Entrepreneurship and Risk Premium

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ABSTRACT. This article deals with the measurement and determination of entrepreneurship. It utilises the issue of the absence of the entrepreneur from neoclassical theory and uses the theory of portfolio management to establish a model connecting risk premium with the entrepreneurship premium. It shows that the non-systematic risk may be a satisfactory proxy of the level of entrepreneurial activity. The development of successful entrepreneurial activity proxy contributes towards the development of a theorisation of entrepreneurship and an assessment of its contribution to growth.

1. Introduction

The renewal of interest in entrepreneurship as a factor of development of the new economy (knowledge-based economy, new technology, small businesses etc.) in the decade 1980–1990 brought to the surface a number of problems that surround the utilisation of its substance. The most significant of these concerns the understanding of its importance in the growth process.

The distinction between the two meanings (entrepreneur vs entrepreneurship) is important from the perspective of a theoretical foundation setting and for the purposes of empirical utilization. The entrepreneur, having a distinguished role in the economy, requires a fitting theoretical foundation to be accepted and it is common knowledge that in neoclassical theory this theoretical foundation of its characteristics is not accepted. Entrepreneurship, though, as a situation that describes the general structural functioning of the economy and of society, does not encounter the same difficulties of incorporation in the theoretical and empirical model construction.

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The scope of the paper is to develop a theoretical model of understanding of entrepreneurship in such a way as to be able to incorporate it in an operational form within a growth theory. In the second and third section, the relation between entrepreneurship theory and entrepreneurship indicators is discussed. We propose that the non-systematic risk is a satisfactory indicator of the entrepreneurship level. However, what is in question is whether it is verified that the non-systematic risk (NSR) expresses in a satisfactory manner the level of entrepreneurship in an economy. This confirmation will be sought through the successive stages of the development of this paper. To begin with, a discussion connecting the measure (entrepreneurship indicator) and the entrepreneurial activity will take place. Following this, an attempt shall be made to prove that the potentiality of NSR, compared mainly to the self-employment rate variable, will be considered within the framework of an entrepreneurship model. Finally, in the next section, the proposed measure of entrepreneurial activity is connected to the outcome (that is, economic growth) within the framework of the standard growth model. In the end, conclusions will be drawn.

2. Entrepreneurship theory and entrepreneurship indicators

Different approaches to the entrepreneur and/or entrepreneurship have already been expounded by other researchers, such as Herbert and Link (1982, 1989), Binks and Vale (1990), Ripsas (1998) and Wennekers and Thurik (1999) and Venkataraman (1997, 2000).

According to that last scholar, entrepreneurship is about the presence and the variation of quality of entrepreneurial opportunities (of product and factor markets) and the presence of enterprising

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individuals (agents). Measuring entrepreneurship could refer to the presence of entrepreneurs (agents) in an economy and/or to developing measurement indices of entrepreneurship (activity).

The first approach includes attempts that have suggested that the self-employment rate is the proper entrepreneurship index. The self-employment rate as an entrepreneurship indicator has already been posited from the start of the 1990s (Foti and Vivarelli, 1994). The issue of the measurement of entrepreneurship was dealt with by Wennekers and Thurik (1999). As a proxy for entrepreneurial activity, the number of entrepreneurs is used, with the hope that the "real" number of entrepreneurs would approach the level of entrepreneurial activity more closely.

What we may observe from the above-mentioned attempt is that: (a) on numerous occasions different types (Schumpeterian, Austrian type etc.) of entrepreneur coexist within the same person or are manifested in a person who does not exhibit in a typical manner any of the above characteristics in a way that can be quantified, and (b) even if we are able to quantify them with precise measurements it is not at all certain that we solve the theoretical issue of the relationship between entrepreneurship and growth.

Along the lines of this approach one could enlist works that interpret entrepreneurship on the assumption that it is sufficiently expressed by quantifiable indices, as is the growth in sales, etc. (Evans, 1987 and more recently Basu and Gorwami, 1999) or the employment of the SMEs (Fitzroy, 1990).

The second approach attempts to develop measurement indices of entrepreneurship activity, that is, entrepreneurship indicators. This approach could include theoretical beliefs surrounding entrepreneurship that link economics with other neighbouring sciences such as sociology, psychology and politics. If one attempted to locate the indices that are connected with this approach, one could discover a number of mainly indirect indices that express forces of reinforcement or retraction of entrepreneurship. These indices may express the social or psychological characteristics of a society (the entrepreneurial spirit) or even genetic characteristics (creed, origin, familial tradition etc., Petrakis, 1997).

The Neoclassical theory, as it developed, did not include a role for the entrepreneur (Baumol, 1968, 1993; Barreto, 1989) on a micro level, at least as established in the firm theory, in which everyone has perfect information and there is equilibrium. Only if one introduces imperfect information and perfect predictability, as Leibenstein (1968, 1979) has done for dealing with x-efficiency, and Coase (1937) through institutionalism does the role of the entrepreneur become relevant. The revelation of the entrepreneur could come both from the equilibrium approach and the entrepreneur's different beliefs (Khilstrom and Laffont, 1979). It is certain that an agent who prefers uncertainty could only live in an entrepreneurial world.

