCI). This variable captures a range of alternative explanations for achieving sustained economic growth. In addition, we incorporate the initial level of economic development to correct for convergence.

The rest of this paper is organized as follows. In section 2 the TEA and GCI rates are introduced and discussed in some detail. In section 3 we present our model and the description of the variables. Section 4 is used for results and section 5 concludes.

2. ENTREPRENEURSHIP, COMPETITIVENESS AND GROWTH

Countries, even in similar stages of economic development, differ strongly in the rates of entrepreneurial activity. The GEM *Global Executive Reports* show large differences between countries like Japan, France, Belgium and Sweden with low entrepreneurial activity and countries like the U.S., Canada, Australia and South Korea with high entrepreneurial activity. Some developing countries like Brazil and Mexico top the list of countries with high entrepreneurial activity. Entrepreneurial activity is correlated with the self-employment rate (Table I in Carree et al., 2002 and Table 2.1 in Audretsch et al., 2002). However, there are exceptions to this rule. Japan, for example, has self-employment rates that are relatively close to those of the U.S. (Van Stel, 2003). However, the new entry rate is far smaller in Japan, where there are many (inefficient) small establishments in the retail and wholesale sectors. Carree et al. (2002) show that countries may not

[4] It is not straightforward that knowledge or R&D always spills over due to its mere existence (Audretsch and Keilbach, 2003). See also Acs and Audretsch (2003) and Audretsch and Thurik (2003).

only have too few self-employed, but may also have too many. Italy is given as an example for the latter situation.[5]

In case entrepreneurial activity would be important for economic progress, we should find countries that are high on the list of countries ranked in terms of this activity to also grow relatively fast. The usual ceteris paribus condition applies here since there are many other factors that may explain economic progress. These include factors like schooling, inflation, investment in fixed assets, climate, institutional quality and property rights. It is important to gain insight in alternative explanations for economic growth *next to* entrepreneurial activity.

In the present section we will discuss our two key variables, the TEA rate capturing a modern view on entrepreneurial energy and the GCI rate encompassing a range of alternative explanatory variables.

Total Entrepreneurial Activity (TEA)

Data on total entrepreneurial activity are taken from the *Global Entrepreneurship Monitor* (GEM) Adult Population Survey. This database contains various entrepreneurial measures that are constructed on the basis of surveys of - on average- some 3,000 respondents per country (37 countries in 2002). The total entrepreneurial activity rate (TEA) is defined as that percent of adult population (18-64 years old) that is either actively involved in starting a new venture or the owner/manager of a business that is less than 42 months old (Reynolds et al., 2002). We use two measures of total entrepreneurial activity: the TEA rate for 2002 (37 countries) and the average TEA rate for 2001 and 2002 (28 countries). In 2002 the TEA rate (per 100 adults) ranges from values above 15 in Chile, Thailand and India, to 10.5 in the United States, to values below four in Russia, Belgium, France, Japan, Croatia and Hong Kong. For most countries, TEA rates in 2002 are lower than in 2001 due to a universal decline in economic growth rates in 2002 compared to 2001. The relative rankings between countries remained quite stable though (Reynolds et al., 2002). For the 28 countries that participated in GEM both in 2001 and in 2002, the rank correlation (Spearman's ρ statistic) is 0.8 and significant at the 0.01 level. This indicates that total entrepreneurial activity may be seen as a *structural* characteristic of an economy. This makes the variable suitable for inclusion in models aiming to explain structural growth such as the model that we will estimate in this paper. The high rank correlation suggests that it does not matter a lot whether TEA 2001/2002 or TEA 2002 is used. Nevertheless, we present results for both TEA measures.

