MACROECONOMIC FACTORS OF ENTREPRENEURSHIP IN THE EUROPEAN UNION

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Abstract: *Entrepreneurship has been traditionally related to several economic factors, including economy growth, inflation, unemployment, interest rates. The causal relation between these variables however has been the topic of several hypothesises. Our goal is to assess these relations in the case of the European Union. While several similar studies have been pursued in the field, we aim to bring further evidence to the potential of impacting entrepreneurship through changes in economic factors at the country level Our analysis used panel regression to estimate the relation between macroeconomic factors and entrepreneurial density. Results indicate that Gross Domestic Product is positively related to entrepreneurial activity, and further more in the case of the European Union we bring evidence to the fact that the relation might be quadratic, as opposed to linear as it is generally suggested. In the case of the European Union this results in a reversed U shape of the distribution. More specifically, in the case of the investigated period only the upward half of the reversed U was observed, so on this specific interval the overall effect was positive. Regarding inflation we have observed a positive, but weak, relationship between it and entrepreneurial activity. The direction of the relation was not expected, however we provide a potential explanation in the specifics of inflation in the European Union (relative stability). Ease of starting a business, measured as the cost, time and procedures required is negatively related to entrepreneurial activity, as is the lending interest rate. Unemployment could not be significantly related to entrepreneurial density, however we believe that this is due to the fact that the lagged effect that we expected to find might either have a unit lower than 1 year, might have different values in different countries, or both. We conclude that these relations could provide a means to better understand the impact of economic changes on the entrepreneurial supply and demand.*

Keywords: entrepreneurship, GDP, inflation, unemployment, ease of starting a business, lending rate

JEL classification: L26

1. Background

The study of entrepreneurial activity has gained momentum in the last decades, as more and more governmental focus is being directed to its encouragement. This focus is generated by a series of assumptions, namely that increasing entrepreneurial activity will have a positive impact on the economy and society.

These measures, beyond the more general assumption of efficiency and efficacy (Acs, Morck, & Yeung, 2001; Lundström et al., 2014), require a good understanding of the relations between policy, economic indicators and entrepreneurial activity.

Our study aims to address the latter two terms. We propose that several key economic indicators, such as inflation, unemployment, gross domestic product, have a significant impact on the entrepreneurial activity in the European Union, and we postulate that, if this is the case, any policy changes that aim to change one of these indicators will have an indirect effect on entrepreneurship as well.

1.1 Entrepreneurship

Research in the field is rich, however relatively fragmented as a consensus on the meaning of several key terms has yet to be achieved. Who is the entrepreneur, what is entrepreneurship and what functions does it play in the economy are still debated topics (Alam & Mohiuddin, 2014; Carland & Hoy, 1984; Cuervo, Ribeiro, & Roig, 2007; Cunningham & Lischeron, 1991; Jonsson, 2014; Veciana, 2007).

However from the general empirical approaches one can notice that the operational definition of entrepreneurship tends to be similar, and the indicator of entrepreneurial activity is most frequently the number of economic entities that are newly registered in a certain time frame and / or the number of self-employed individuals (Van Der Sluis, Van Praag, & Vijverberg, 2008).

In our case we decided to use the same operational definition and include in our study the number of newly registered entities as a proxy indicator of entrepreneurial activity. While we support the idea that this only a segment of the entrepreneurial phenomenon, in the case of our analysis we have to rely on historical data sources from national and international entities, and generally no further information is available. For instance it would be of interest to assess the number of entrepreneurs and not the number of economic entities, as one entrepreneur could arguably be responsible for several entities, or a single entity might entice several individual with entrepreneurial profile.

1.2 Macroeconomic factors of entrepreneurship

Several factors are considered to be influenced or influence entrepreneurial activity. The ones that we have selected are some of the most often invoked in the literature, namely Gross Domestic Product (GDP), Inflation, Unemployment, Loan rates, and Difficulty of starting a business.

