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ABSTRACT

In the present note an effort will be made for a contribution to economic theory by estimating an econometric relationship between the foreign direct investment [FDI] and total economy's entrepreneurship reward [r_{EM}]. This note is based mainly on the next two papers. First, it will be based on the discussion paper "Understanding the Role of Entrepreneurship for Economic Growth." by Martin Carree and Roy Thurik, MPIoE, #2005, in which the authors show the importance of entrepreneurship to adapt to new technology, to develop capacity and reach economies of scale. Second, it will be based on the discussion paper "Does Entrepreneurship Create Enough Jobs in Europe? A Note." by Miltiades N. Georgiou, MPIoE, #0806, in which entrepreneurship reward [r_{EM}] is measurable and consequently can be related with the other measurable economic variables like the [FDI]. Hence, in the present note a relationship between [FDI] and [r_{EM}] can be numerically estimated. More specifically, it will be pointed out with panel data econometric analysis that in all Western European Countries and the United States [FDI] is positively related with [r_{EM}], and that decisions about [FDI] are mainly affected by [r_{EM}].

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PART 1. THEORY

Recalling the paper of Georgiou N. M. (2005), total economy's entrepreneurship reward [$\mathbf{r_{EM}}$] can be measured by the equation (1) as follows:

$$r_{EM} = \frac{(1+wp)}{(1+i)*(1+r_{LD})} - 1 \qquad (1)$$

where [$\mathbf{r_{EM}}$] expresses the residual as the average annual reward of total economy's entrepreneurship, [**wp**] stands for the annual growth rate in wholesale prices (total manufacturing sector, as in line 63 of International Financial Statistics (IFS)). Besides, [$\mathbf{r_L}$], which is the lending rate (as in line 60p of IFS) will be now the average cost of loans that each company bears for the working capital as well as the fixed assets. It should be noted however that since [$\mathbf{r_L}$] includes the inflationary adjustment, this lending rate will be "deflated" and converted into [$\mathbf{r_{LD}}$] as in (2):

$$r_{LD} = \frac{r_L}{(1+i)} \qquad (2)$$

This definition of [$\mathbf{r_{EM}}$] refers to macroeconomic level.

Besides, the entrepreneurship is important as it is shown in the next works. Cohen and Levinthal (1989) suggest that firms develop the capacity to adapt new technology. Firms invest in new technology and have economies of scale in R&D (Klepper 1996). The importance of entrepreneurship on economic growth is fully analyzed in the paper of Carree and Thurik (2005).

Further, there is a positive relationship between foreign direct investment [FDI] and entrepreneurship. This view is expressed in the following two studies.

According to Backer and Sleuwaegen (2006) [FDI] has in the long run positive effects on domestic entrepreneurship as a result of learning, demonstration, networking and linkage effect between foreign and domestic firms. Further, in the study of Noland (2004) it is claimed (between others) that countries with better attitudes toward globalization attract more [FDI] and exhibit more local entrepreneurship. According to Acs et al. (2005) [FDI] not only enables the transfer of intangibles to another country, but also makes knowledge spillovers and may play a role in indigenous entrepreneurship.

In the present paper the definition of entrepreneurship refers to the whole economy of a country as an average. It is supposed that a capable entrepreneurship will "attract" [FDI]. Hence, it is ex-ante assumed that there is a positive relation between [FDI] and [r_{EM}], under the assumption that [FDI] will depend on [r_{EM}].

PART 2. THE ECONOMETRIC MODEL

2.1 The Formulation of the model

I test the hypothesis that [FDI] is positively related to [r_{EM}]. It is also assumed that [FDI] depends on [r_{EM}], [r_{EM}] being the independent variable. In economics this means that a capable entrepreneurship "attracts" [FDI]. Regarding the formulation of [FDI], since it has too high variation in the original annual values, and since it refers to the long run, the definition of [FDI] in the present model is a ten years simple average. In other words, for the year [t] and country [i] the $FDI10_{it}$ is the simple average of the years t, t-1, …,t-9. Hence, this definition of [FDI] as a moving average has a much lower variation helping the creation of a robust model.

More specifically,

$$FDI10_{it} = \left(\frac{1}{10}\right) * \sum_{0}^{9} FDI_{i,t-k} \qquad (3)$$

Hence, the formulation of [$FDI10_t$] implies equivalently a rather continuous flow of [FDI], which by assumption depends on the entrepreneurial ability. FDI is in millions of US$.

The model is:

$$Y1_{it} = c_0 + c_1 r_{EM\,it} + error_{\,it} \qquad (4)$$

where

$$Y1_{it} = \ln\left(\frac{1}{FDI10_{it}}\right) \qquad (5)$$

with expected $c_1<0$.