Growth Competitiveness Index (GCI)

The Growth Competitiveness framework is employed by the World Economic Forum's *Global Competitiveness Report* (GCR). A central objective of the GCR is to assess the capacity of the world's economies to achieve sustained economic growth. In the GCR this is done by analyzing the extent to which individual national economies have the structures, institutions, and policies in place for economic growth over the medium term (McArthur and Sachs, 2002). These features of national economies are summarized in the Growth Competitiveness Index (GCI). The GCR identifies three inter-related mechanisms involved in economic growth: efficient division of labor, capital accumulation (including human capital), and technological advance. Concerning the last-mentioned mechanism, a distinction is made between the creation of new technologies (*technological innovation*) and the adoption of technologies that have been developed abroad (*technology transfer*). In the GCR framework technological innovation is seen as the most

[5] See also Van Stel and Carree (2004).

important factor for achieving long-term economic growth. In this connection the GCR distinguishes between *core economies* (countries that are technological innovators) and *non-core economies*.[6] The core economies are typically the richest countries. It is argued that economic growth is achieved in different ways in these two types of economies. In core economy countries, growth is powered by their capacity to innovate and to win new global markets for their technologically advanced products (technological innovation). High growth rates of non-core economies are often achieved by rapidly absorbing the advanced technologies and capital of the core economies, for example through high levels of foreign direct investment from high-tech multinationals of the core economies (technology transfer). This type of growth process is sometimes also called "catch-up growth". These different drivers of economic growth are in line with the different roles entrepreneurship, knowledge and economic structure play in the two types of economies – managed versus entrepreneurial – Audretsch and Thurik (2001) distinguish using their fourteen dimensions and explains why the model of the entrepreneurial economy may be a better frame of reference than the model of the managed economy in the contemporary, developed economies.

Besides technology, two other major pillars of growth are identified in the Growth Competitiveness framework: the quality of public institutions and the macro-economic environment. Institutions are crucial for their role in ensuring the protection of property rights, the objective resolution of contract and other legal disputes, and the transparency of government. All these factors are important for achieving an efficient division of labor. Public institutions are also important for establishing societal stability required to achieve economic growth. The macro-economic environment relates to government monetary and fiscal policies and stability of financial institutions. It involves such things as budget balance, modest taxation, high rates of national savings and a realistic level of the exchange rate that preserves the competitiveness of the export sector. Again, these factors are important conditions for achieving capital accumulation and an efficient division of labor which in turn influence economic growth.

In the GCR the growth potential of economies is measured by the *Growth Competitiveness Index* (GCI). This index aims to "measure the capacity of the national economy to achieve sustained economic growth over the medium term, controlling for the current level of economic development" (McArthur and Sachs, 2002). The GCI reflects the three major pillars of economic growth identified in the GCR framework: technology, public institutions, and the macroeconomic environment. It is argued that these factors play different roles at different stages of economic development, and therefore these factors (or subindexes) get different relative weights in constructing the overall GCI index for economies at different stages of development. In particular, for the so-called core economies identified in GCR the technology sub-index gets a higher weight compared to the non-core economies. This is because technology is the main source of competitiveness in modern economies. Likewise, within the technology sub-index, innovation gets a higher relative weight compared to technology transfer in the core economies. For the construction of the GCI information from 'hard' data sources (international statistics) and information from the *GCR Executive Opinion Survey* are combined.[7] The main phenomena reflected by the three GCI sub-indexes are described below.

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[6] A country is defined to be a core economy if it achieves at least 15 US utility patents per million population. 24 Countries met this criterion in 2000.

[7] The Executive Opinion Survey is a survey among firms within countries. The goal of the survey is to capture a broad array of intangible factors that cannot be found in official statistics but that nonetheless may influence the growth potential of countries. For details, see Cornelius and McArthur (2002).

The technology index consists of an innovation sub-index, a technology transfer sub-index and an ICT sub-index. The innovation sub-index is mainly determined by the gross tertiary enrollment rate. Also, the number of US utility patents and the relative country scores on some Survey questions with relation to innovation are used in this sub-index. The technology transfer sub-index mainly relates to foreign direct investment. The ICT sub-index measures such things as the per capita numbers of mobile telephone users, Internet users, telephone mainlines, personal computers, et cetera. The public institutions index consists of a contracts and law sub-index and a corruption sub-index and the values of this index are based on Survey questions on the independency of judiciary from government, the imposed costs on business of organized crime, and the extent to which the payment of bribes are common in contacts with government services. The macroeconomic environment index captures stability indicators such as the inflation rate, the exchange rate, the general government surplus, and the national savings rate. Also, the country credit rating and the level of government expenditure are included in the macroeconomic environment index. High levels of government expenditure are assumed to be financed through (too) high tax rates that may hamper economic growth.