The phenomenon of disappearance is observed in the traditional growth theory (Solow, 1957). Since there is perfect competition, there are no profit opportunities for entrepreneurs. In the endogenous growth theory, as expounded by Romer (1990) and Lucas (1988), the variable that expresses human capital, which was imported, sparked a discussion on the existence of one or more factors that contribute to the enlargement of the economy, which made it possible to interpret the residual term of growth.

3. Entrepreneurship and risk

The way, the time and the pattern of revelation of the existence of entrepreneurial opportunities are the starting point for understanding (and thus measuring) entrepreneurship. The second stage of the understanding procedure is to clarify why, when and how entrepreneurial agents discover and evaluate opportunities. The final stage is when and how different models of their exploitation are employed (Venkataraman, 1997). Thus we should develop instruments for measuring entrepreneurship, which could express the evolution of entrepreneurial opportunities irrespectively if they originate from market inefficiencies, from changes in the patents of productions costs and benefits or they constitute new information. Opportunities rise in the uncertain environment. Living in an uncertain environment means taking position against risk.

The portfolio theory, as shaped by Markowitz (1952), Tobin (1958) and Sharpe (1964), recognised the positive relationship between expected

return and risk. This recognition was founded on the hypothesis of risk-averse behaviour in the economic agent and in the hypothesis of completeness, continuity and transitivity (Eichberger and Harper, 1997) of the function of its utility. Thus, once again there is no place for the entrepreneur since in reality everyone exhibits entrepreneurial behaviour. In essence, the entrepreneur has been ostracised, but not entrepreneurship, at least not in its specific form; in other words the situation that links in a positive manner expected return and risk. To put it differently, the entrepreneur is not needed for the theoretical model to function. On the contrary, what is necessary is an environment of entrepreneurship. In the moulding of this environment, risk plays a determinative role.

When an individual creates a portfolio, optimalisation is based on the risk and return relationship: risk in that the portfolio is the result of either systematic risk or, in the case of imperfect unsystematic risk, diversification due to project indivisibility or project interrelationships (Acemoglu and Zilibotti, 1997) or a combination of both. Given these prerequisites, the risk premium that the economic agent enjoys is the entrepreneurship premium that we come across in entrepreneurship theories.

If one could accept that the entrepreneur in any of his or her roles (Herbert and Link, 1989; Dijk and Thurik, 1995; Wennekers and Thurik, 1999) is always risk-averse then the risk premium of Markowitz, Tobin and Sharpe is the other side of the coin for the entrepreneurship premium. The entrepreneurship premium is the necessary motive for the role of the entrepreneur to be set in motion, or in other words, it is the reason why the economic agent who acts in the entrepreneurial arena assumes risk. An economy without risk is one without entrepreneurship. Therefore, the level of risk that the economic agent assumes for a given level is indicative of the level of entrepreneurship within which he or she chooses to act. Consequently, if we could measure the specific levels of a kind of risk in the economy, we could have a proxy of the level of entrepreneurship in the economy.

In traditional financial theory the risk may be systematic or non-systematic or it could take another form such as financial risk, liquidity risk etc. The non-systematic is characteristic, for every investment opportunity and through the organisation of the portfolio; the risk can be reduced and, in some circumstances, be completely alleviated. Systematic risk, on the other hand, is characteristic of the total market. The well-known tools of financial theory (CAPM Coefficient β, Sharpe, 1964; Lintner, 1965; Black, 1987) measure systematic risk. However, the indices of non-systematic risk have been studied far less.

We support the postulate that non-systematic risk is a satisfactory indicator of entrepreneurship. This is illustrated by the fact that it shows its mark explicitly on the creative process of destruction. An economy with a high indicator of non-systematic risk is one that is "full" of entrepreneurial attempts of the "omega type" (Binks and Vale, 1990), which presuppose the "reuse" of resources in new uses. Apparently, however, a similar economy would contain equilibriating, creative entrepreneurial events, since the continued fluctuations in return for entrepreneurial efforts creates instability on the side of supply and demand and requires a continual entrepreneurial presence that would cover these gaps.

4. Non-systematic risk, growth and entrepreneurial activity

After Markowitz (1952) it has been widely accepted that one measure of risk is its standard deviation. Thus one acceptable form (Ramey and Ramey, 1995, Acemoglu and Zilibotti, 1997) of measurement of the total risk that exists in an economy is the moving standard deviation of the GDP of that country. On the other hand, the standard deviation of the real returns of investments, either at an isolated level or on a market wide scale, could be an indicator of investment risk that is the non-systematic risk (NSR). To put it differently, the non-systematic risk measures investment risk directly and entrepreneurial activity indirectly since it reflects all possible changes in the entrepreneurial environment. It is true that among other factors, real rates of returns could reflect changes from the contractual setting of wages and someone could agree that this has nothing to do with entrepreneurship. But this is exactly the case. The entrepreneurship environment is repressed and the rate of return reflects the

negative entrepreneurial reflections of the wage setting. Generally speaking, those changes are the result of factors that comprise enterpreneurship: social preferences, innovations, monopolist profits, cyclical influences, new combinations of resources and reallocation of resources, arbitrage opportunities, etc. Therefore, it expresses the entrepreneurial opportunities, which exist in an economy.