The choice of this particular econometric model is rather arbitrary but empirical. It shows however that there is a positive numerical relation between the [FDI] and [r_{EM}].

Data from UNCTAD for the FDI and IMF for the rest. The countries examined are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Spain, Sweden, UK and USA covering annually the period 1990 – 2003 (as it is shown in detail in table3). The sample has a total size of 194 observations.

2.2 Econometric comments

To handle heteroskedasticity EGLS method, since the sample is large, the method of EGLS or FGLS (feasible generalized least squares) will be used. According to the work of Yaffee (2003, p.10) the methods of "fixed effect" as well as "random effect" are not efficient when there is heteroskedasticity (either between time periods or between cross sections). In large samples however the method of EGLS or FGLS (feasible generalized least squares) can handle the above-mentioned problem of heteroskedasticity. The estimation of the present model is based on the software package EVIEWS using the method EGLS with cross section weights to handle the heteroskedasticity between cross sections.

Hence the estimated regression is in brief as in (6):

$$Y1 = -9{,}261 - 6{,}615\ r_{EM} \qquad (6)$$

The detailed estimated regression results are in table 1. I observe that model (4) estimated as in (6) meets the three required criteria of homoskedasticity, specification and normality (as shown in detail in table 2). Further there is not autocorrelation. The constant term is negative and statistically significant. Besides, the coefficient of $[r_{EM}]$

is negative and statistically significant, as initially assumed. The adjusted R^2 is very high.

PART 3. CONCLUSIONS

The importance of this paper is that it uses a numerical estimation of the total economy's entrepreneurship reward and finds out an empirical relationship between the [FDI] and [r_{EM}]. Of course, the decision to make an [FDI] inflow in a country depends apart from entrepreneurship on many factors (like inflation expectations, political stability, demand and consumption expectations, and so forth). However, the very high value of R^2 (96,6%) proves that entrepreneurship explains 96,6% of the total variance in Y1. In other words, all the other factors together explain only the 3,4% of the total variance in Y1. In economics this means that in this paper it is pointed out that entrepreneurship ability matters most in [FDI] decisions.

In the present note it is pointed out that a capable entrepreneurship "attracts" foreign direct investment examined in a country level. It would be of interest to measure entrepreneurship in each sector of the national economy (say food, chemicals, clothing, etc) and relate it to corresponding sectoral FDIs. In case this is feasible, then economic theory will be in a position to analyze the FDI activity in each sector as a result of the entrepreneurship capability of this sector.

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APPENDIX

Table 1. Results

Period	**1990 - 2003**
Method	**EGLS (cross section)**
Constant	-9,261 (-76,17)
r_{EM}	-6,615 (-20,25)
Adjusted R^2	0,966
Durbin-Watson	2,0003

Table 2. Diagnostic Tests[1]

Model	1990 - 2003	Critical values (at 95%)
Heteroskedasticity	0,110	3,894
Heteroskedasticity	0,110	3,894
Heteroskedasticity	0,111	3,841
Heteroskedasticity	1,694	5,991
Heteroskedasticity	0,155	7,815
$RESET_1$	2,872	3,841
$RESET_2$	2,641	5,991
$RESET_3$	2,372	7,815
Normality	0,199	5,991

Test 1: Regression of the squared residuals on X. That is, $u_t^2 = x_t'\gamma_1 + v_{t,1}$

Test 2: Regression of absolute residuals on X. That is, $| u_t | = x_t'\gamma_2 + v_{t,2}$ (a Glejser test)

Test 3: Regression of the squared residuals on $\hat{Y}$

Test 4: Regression of the squared residuals on $\hat{Y}$ and $\hat{Y}^2$

Test 5: Regression of the log of squared residuals on X (a Harvey test)

Test 6: Regression of residuals on $\hat{Y}^2$

Test 7: Regression of residuals on $\hat{Y}^3$

Test 8: Regression of residuals on $\hat{Y}^4$

Test 9: Normality test

[1] The diagnostic tests are based on Halkos (2003)

Table 3. Data Collection

Country	90	91	92	93	94	95	96	97	98	99	00	01	02	03
Austria	…	…	…	…	…	…	…	…	ν	ν	…	…	…	…
Belgium	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν
Denmark	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	…
Finland	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	…
France	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν
Germany	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν
Greece	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν
Ireland	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν
Italy	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν
Netherlands	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	…
Norway	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν
Spain	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	…
Sweden	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν
UK	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν
USA	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν	ν

Source: FDI from UNCTAD, the rest from IMF. Calculations are mine.