The GCI thus tries to capture factors determining economic growth. In a test regression for 75 countries, McArthur and Sachs (2002) show that the 2001 growth competitiveness index indeed has a significantly positive influence on economic growth over the period 1992-2000, while controlling for the catch-up effect as measured by initial income level of countries. This supports the view that the GCI indeed captures important factors determining the capacity of national economies to grow. However, a disadvantage of this approach is that the GCI is used to explain past growth instead of future growth, resulting in a clear direction of causality problem. In this paper, we try to solve this causality problem.

3. MODEL AND DATA

In this section we present our model and discuss our data. We make use of the *Global Entrepreneurship Monitor* (GEM), the *Global Competitiveness Report* (GCR), and other sources. Data on four basic variables are used in our model: total entrepreneurial activity, growth of GDP, per capita income, and the growth competitiveness index. The sources and definitions of these variables are listed below.

Total Entrepreneurial Activity

Data on total entrepreneurial activity are taken from the GEM Adult Population Survey for 2001 and 2002.

Growth of GDP

GDP growth rates are taken from the IMF World Economic Outlook database of the International Monetary Fund, version September 2003.

Per capita income

Gross national income per capita 2001 is expressed in (thousands of) purchasing power parities per US$, and these data are taken from the 2002 World Development Indicators database of the World Bank.[8]

[8] See http://www.worldbank.org/data/databytopic/GNIPC.pdf. Taiwan is missing in this database and we estimate the 2001 per capita income level in Taiwan to be 16,761 US$, based on information at http://siakhenn.tripod.com/capita.html.

Growth Competitiveness Index

Data on the GCI 2001 are taken from page 32 of *The Global Competitiveness Report 2001-2002*. The variable was described in section 2.

In this paper we investigate whether entrepreneurship may be considered a determinant of economic growth, next to technology, public institutions and the macroeconomic environment (which are all captured by the GCI). As both entrepreneurship and the factors underlying the GCI are assumed to be structural characteristics of an economy, we do not want to explain *short term* economic growth but rather growth in the *medium term*. Therefore we choose average annual growth over a period of five years (1999-2003) as the dependent variable in this study.

We stay close to the model of McArthur and Sachs (2002) who explain national growth rates over the period 1992-2000 by the GCI, and (the log of) initial income level of countries (catch-up effect). We add two new features to this model. *First*, we include the total entrepreneurial activity rate from the *Global Entrepreneurship Monitor* as an additional determinant. We also test for a possible *non-linear* impact of this variable following Carree and Thurik (1999) and Audretsch and Thurik (2001). This is done because we should be careful in comparing countries in different stages of economic development. It is important to investigate to what extent the impact of entrepreneurial activity is similar across stages of economic development. High start-up rates in developing countries are perhaps less a sign of economic strength when compared to such rates in highly developed economies.[9] *Second*, we try to solve the causality problem that arises by measuring growth rates in periods preceding the measurement of the GCI.[10] To this end we have collected data on *annual* economic growth rates instead of over an eight-year period so that we can measure growth in a period after the independent variables are measured. Furthermore, we include a lagged dependent variable (*i.e.*, lagged growth rates) as an explanatory variable to 'correct' for reversed causality.[11]

As mentioned, we test for a non-linear relationship. In particular we include an interaction term of the total entrepreneurial activity rate multiplied by per capita income. TEA rates may reflect different *types* of entrepreneurs in countries with different development levels. In particular, average human capital levels of entrepreneurs may differ between countries (shopkeepers versus Schumpeterian entrepreneurs). It may be hypothesized that higher levels of entrepreneurial activity have a bigger impact on growth in countries with higher levels of economic development. In our empirical application we test this hypothesis by including an interaction term with per capita income.

4. RESULTS

Regression results are presented in Table 1. The left three columns use data for the 28 countries that participated in the *Global Entrepreneurship Monitor* in both 2001 and 2002. We use the average total entrepreneurial activity rate over 2001 and 2002. The right three columns use data for the 37 countries that participated in GEM 2002, minus Croatia.[12] These regressions use TEA

[9] See Peretto (1999) and Carree et al. (2002).