In OECD (1997a) the rates of return on capital in the business sector are published for the years 1970–1997 (with forecasts for 1998 and 1999). The standard deviation is calculated as a six-year "moving" average of the rate of return, since we want to lose as few years as possible. The weighting pooling correlation between NSR και Growth Rate for 10 countries (Spain, Japan, U.S.A., France, Germany, Ireland, Sweden, Italy, Finland, U.K., which account for 78% of the total OECD weighting) is 0.38, which is considered to be statistically significant (Koutsoyannis, 1997, p. 431). Note that the data from the above countries will be used afterwards in all the empirical tasks of this article. Due to the large amount of empirical data that was necessary for each country, the number of different countries had to be reduced although they represent almost the 80% of the economic activities of the OECD countries.

As a next step to reinforce the argument that the non-systematic risk is a satisfactory measure for entrepreneurship we could examine its correlation with other direct measures of entrepreneurial activity such as venture capital activity, firm formation rates etc. Without doubt, an extensive discussion concerning the selection of entrepreneurial variables could be carried out. However, in the scope of this article the criteria for selection are related to the availability of the empirical data. We have purposely collected data from various sources presented in Table I.

Examining the relation between the Non-Systematic Risk and the entrepreneurial variables, through the Pool data of Table I, a high positive correlation results between the non-systematic risk and the entrepreneurial variables of Table I. These findings reinforce the view that we have already presented by which the non-systematic risk expresses the essence of entrepreneurship in a satisfactory way. This can be concluded through the almost positive singular correlations it has with the direct indices of entrepreneurship.

5. The non-systematic risk as an endogenous variable in the entrepreneurship model

In this section of the paper, the ability of non-systematic risk to act as a proxy of the entrepreneurship level of the economy within an entrepreneurship model shall be tested. We consider non-systematic risk as an endogenous variable and we shall explore to what extent its variation exogenous variables determine entrepreneurship. Should the empirical study prove satisfactory, we shall not, of course, be able to prove that the proxy used does not express anything else but the level of entrepreneurship. We shall, however, be able to demonstrate that it more than adequately represents entrepreneurship opportunities.

The development of a satisfactory model of entrepreneurship must be supported by the introduction of those variables, which describe the basic characteristics of the entrepreneurial environment.

In general, a series of factors have been proposed that shape the level of entrepreneurship in an economy, namely the level of development, technological change, changes in industrial structure, demographic changes, and unemployment, the role of government, cultural and psychological factors. Below, the dominant conceptions are presented in regard to the quality and direction of the relationship of the relevant factors and of entrepreneurship. It will be seen that the analysis also depends on the method of measurement of the levels of entrepreneurship.

The case of the relationship of the level of development (prosperity) and the self-employment rate is characteristic. Because of the influence of prosperity on the alternative situation of self-employment (on the level of wages in other words) this relationship is based on a negative sign. When, however, entrepreneurship is considered as a fostering factor of growth then the relationship of prosperity and entrepreneurship must have a positive sign. In reality this is true if growth is the dependent variable and entrepreneurship is the independent variable. This raises the question: what is the effect of the level of growth on the entrepreneurial profit rate versus the wage rate? If prosperity has as a result a faster rise in the entrepreneurial profit rate in comparison to the wage rates, then the relationship will be positive.

TABLE I
Indicators of entrepreneurial activity and their correlation to non-systematic risk: Pool data

	New enterprises formation rate (new enterprises as a % of the total number of enterprises 1988–1994)	Number of venture capital deals	Venture capital investment as percentage of GDP	Seed and start-up investment as per cent of total investment	Per capital entrepreneurial investments for research and development	Per capital entrepreneurship investments	Added value from enterprise in advance technology (% of total industry added value (1997))	Patents applications per 10000 habitants (1996)
United States	0.421162841	817.295332	0.070737945	0.189360037	248.126945	1161.190572	0.089238638	2.176552149
Germany	0.01497874	90.64057926	0.003840703	0.021507934	36.23062702	253.1022955	0.012162225	0.665721769
France	0.009747342	87.81389616	0.005268834	0.011415807	20.46063781	147.4395317	0.010537668	0.193190572
Italy	0.004896626	14.68987829	0.003376984	0.010130951	7.935911262	44.82945617	0.0051499	0.101309505
United Kingdom	0.01053397	80.92004314	0.007182252	0.003910337	14.68371591	125.8490217	0.011571407	0.247388692
Finland	0.000411031	0.715760283	0.000212602	0.001835464	2.14728085	9.489138808	0.000701587	0.030472963
Ireland	0.000558774	0.296102295	0.000334309	0.000405947	0.639963026	6.227699892	0.002220767	0.010506856
Spain	0.005075335	6.650439069	0.001750116	0.002843938	2.362655985	63.22292405	0.003106455	0.026251733
Sweden	0.000716068	2.02033585	0.001534432	0.0002941	4.999691881	17.65875828	0.001380989	0.060098598
Correlation coefficient with non-systematic risk	*0.987905*	*0.994614*	*0.991773*	*0.994642*	*0.994152*	*0.994906*	*0.996700*	*0.980067*
Notes					In Euro 1997 prices equivalent purchasing parity	Total investment excluding housing and public investments	Advanced technology includes, pharmaceutical products, office equipment, informatics, telecommunications, aerospace technologies	
Sources	The European Observatory for SME's (1996)	EVCA (1997). Venture One (1997) Fostering Entrepreneurship, OECD 1998b			OECD, EAS (MSTI Database) 1998c Benchmarking UNIC, 1999	OECD National Accounts	OECD, DSTI (STAN Industrial Database) (1998a)	OECD, Main Science and Technology Indicators (1998d) IFO Patent Statistics