[10] The intertemporal relation between occupational choice and economic development has been dealt with in a series of recent papers (Banerjee and Newman, 1993; Iyigun and Owen, 1999; Lloyd-Ellis and Bernhardt, 2000).

[11] The Granger (1969) approach to the question of whether x causes y is to see how much of the current y can be explained by past values of y and then to see whether adding lagged values of x can improve the explanation. y is said to be Granger-caused by x if x helps in the prediction of y, or equivalently if the coefficients on the lagged x's are statistically significant (Audretsch et al., 2001).

[12] Croatia is excluded because the Growth Competitiveness Index is not available.

2002 as entrepreneurship measure. We do this to investigate whether results are affected by the inclusion of eight additional countries in the estimation sample. The countries participating in GEM 2001 and GEM 2002 are listed in Appendix 1.

Table 1: Estimation results, dependent variable average annual growth of GDP over period 1999-2003

	Model I	Model II	Model III		Model IV	Model V	Model VI
Constant	-.004 (.1)	-.008 (.2)	.107 (1.7)		.011 (.4)	.018 (.6)	.098** (2.3)
log (YCAP)	-.028* (1.9)	-.026 (1.7)	-.056*** (2.8)		-.025** (2.2)	-.028** (2.3)	-.060*** (3.6)
GCI	.023 (1.6)	.022 (1.5)	.016 (1.2)		.017 (1.5)	.018 (1.6)	.021* (2.0)
$TEA_{2001/2002}$		.036 (.3)	-.435* (1.8)				
$TEA_{2001/2002}$*YCAP			.025** (2.2)				
TEA_{2002}						-.058 (.7)	-.428** (2.6)
TEA_{2002}*YCAP							.021** (2.6)
Lagged growth	-.100 (.5)	-.115 (.6)	-.080 (.4)		.013 (.1)	.031 (.2)	.006 (.0)
Adj. R^2	.032	.000	.135		.138	.124	.257
Observations	28	28	28		36	36	36

Note: Absolute t-values are between brackets. TEA is total entrepreneurial activity rate (*Global Entrepreneurship Monitor*), GCI is growth competitiveness index 2001 (*Growth Competitiveness Report*), YCAP is per capita income of 2001. Lagged growth is average annual growth of GDP over the period 1994-1998.
*** Significant at 0.01 level. ** Significant at 0.05 level. * Significant at 0.10 level.

All model specifications in Table 1 use initial income and lagged growth as control variables. We present results for models including the growth competitiveness index only, models including the GCI and a linear TEA term, and models including GCI, TEA and an interaction term (TEA times per capita income). For both samples the addition of only a linear TEA term decreases the adjusted R^2, while the addition of a linear term in combination with an interaction term increases the adjusted R^2 considerably, compared to specifications using GCI only. When included both, the linear TEA rate and the interaction term are significant in both samples. This suggests that the relation between entrepreneurship and economic growth is non-linear indeed. The impact increases with per capita income. For the 36 countries sample, the impact of total entrepreneurial activity on average growth can be written as $-.428 + .021 YCAP$. This expression has value zero for a per capita income level of about 20,000 US$. So, only beyond this level, increasing levels of entrepreneurship start to contribute to economic growth. For comparison, 20 out of the 36 countries in our data set have a 2001 per capita income level that is higher than 20,000 US$.[13]

Regarding the Growth Competitiveness Index, we find a positive coefficient in all model specifications. The impact on growth is almost significant at 10% level in four out of the six model specifications. The two models including both a linear and an interaction term provide a mixed picture. In the 28 countries sample (model III) the statistical association is somewhat weaker while for the 36 countries sample (model VI) the effect is significant at 10% level (p-value .057). Hence,

[13] Spain is closest to the turning point with a per capita income of 20,150 US$.

factors influencing the overall GCI such as average education levels, ICT levels, the absence of corruption, macroeconomic stability, etc. seem to contribute positively to economic growth.

The effect of entrepreneurial activity is significant even after correcting for the GCI. This suggests that the two effects are complementary. The additional positive impact of entrepreneurship may be caused by various factors. It may indicate that entrepreneurial activity is important in the process of the *commercialization* of new (technological) knowledge. It may also indicate that entrepreneurial activity is important for a healthy development of the business population. Eliasson (1995) shows that the absence of new entrants is expected to have a negative impact on the economic performance of the Swedish economy after about two decades. New firms are important in the introduction of various (non-technological) innovations and they may also serve as a vehicle of increased work effort since the reward for entrepreneurs is likely to be more effort-dependent than for employees. Entrepreneurs may also be more likely than incumbent firms to enter (or even create) new industries. The history of the software- and biotech-industries shows the importance of new firms in the early phases of the industry evolution.

As regards the control variables, we find a highly significant negative impact of per capita income, indicating that many of the poorer countries experience a process of "catch-up growth". We do not find a significant effect of the lagged dependent variable.

Because our most recent entrepreneurship data are from 2002, and we want to measure the impact on medium term growth, we cannot avoid that the periods for which we measure economic growth and entrepreneurship partly overlap. This makes it difficult to assess the correct direction of causality. Therefore we have estimated various model specifications in which the lengths of the growth periods vary from two to five years. We also varied the most recent year for which we measure growth (2002 or 2003). This is because 2003 is a growth projection instead of a realization. Results of these exercises are presented in Appendix 2. We see that the longer the growth period, the less strong the business cycle effect (effect of lagged growth) is. For five-year periods the business cycle effect is almost absent and this may indicate that the length of the average business cycle is about five years. Obviously, for shorter periods the effect of the lagged dependent variable is stronger, leaving less room for the other variables to contribute to explained variation in growth rates. However, the general pattern is the same in all four tables in Appendix 2. There is a positive effect on growth of GCI and an effect of TEA that increases with per capita income. Therefore we feel that our results are quite robust and that the direction of causality is indeed as we claimed it is.

5. DISCUSSION

Entrepreneurship fails to be a well documented factor in the empirical growth literature because of difficulties defining and measuring entrepreneurship. The investigation of the impact of entrepreneurial activity on economic growth has been one of the main justifications of the *Global Entrepreneurship Monitor* project. In the present paper we have critically analyzed whether the acclaimed impact of the Total Entrepreneurial Activity (TEA) rate on economic growth stands the test of adding competing variables. There is an impact but not a simple linear one of the TEA rate on GDP-growth. We find a significant non-linear effect: the TEA rate has a negative effect for the relatively poor countries, while it has a positive effect for the relatively rich countries. The results show that entrepreneurship matters. However, the effect of entrepreneurial activity on growth is not straightforward and can be understood using the distinction between the Schumpeter Mark I versus Mark II regimes or the 'entrepreneurial' versus 'managed' economy.

In Schumpeter (1934) the role of the entrepreneur as prime cause of economic development is emphasized. Schumpeter describes how the innovating entrepreneur challenges incumbent firms by introducing new inventions that make current technologies and products obsolete. This process of creative destruction is the main characteristic of what has been called the Schumpeter Mark I regime. In Schumpeter (1950) the focus is on innovative activities by large and established firms. Schumpeter describes how large firms outperform their smaller counterparts in the innovation and appropriation process through a strong positive feedback loop from innovation to increased R&D activities. This process of creative accumulation is the main characteristic of what has been called the Schumpeter Mark II regime. The extent to which either of the two Schumpeterian technological regimes prevails in a certain period and industry varies. It may depend upon the nature of knowledge required to innovate, the opportunities of appropriability, the degree of scale (dis)economies, the institutional environment, the importance of absorptive capacity, demand variety, etc. Industries in a Schumpeter Mark II regime are likely to develop a more concentrated market structure in contrast to industries in a Schumpeter Mark I regime where small firms will proliferate.