General Note: Pool Data, constructed on the OECD weights, OECD 1999, p 192 (USA: 35.32 and for our sample 0.45, Japan: 13.66 and for our sample 0.17, Germany: 8.31 and for our sample 0.10, France: 5.70 and for our sample 0.07, Italy: 5.48 and for our sample 0.07, U.K.: 5.18 and for our sample 0.06, Spain: 2.84 and for our sample 0.036, Sweden: 0.83 and for our sample 0.010, Finland: 0.46 and for our sample 0.005, Ireland: 0.31 and for our sample 0.003. Total OECD weighting of our sample: 78.09.

Prosperity will then have a positive relationship if we accept that the positively structured changing of the economy (both on the production and consumption side) because of the new fields and products (new technology) creates monopolistic profit rates and higher rates of profit.

On the basis of the above findings we reach the conclusion that we expect that per-capita income exert positive effects on the level of entrepreneurship when the NSR proxy measures this.

In general, it is considered that changes in technology can exert both positive and negative pressures on entrepreneurship with ambiguous results. Following a Schumpeterian model (Schumpeter, 1947), since invention and technological change provide the opportunities for new combinations of factors of production, the rate of technological change enhances new venture formation by creating new opportunities (Dean et al., 1993). At any rate, it seems that there is significant empirical evidence to support this perspective (Black, 1987). When, however, entrepreneurship is measured by non-systematic risk, we must await a positive relationship of that variable and the technology variable because of the uncertainty that usually accompanies the introduction of new technology. However, when it is measured by the self-employment rate then it is not clear what kind of sign we should expect.

A change in industrial organisation (chiefly in the direction of an increase in the share of services) is expected to have inflationary effects on entrepreneurship, whether measured by NSR or by the self-employment rate. This occurs because the transposition of the production prototype towards new products and new technologies has fewer requirements in capital per final product (services) to enable the larger entrance of self-employed and higher uncertainty (due to new technologies).

Five categories of factors are usually attached to the demographic effects on entrepreneurship: the size of population (positive effect), immigration (special categories of population with special characteristics), urbanisation (different conditions of purchasing habits – positive relationship), familial tradition and finally the education level of the population. As concerns the last of these variables, its effect could be uncertain in direction. If, though, entrepreneurship is expressed by the self-employment rate, one could argue that the educational level reinforces the sense of independence and self-confidence and thus is an enabling factor for self-employment. At the same time, it improves the returns and consequently makes the alternative condition of the wage rate more expensive. Thus, the final result is ambiguous. If the level of risk, a positive relationship expresses entrepreneurship would be expected. This is due to the opportunity that education offers to adopt new technologies, which consequently leads to a greater degree of uncertainty.

Unemployment is a significant contributing factor to the evolution of the level of entrepreneurship. Thus, when it increases, it leads to upward pressures on entrepreneurship. At the same time, the opportunity cost for one to become an entrepreneur decreases (Meager, 1992 – push or pull?). Given that the increase of unemployment is usually observed during a period of recession and given that a recession does not favour the increase in entrepreneurship, unemployment may be correlated negatively with entrepreneurship. Generally, when entrepreneurship is measured with the self-employment rate, we could say that the direction of this relationship is uncertain. When entrepreneurship is measured with non-systematic risk it can be related to unemployment positively (Parker, 1997). Greater unemployment means reduced wage rates and consequently it follows that there are larger returns in capital, hence larger fluctuations, and this implies risk. If unemployment is the result of a recession, once again returns are expected to have larger fluctuations (in a negative direction). In both circumstances, the level of unemployment seems to be related positively to entrepreneurship.

What we should pay attention to is that changes in the unemployment rate are indicative of periods of reformation of production and consequently, periods of uncertainty. The redistribution of resources for the development of new activity (omega event), even if it means a recession in production, also means accelerating entrepreneurial activity. For this reason we may see a positive correlation of unemployment change and entrepreneurship as it is measured by the NSR indicator. At the same time, of course, the acceleration of unemployment can discourage the expression of entrepreneurship when it is measured in the form of self-employment. Thus it is not a rare

phenomenon to observe a negative relationship between the rate of change of unemployment and the level of entrepreneurship, as is measured by the unemployment rate.

The role of government policy is multifaceted as it concerns entrepreneurship and has an uncertain final direction. It has been found (Petrakis, 1997) that tax policies, motivation policies etc. can have a composite influence on the level of entrepreneurship. An interesting and quantifiable side of the question is the size of the public sector in the economy. A large public sector has crowding out effects on the private sector and consequently on entrepreneurship as well (OECD, 1998, p. 20). At the same time, though, the public sector could develop important programmes of public procurements so as to exert positive effects on the growth of entrepreneurship (Hartley and Hutton, 1988).

What we may obtain from the relationship of the public sector and entrepreneurship, however, is the negative relationship between the change of the share of the public sector and that of entrepreneurship, regardless of how it is measured (self-employment or non-systematic risk).

The model is estimated based on the hypothesis that the exogenous variables are not interdependent. However a potential endogeneity may exist. The model of determination of entrepreneurship takes the following form:

$$EN = EN (I, IS, L, E, U, UC, T, G, GD) \quad (1)$$

Where EN stands for entrepreneurship
(For the rest of the symbols see Table IIb).

The model is presented in Tables IIa and IIb.

It is true that we would be more convincing if we used fixed effects in one regression since there is a lot of unobserved heterogeneity in the countries. In this way the heterogeneity would be partially out. However, this would introduce unit root problems. As a way to partially take out some of the heterogeneity of the countries we choose to weight the country variables with the OECD weights used for constructing aggregate variables from individual country variables. Note that in this case the empirical founding (since we run the estimations with and without weighting) was significantly improved.

On the basis of the above econometric conclusions we discover that the model of assessment of entrepreneurship, when it is expressed by non-systematic risk and the self-employment rate, displays the following characteristics:

1. The estimated sign of the variables in relation to those theoretically expected. It is observed that the NSR displays greater concision in regard to what is expected in comparison with the estimated signs.
2. The statistical significance of the coefficients of the variables. It was observed that the first regression contains six non-significant variables (95% significance level) and the second only two.
3. The degree of interpretation of the dependent variable ($\bar{R}^2$). It is observed that the SE variable is interpreted to 99%, while the NSR is interpreted to 89%.
4. The F-statistic of the entire regression. It is observed that the two samples display high F-statistic values and nil probability, from which it follows that the common behaviour of the variables significantly affects the dependent variable statistically. In general, the results are satisfactory.

Despite the good performance of the determinative models of the level of entrepreneurship, the issue of the self-employment rate and that of entrepreneurship remain open. In other words, if the SE (self-employment rate) is not considered to be an independent variable, then it is very probable that it has to be considered one of the determinative factors of entrepreneurship. Indeed, it should be one of the important positive factors of determination of the level of entrepreneurship of an economy that satisfactorily describes the supply side conditions of entrepreneurship. Because it seems to be an important factor in shaping the level of entrepreneurship, a large number of studies consider it to be an indicator of entrepreneurship. Put differently, in order to accept that the self-employment rate is one of the independent variables we must accept that two conditions are presupposed: first, the self-employment attitude of economic agents is determined by factors that are not expressed through other determinative factors of entrepreneurship, and second, there are indications of causality in the direction of the relationships that arise from self-employment and are

TABLE IIa
Factors affecting entrepreneurship: Two alternatives SE vs. NSR

	Indicants of entrepreneurship	Self-employment rate				Non-systematic risk			
	Independent variable	Theoretical expected sign	Estimated sign	Coefficient	*t*-Statistic	Theoretical expected sign	Estimated sign	Coefficient	*t*-Statistic
1	Constant (C)		–	0.010073	–0.022276		–	0.005401	–8.456124*
2	Per capita income (I)	–	–	0.007978	–0.370965	+	+	0.164886	3.910266*
3	Industrial structure change (IS)	+	+	0.006354	1.703603	+	+	0.019518	5.659987*
4α	Labour force rate change (L)	+	–	0.093285	–2.863737*	+	–	0.172988	–1.496162
4β	Education level of working population (E)	?	–	0.107929	–5.240005*	+	+	0.026177	2.958173**
5	Unemployment rate (U)	?	+	0.036197	2.233222*	+	+	0.082696	4.965647**
6	Unemployment rate change (UC)	+	–	0.063640	–0.433531	+	+	0.550237	1.119380
7	Technological level (T)	+	+	0.006294	1.635879	+	+	0.052983	5.710784*
8	Government' share (G)		–	0.020868	–2.127481*		–	0.046206	–7.013503*
9	Government' share rate of change (DG)		–	1.740613	–1.372498		+	3.186241	2.400134*
10	SE_{t-2}		+ 1.000793		498.6391*				
	Adjusted R^2	0.998985	Prob (F-stat): 0			0.892034	Prob (F-stat): 0		

Notes:
1. The first regression has been corrected for Autocorrelation 2nd degree. It has also used White's Heteroskedasticity-Consistent covariance method of correction.
2. * F-test results at a 95% significance level.
3. E-Views, Econometric Views, Micro TSP, 1994 have been used.

receptors of the entrepreneurship indicator, and not the opposite.

The entrenchment of the first condition has a theoretical and empirical character. The theoretical character originates from the fact that self-employment is determined by a series of factors such as those described earlier but at the same time is the result of a series of characteristics of society and of the individual that have not been described until now. At the individual level, the sense of independence and the self-motivational forces of the individual are the result of cultural and historic conditions and form part of a basic factor in shaping attitudes towards self-employment.

On an economy-wide level, perhaps, the most important of the significant factors shaping the self-employment rate are consequences of the development of entrepreneurship. To put it in another way, the development of new initiatives within existing production methods creates the preconditions for the exiting of the creative individuals from the swelling of the self-employment rate. In essence, the factors described above shape the content of the residual of the regression that makes self-employment a dependent variable.