Most of the 20th century can be described as a period of accumulation. From the Second Industrial Revolution till at least the conglomerate merger wave of the late 1960s the large firm share was on the rise in most industries and the economy as a whole. It was the period of "scale and scope" (Chandler 1990). It was the era of the hierarchical industrial firm growing progressively larger through exploiting economies of scale and scope in areas like production, distribution, marketing and R&D. The period has the characteristics of the Schumpeter Mark II regime. However, by the end of the 20th century things seemed to have changed (Carree et al., 2002). The results of the present study show that the regime switch may have taken place at a level of prosperity of about 20,000 US$ of 2001.[14]

A striking result of our study is the negative impact of entrepreneurship on GDP-growth for developing countries.[15] The result that poorer countries fail to benefit from entrepreneurial activity does not imply that entrepreneurship should be discouraged in these countries. Instead, it may be an indication that there are not enough larger companies present in these countries. Large firms play an important role in the transformation process from a developing economy to a developed economy. Through exploitation of economies of scale and scope they are able to produce medium-tech products. Many local workers may be employed by the large firms and by training on the job these local workers may become more productive compared to when they would run a small store and struggle to survive as an "entrepreneur". Furthermore, in the proximity of large firms, smaller firms may also flourish, as they may act as suppliers for large firms (outsourcing) and may learn a lot of the large companies.

A second possible explanation for the negative effect in poorer countries is that the entrepreneurs have lower human capital levels compared to entrepreneurs in developed countries, as we hypothesized earlier. It is likely that the negative effect reflects the presence of many "marginal" entrepreneurs (shopkeepers) in small crafts who may be more productive as wage-earner in a bigger

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[14] This does not necessarily imply that countries which are currently below this level are in the Schumpeter Mark II regime.

[15] Further analysis reveals that the effect is *significantly* negative for the poorest 12 countries in our data set. We compute a multiplicative dummy variable of TEA in 2002 times a dummy indicating whether or not a country belongs to the N poorest countries. We also compute the complement dummy (TEA for the 36-N countries with the highest per capita income values). Using model specification VI in Table 1, but including the two TEA dummy variables instead of the linear TEA term combined with the interaction term, we vary the value of N. It turns out that the effect of TEA is *significantly* negative for values of N of 12 or lower (at 0.001 level). For values of N of 13 or higher, however, the coefficient of TEA for the N poorest countries is not *significantly* negative any more (although still negative). The 12 poorest countries in our data set (excluding Croatia) are India, China, Thailand, Brazil, Russia, Mexico, Poland, Chile, South Africa, Argentina, Hungary and Taiwan.

firm (Carree et al., 2002). To the contrary, in developed countries TEA may reflect more innovative entrepreneurs in new sectors (for instance software companies).

Of course, the human capital levels of the entrepreneurs cannot be identified from the TEA variable, which hampers interpretation. But for poorer countries, even if there are not many large firms and also not many people with high human capital levels, it may still be wise to encourage entrepreneurship if the alternative is unemployment. But perhaps entrepreneurship is not as productive then as in the presence of large firms. Small and large firms often complement each other (Rothwell, 1983; Nooteboom, 1994; Freeman and Perez, 1988).

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APPENDIX 1: PARTICIPATING COUNTRIES IN GEM

In this appendix we give a listing of the countries that participate in the Global Entrepreneurship Monitor 2002. These are 37 countries. We also indicate which of these countries were also participating in GEM 2001. These are 28 countries. In our regression analysis we use samples including these 28 countries (average total entrepreneurial activity rate 2001/2002) and samples including 36 countries (only 2002). The latter sample excludes Croatia because the Growth Competitiveness Index is not available for this country.

Table A1: Countries participating in GEM 2002

1. United States (US)*	2. Russia (RU)*	3. South Africa (ZA)*
4. The Netherlands (NL)*	5. Belgium (BE)*	6. France (FR)*
7. Spain (ES)*	8. Hungary (HU)*	9. Italy (IT)*
10. Switzerland (SW)	11. United Kingdom (UK)*	12. Denmark (DK)*
13. Sweden (SE)*	14. Norway (NO)*	15. Poland (PL)*
16. Germany (DE)*	17. Mexico (MX)*	18. Argentina (AR)*
19. Brazil (BR)*	20. Chile (CL)	21. Australia (AU)*
22. New Zealand (NZ)*	23. Singapore (SG)*	24. Thailand (TH)
25. Japan (JP)*	26. Korea (KR)*	27. China (CH)
28. India (IN)*	29. Canada (CA)*	30. Ireland (IE)*
31. Iceland (IS)	32. Finland (FI)*	33. Croatia (HR)
34. Slovenia (SL)	35. Hong Kong (HK)	36. Taiwan (TW)
37. Israel (IL)*		

An * indicates that a country also participates in 2001.