On the basis of the above techniques we moved on to the econometric verification of the hypothesis that is advanced here, so as to discover whether or not we should consider the self-

TABLE IIb
The definitions and the sources of the variables

Self-employment rate (SE)	*Definition*: Self-employment as percentage of total employment. *Source*: European Commission, *Employment in Europe*, 1997, pp. 119–135.
Per capita income (I)	*Definition*: Real GDP per capita. *Source*: OECD, 1997c, Table 3.2.
Technological level (T)	*Definition*: ANBERT, Total Business Enterprise, millions of PPP dollars. *Source*: OECD, 1997d.
Industrial structure change (IS)	*Definition*: Value added in services as a percentage of GDP. *Source:* OECD, 1997c, Table 5.4.
Labour force rate change (L)	*Definition*: Labour force (percentage change from previous period). *Source*: OECD, 1999, Table 18.
Education level of working population (E)	*Definition*: As an approach to the variable, it has been used as the participation percentage of the work force of people who are still in, or have graduated from, secondary educational level. *Source*: The data originated from the following sources: OECD, 1997b; Psacharopoulos and Arriagada, 1986; 1992; and Barro and Lee, 1993.
Unemployment (U)	*Definition*: Unemployment as a percentage of the total labour force. *Source*: OECD, 1997c, Table 2.15.
Unemployment rate change (UC)	*Definition*: The change in unemployment as a percentage of the total labour force. *Source:* Calculated from the above variable.
Governments' share (G)	*Definition*: Total outlays of government as a percentage of GDP. *Source*: OECD, 1997c, Table 6.5.
Governments' share (GD)	*Definition*: The change in the total outlays of government as a percentage of GDP. *Source*: Calculated from the above variable.

employment rate as one of the interpretative variables of the development of entrepreneurship.

For this reason we used a test of causality direction, the Granger Causality Test (Granger, 1969). For the Granger Causality Test to function at all, it must first be determined whether the two series of data are stationary although co integrated. If the series are non-stationary, in the first levels they are converted to stationary ones with the formation of their first differentiations and co integration of the Augmented Dickey Fuller (ADF) and the Phillips-Peron tests. If the first two series of data are co integrated, examining the function of integration according to Johansen, then they must constitute a relationship of causal connection at least in one direction (unidirectional causality) and possibly in two directions (bi-directional causality).

The application of the above methods ensures that we gain an exact image for the relative trustworthiness of the used examples. The relevant results are presented in Tables IIIa, b, and c.

The ADF and PP test statistics are higher than their critical values (1% s. l.), so the series (SE) and (NSR) are stationary at their first differences.

D.F tests have showed that there is no deterministic trend, a fact that is strengthened by the nature of the variables since we have no theoretical option reasons to believe that there is a deterministic trend. LR test indicates 2 cointegrating equation(s) at 5% significance level. The LR test rejects the hypothesis of no cointegration but not the hypothesis of, at most, one co integration relation. Therefore the test shows that the two variables may co integrate.

We can marginally reject the hypothesis that SE does not Granger cause NSR but we do not reject the hypothesis that NSR does not Granger cause SE. Therefore, it appears that Granger Causality runs one way from SE to NSR and not the other way.

Given that there are strong indications that self-employment should be considered as an explanatory factor of the level of entrepreneurship, it

TABLE IIIa
Verification of stationariness of (SE) series and (NSR) (in first differences)

ADF Test Statistic –4.724980 On D (SE)	1% Critical Value* –3.4885
Phillips-Perron Test Statistic On D (SE) –11.05614	1% Critical Value* –3.4885
ADF Test Statistic –6.199091 On D (NSR)	1% Critical Value* –3.4885
Phillips-Perron Test Statistic On D (NSR) –9.151271	1% Critical Value* –3.4885

* MacKinnon critical values for rejection of hypothesis of a unit root.

TABLE IIIb
Johansen cointegration test

Test assumption: No deterministic trend in the data∀
Series: NSR SE
Lags interval: 1 to 4

Eigenvalue	Likelihood ratio	5% Critical value	1% Critical value	Hypothesised no. Of CE(s)
0.199966	38.30135	12.53	16.31	None**
0.104125	12.64471	3.84	6.51	At most 1*

** Denotes rejection of the hypothesis at 5% (1%) significance level.

TABLE IIIc
Pair wise Granger causality tests

Lags: 2

Null hypothesis	F-statistic	Probability
SE does not Granger cause NSR	196700	4.7E-0.8
NSR does not Granger cause SE	1.74102	0.18001

should be introduced as an independent variable on the determination of entrepreneurship. Note that at the same time the same variable is influenced by the standard independent variables of the model of entrepreneurship.

A rather simple way of solving the above problem is to introduce as an independent variable of the model of forming entrepreneurship the residual of the regression that would have as a dependent variable the self-employment rate. Thus a model of the determination of entrepreneurship could be realised with non-systematic risk as a dependent variable.

The model is estimated based on the hypothesis that the exogenous variables are not interdependent. However, a potential endogeneity may exist. This point will give room to one of the most difficult problems to be handled within the estimation procedures. For this reason we estimate the Correlation matrix to identify possible interdependency in the variables.

The high correlation between some of the independent variables creates a certain skepticism concerning the reliability of the statistical findings due to multicolinearity. Thus the high correlation between the variables L UC T G DG leads us to exclude them in the final version of the model.

The final model is presented in Table V. The final simplified model, which is estimated in fact in two stages, contains essentially (given that two variables E, and U are proved to be non-statistically significant) three variables. The per capita income (I), the industrial structure (IS) and the residual of SE estimation (RESAR). Its interpretative ability is particularly satisfactory.

6. The entrepreneurship (non systematic risk) as an explanatory variable in the standard growth model

In this section we will examine the predictability of entrepreneurship proxy within the standard growth models as far as the growth process is concerned. If this attempt is successful we will have strong evidence that the relation of entrepreneurial activity and measures of outcome, economic growth, is well founded.

To establish this requires a concise theoretical background, namely that of growth accounting literature (Solow, 1957; Jorgensen and Grilisches, 1967; Young, 1994) which divides output growth among changes in measurable input quantities; physical and human capital – and the well-known "Solow residual" or the "total productivity" (TFP) effect. The question we pose is whether risk is a part of the "Solow residual". In other words, the matter here is whether risk has an interpretative ability as concerns the growth rate. However, as we discovered before, a concise theoretical background for the introduction of risk in the lines of the neoclassical example exists only for non-systematic risk as a proxy of entrepreneurship.

TABLE IV
Correlation matrix

	I	IS	L	E	U	UC	T	G	DG	RESAR
I	1.000000	–0.137384	0.513440	–0.027709	0.146069	–0.710781	–0.109283	–0.253960	–0.626491	0.011870
IS		1.000000	–0.048857	–0.018728	–0.015516	–0.001165	0.406257	0.163645	0.017910	0.210992
L			1.000000	0.273338	–0.017840	–0.525527	0.325673	–0.552281	–0.270637	–0.100097
E				1.000000	–0.310854	–0.117652	0.547730	–0.660661	0.088643	–0.000181
U					1.000000	0.036722	–0.394977	0.174878	–0.091530	0.071595
UC						1.000000	–0.107808	0.272697	0.598763	0.057087
T							1.000000	–0.521211	–0.028772	0.037888
G								1.000000	0.135792	0.099525
DG									1.000000	–0.008663
RESAR										1.000000

TABLE V
The entrepreneurship model: non-systematic risk as dependent variable

	Variable	Theoretical expected sign	Estimated sign	Coefficient	*t*-Statisti
1	Per capita income (I)	+	0.017450	4.707708*	
2	Industrial structure change (IS)	+	+	0.07642	4.047304*
3b	Education level of working population (E)	+	+	0.003946	1.305926
4	Unemployment rate (U)	+	+	0.010506	0.865765
9	Residual of SE (RESAR)	+	+	0.080809	4.435177*
10	NSR_{t-1}		0.841343	5.170695*	
	Adjusted R^2	0.746952			
	F-statistic	53.54229	Prob (F-stat): 0		

Notes:
1. The regressions have been corrected for Autocorrelation 1st degree. It has also been used White's Heteroskedasticity – consistent covariance method of correction.
2. * F-test results at a 95% significance level.
3. Source: the E-Views, Econometric Views, Micro TSP, 1994 have been used.

Following Solow and the others we may postulate:

$$Y_{it} = \alpha_{it} K_{it} + (1 - \alpha_{it}) L_{it} + S_{it} \quad (2)$$

where Y_{it} refers to the proportional rates of change of output, K_{it} refers to the proportional rates of physical capital, L_{it} refers to the proportional of human capital, S it refers to the proportional rates of TFP (Solow residual) and α_{it} is capital's share of national income.

To the degree that the "Solow residual" is an endogenous variable dependent on the variables of capital and labor, then formula (2) is an accounting expression with an unexplained residual. As long as the work of the researchers (Solow, 1957) ignored the quality in inputs, a large part of growth was attributed to TFP.

Endogenous growth theory (Romer, 1990; Lucas, 1988), with the variable that was imported and expresses human capital, opened the dialogue for the existence of one or more factors that contribute to the enlargement of the economy, that are capable of interpreting the residual term of growth.

Thus, because the theoretical content of the basic inputs improved with the addition of their qualitative dimensions (Jorgensen and Grilisches, 1967; Jorgensen et al. 1987) it was illustrated that a substantial portion of the "Solow residual" could represent the changes in input quality.

For the consequences of our analysis, we shall accept that:

$$S_{it} = T_{it} + HCQ + NS_{it} \quad (3)$$

where T_{it} stands for the technological level (quality of capital), HCQ refers to the changes in the

human capital quality, and NS_{it} stands for the New Solow Residual.

In contrast to capital, labor and human capital quality variable, which are endogenous variables, referring to the Lucas – Romer approach, the effect of technology is exogenous and therefore it appears in "level" form. Before proceeding with the empirical assessment of the above proposition, the endogenous variables were tested for multicolinearity by constructing a correlation matrix (Table VI).

The correlation coefficient do not reveal any significant association *K*, *L*, *T*, *HCQ*. We now could estimate the standard growth model as it is presented in Table VII.