APPENDIX 2: ESTIMATION RESULTS

In this appendix we present estimation results for a variety of model specifications. Table A2 until A5 contain results for average growth measured over two-, three-, four- and five-year periods, respectively. Within each table, there are two blocks of four specifications: one with 2003 as most recent year and one with 2002 as most recent year. This is done because growth over 2003 is a growth *projection* by IMF and not a growth *realization*. Furthermore, each two pairs of columns differ in that total entrepreneurial activity is averaged over 2001 and 2002 (28 observations) or is measured over 2002 only (36 observations). Finally, within each pair of columns, results are given for models including total entrepreneurial activity only (linear term), and for models including both a linear TEA term and an interaction term with per capita income (TEA times YCAP).

Table A2: Estimation results two-year growth

	Dependent variable average annual growth GDP over (two-year) period:							
	02-03	02-03	02-03	02-03	01-02	01-02	01-02	01-02
Constant	-.020 (1.2)	.054 (1.9)	-.014 (.8)	.012 (.4)	-.033 (1.0)	.063 (1.0)	-.018 (.6)	.025 (.5)
log ($YCAP_{2001}$)	-.016 (2.2)	-.037 (3.9)	-.026 (4.2)	-.036 (3.5)	-.016 (1.1)	-.043 (2.1)	-.021 (1.9)	-.039 (2.1)
GCI_{2001}	.011 (1.9)	.009 (1.8)	.017 (3.2)	.018 (3.4)	.014 (1.1)	.011 (.9)	.014 (1.4)	.016 (1.6)
$TEA_{2001/2002}$	.046 (.8)	-.257 (2.3)			-.026 (.2)	-.42 (1.7)		
$TEA_{2001/2002}$*$YCAP_{2001}$		.016 (3.0)				.022 (1.8)		
TEA_{2002}			-.001 (.0)	-.114 (1.1)			-.020 (.2)	-.219 (1.1)
TEA_{2002}*$YCAP_{2001}$				.006 (1.2)				.011 (1.2)
Lagged growth	.66 (7.1)	.57 (6.7)	.62 (6.9)	.58 (6.0)	.64 (4.4)	.57 (4.0)	.59 (4.5)	.54 (3.9)
Adj. R^2	.72	.79	.75	.75	.44	.49	.46	.47
Observations	28	28	36	36	28	28	36	36

Note: Absolute t-values are between brackets. TEA is total entrepreneurial activity rate (GEM), GCI is growth competitiveness index (GCR). Lagged growth for regressions explaining average growth 2002-03 and 2001-02 refers to average growth over periods 2000-01 and 1999-2000, respectively.

Table A3: Estimation results three-year growth

	Dependent variable average annual growth GDP over (three-year) period:							
	01-03	01-03	01-03	01-03	00-02	00-02	00-02	00-02
Constant	.013 (.5)	.115 (2.5)	.020 (.8)	.065 (1.6)	.003 (.1)	.104 (1.4)	.012 (.3)	.082 (1.5)
log ($YCAP_{2001}$)	-.011 (.9)	-.042 (2.6)	-.021 (2.2)	-.042 (2.4)	-.018 (1.1)	-.048 (2.0)	-.027 (2.1)	-.058 (2.6)
GCI_{2001}	.003 (.3)	.002 (.2)	.009 (1.0)	.012 (1.4)	.014 (.9)	.011 (.7)	.018 (1.5)	.022 (1.9)
$TEA_{2001/2002}$	.007 (.1)	-.43 (2.3)			-.045 (.3)	-.47 (1.6)		
$TEA_{2001/2002}$*$YCAP_{2001}$		.024 (2.6)				.023 (1.7)		
TEA_{2002}			.009 (.1)	-.215 (1.2)			-.070 (.7)	-.409 (1.9)
TEA_{2002}*$YCAP_{2001}$				.012 (1.4)				.019 (1.7)
Lagged growth	.48 (2.8)	.37 (2.3)	.39 (2.8)	.28 (1.7)	.34 (1.4)	.27 (1.1)	.23 (1.4)	.094 (.5)
Adj. R^2	.26	.41	.39	.41	.03	.10	.13	.18
Observations	28	28	36	36	28	28	36	36

Note: Absolute t-values are between brackets. TEA is total entrepreneurial activity rate (GEM), GCI is growth competitiveness index (GCR). Lagged growth for regressions explaining average growth 2001-03 and 2000-02 refers to average growth over periods 1998-2000 and 1997-99, respectively.