In the light of the analysis in the previous sections the variable *NS* could be analysed as follows:

$$NS = NSR + \varepsilon$$

where *NSR* stands for the non-systematic risk as an indicator of entrepreneurship; ε stands for an error which is independently disturbed and is unique for each country included in the sample.

The new variable we introduce could take the place of the dummy variable, which captures the effects of entrepreneurship as concerns the classical interpretative variables of the neoclassical model. That, at any rate, is the deeper meaning of the level of entrepreneurship that exists in an economy.

The results are presented in Table IX.

The results of the econometric estimations are satisfactory as far as the interpretative ability of the model being used is concerned. The signs of the models were as expected and the R^2 is at a satisfactory level. We can make a comment concerning the partial regressions coefficients. Since they represent the partial influence of each independent, when it changes for one unit, to the average value of dependent variable (growth rate), the rest of the independent variables remain constant, the levels of the partial regressions coefficients can be used to evaluate the influence of

TABLE VI
Correlation matrix

	T	*K*	*L*	*HCQ*
T	1.000000	0.172947	0.296738	–0.106189
K		1.000000	0.287929	0.220561
L			1.000000	0.206804
HCQ				1.000000

TABLE VII
The standard growth model

Variable	Coefficient	Std. error	*t*-Statistic
C	0.00504	0.000518	9.731674*
K	0.227782	0.014017	16.25021*
L	0.164723	0.067255	2.449242*
T	0.037757	0.00515	7.331285*
HCQ	0.053811	0.002735	19.67841*
G (*t* – 1)	0.409856	0.101489	4.038428*
Adj R^2	0.856728	Prob (F-stat.)	0

Source:
1. The results have been corrected for Autocorrelation 1st degree.
2. * F-test results at a 95% significance level.
3. E-Views, Econometric Views, Micro TSP, 1994 have been used.

TABLE VIII
Definitions and sources of variables

Capital (*K*)	*Definition*: Real total gross fixed capital formation (Percentage change from previous period). *Source*: OECD, 1999, Table 5.
Labor Force (*L*)	*Definition*: Employment (Percentage change from previous period). *Source*: OECD, 1999, Table 20.
Technological Level (*T*)	*Definition*: ANBERD, Total Business Enterprise, millions of PPP dollars current prices. Levels. *Source*: OECD, 1974–1995.
Human Capital (*HCQ*)	*Definition*: As an approach to the variable, it has been used as the participation percentage of the work force of people who are still in, or have graduated from, secondary educational level. (Percentage change from previous period) *Source*: The data originated from the following sources: OECD, 1997b; Psacharopoulos and Arriagada, 1986; 1992; and Barro and Lee, 1993.

TABLE IX
The standard growth model and the NSR

Variable	Coefficient	Std. error	*t*-Statistic
C	0.004709	0.000544	8.656043*
K	0.222467	0.013663	16.28297*
L	0.177355	0.066889	2.651468*
T	0.032725	0.005934	5.514373*
HCQ	0.046367	0.002916	15.8998*
NSR	0.252387	0.038787	6.507014*
G ($t-1$)	0.457508	0.038787	6.507014*
Adj R^2	0.855868	Prob (F-stat.)	0

Source:
1. The results have been corrected for Autocorrelation 1st degree.
2. * F-test results at a 95% significance level.
3. The E-Views, Econometric Views, Micro TSP, 1994 have been used.

the independent growth factors and the enterpreneurship proxy to the determination of the dependent variable. Therefore, we can conclude that the enterpreneurship influence accounts for 25% of the influence of the basic growth factors of the growth rate.

7. Conclusions

In this article it has been suggested that we consider risk as the missing link between the entrepreneurship theory and the neoclassical theory. The initial idea is old enough and in essence has, for the first time, been suggested by the supporters of the entrepreneur as an agent of uncertainty. We support the self-evident idea that the environment of the neoclassical theory has been structured in such a way as to allow the existence of entrepreneurial behaviour, while not allowing for a significant role for the entrepreneur. As such, the risk premium of the economic agent of neoclassical theory is nothing more than the entrepreneurship premium of entrepreneurship theories. If, though, this is absolutely and readily acceptable, then the measurement of the level of (non-systematic) risk can allow for a satisfactory "revelation" of the level of entrepreneurship in economic activity.

The validity of the proposed measure of entrepreneurial activities was tested in three stages. In the first, we examine the correlation between entrepreneurship variables (i.e. venture capital start-ups etc) with the proposed variable. In the second, we examine the superiority of the new measure versus a traditional one like the self-employment rate as endogenous variables. In repeated econometric analyses we built up an acceptable model of entrepreneurship determination. Based upon the available indicators, the new measure demonstrated a much better behaviour as an entrepreneurship proxy than the self-employment rate.

In the third level, the entrepreneurship proxy was connected to the outcome of the growth rate. We enlisted the more organized forum of the neoclassical growth theory into our analysis and broke new ground in the growth accounting modeling by recreating the explanatory factors that include capital, labor, technology and human capital. The contribution of non-systematic risk (entrepreneurship) is realized as statistically significant, a fact that contributes to an increase of the interpreted residual of the growth rate.

Having used all the empirical indications we came to the conclusion that we have in our hands a good entrepreneurship proxy, which could also allow us to reconsider the relation of entrepreneurship and the neoclassical constructions.

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