Table A4: Estimation results four-year growth

	Dependent variable average annual growth GDP over (four-year) period:							
	00-03	00-03	00-03	00-03	99-02	99-02	99-02	99-02
Constant	.019 (.6)	.124 (2.3)	.030 (1.1)	.095 (2.4)	-.015 (.3)	.10 (1.3)	.007 (.2)	.092 (1.8)
log ($YCAP_{2001}$)	-.018 (1.3)	-.048 (2.6)	-.024 (2.4)	-.054 (3.2)	-.025 (1.3)	-.058 (2.2)	-.027 (1.9)	-.065 (3.0)
GCI_{2001}	.010 (.8)	.007 (.6)	.013 (1.3)	.017 (1.9)	.022 (1.3)	.018 (1.1)	.021 (1.5)	.025 (2.0)
$TEA_{2001/2002}$	-.018 (.2)	-.456 (2.2)			.003 (.0)	-.490 (1.6)		
$TEA_{2001/2002}$*$YCAP_{2001}$		.024 (2.3)				.027 (1.8)		
TEA_{2002}			-.054 (.7)	-.368 (2.3)			-.083 (.8)	-.488 (2.4)
TEA_{2002}*$YCAP_{2001}$				.018 (2.2)				.023 (2.2)
Lagged growth	.16 (.8)	.11 (.6)	.18 (1.2)	.054 (.4)	.058 (.2)	.029 (.1)	.12 (.6)	.039 (.2)
Adj. R^2	.01	.17	.22	.30	.00	.06	.07	.18
Observations	28	28	36	36	28	28	36	36

Note: Absolute t-values are between brackets. TEA is total entrepreneurial activity rate (GEM), GCI is growth competitiveness index (GCR). Lagged growth for regressions explaining average growth 2000-03 and 1999-2002 refers to average growth over periods 1996-1999 and 1995-98, respectively.

Table A5: Estimation results five-year growth

	Dependent variable average annual growth GDP over (five-year) period:							
	99-03	99-03	99-03	99-03	98-02	98-02	98-02	98-02
Constant	-.008 (.2)	.107 (1.7)	.018 (.6)	.098 (2.3)	-.03 (.9)	.071 (1.1)	.002 (.05)	.11 (2.6)
log ($YCAP_{2001}$)	-.026 (1.7)	-.056 (2.8)	-.028 (2.3)	-.060 (3.6)	-.028 (1.9)	-.054 (2.8)	-.026 (2.1)	-.065 (4.3)
GCI_{2001}	.022 (1.5)	.016 (1.2)	.018 (1.6)	.021 (2.0)	.028 (2.1)	.022 (1.7)	.021 (1.8)	.021 (2.1)
$TEA_{2001/2002}$	.036 (.3)	-.435 (1.8)			.017 (.1)	-.402 (1.7)		
$TEA_{2001/2002}$*$YCAP_{2001}$		.025 (2.2)				.022 (1.9)		
TEA_{2002}			-.058 (.7)	-.428 (2.6)			-.11 (1.3)	-.597 (3.8)
TEA_{2002}*$YCAP_{2001}$				.021 (2.6)				.027 (3.5)
Lagged growth	-.12 (.6)	-.08 (.4)	.03 (.2)	.01 (.0)	-.051 (.3)	-.007 (.0)	.09 (.6)	.14 (1.1)
Adj. R^2	.000	.14	.12	.26	.06	.16	.12	.35
Observations	28	28	36	36	28	28	36	36

Note: Absolute t-values are between brackets. TEA is total entrepreneurial activity rate (GEM), GCI is growth competitiveness index (GCR). Lagged growth for regressions explaining average growth 1999-03 and 1998-2002 refers to average growth over periods 1994-1998 and 1993-97, respectively.