The relationship between GDP and entrepreneurial activity has been investigated previously in several studies, generally using Global Entrepreneurship Monitor data and the results indicated a negative relation (Arin, Huang, Minniti, Nandialath, & Reich, 2014), a U shaped relation (Wennekers, Van Wennekers, Thurik, & Reynolds, 2005), a positive relation for developed economies (Stel, Carree, & Thurik, 2005) or a negative relation, with some deviations from the trend at the highest GDP levels (Amorós & Bosma, 2014).

As it can be noticed from this brief review there is emerging evidence for a non-linear relationship, and we plan to test this hypothesis in the case of the European Union as well.

The relationship between unemployment and entrepreneurial activity is postulated to be bidirectional, with two concurrent effects: "push" and "pull" (D. Audretsch, Carree, & Thurik, 2001). However empirical results in this case are mixed, with some studies reporting a positive relation (Brixy, Sternberg, & Stüber, 2012; Ritsilä & Tervo, 2002; Theunissen, Verbruggen, Forrier, & Sels, 2009), others a negative one (D. Audretsch & Fritsch, 1994) and some failing to observe a significant effect (D. B. Audretsch & Keilbach, 2008; Noorderhaven, 2004). An explanation is the different time lags used by these studies, as the relation seem to change sign as a function of the time lag chosen (Sipos-Gug, 2012) and it might thus be non-linear (Congregado, Golpe, & Carmona, 2010; Faria, Cuestas, & Mourelle, 2010).

2. Method

In our analysis we used the data regarding entrepreneurship and the macroeconomic factors investigated provided by the World Bank and Eurostat. Where it was possible the two sources were compared and used to complete each other.

We excluded Greece and Cyprus from our analyses due to the large number of missing values. The resulting data base therefore included 26 European countries.

We included the following indicators:

- Gross Domestic Product (GDP) per capita, constant 2005 USD (Source: http://data.worldbank.org/indicator/NY.GDP.PCAP.KD)
- Entrepreneurial density - the number of newly registered entities per 1000 inhabitants or working age (Source: http://data.worldbank.org/indicator/IC.BUS.NDNS.ZS)
- Inflation - Harmonized consumer price index (HICP) (Source: Eurostat http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tec00118&plugin=1)
- Difficulty of starting a business - the length, cost and number of procedures required to start a business. The cost of starting a business is normalized by the World Bank by reporting it as a percentage of Gross National Income (GNI) per capita
  (Source: http://data.worldbank.org/indicator/IC.REG.COST.PC.ZS)
- Unemployment
  (Source: http://data.worldbank.org/indicator/SL.UEM.TOTL.NE.ZS)
- Ease of financing - the lending interest rate
  Source: http://data.worldbank.org/indicator/FR.INR.LEND).

The data was processed in R version 3.1.3 with the use of the "plm" package (Croissant & Millo, 2008).

3. Results

We resulted to several regression models with single predictors as the data base presented a number of missing values and a multiple regression model would have lead to short (4-5 years) time series.

3.1. GDP

We tested several models relating GDP to entrepreneurial density. We started with linear fixed and random effects models. According to the usual methodology in the field we used the Hausman test to whether the coefficients of the fixed model and the random effects model are equal (Frondel & Vance, 2010).

As the Hausman test yielded values that were under the critical value, we concluded that in this case the fixed effects model should be used, and further analyses addressed this model.

Table 1: Fixed effects linear model of entrepreneurial density regressed on GDP

Test	Statistic	Value
Anova	F(1,206)	39.316
	p	<0.01
Linear Coefficient	Estimate	0.000332
	t	6.27
	p	<0.01

Our results indicate a valid model ($F(1,206)=39.31$, $p < 0.01$) and that GDP is a significant factor of entrepreneurial density in the EU. The relationship is linear and positive, as expected, so an increase in GDP is a strong predictor of increased entrepreneurial activity. This result confirms similar results by other researchers and can easily be explained by the fact that a growing economy creates multiple opportunities that entrepreneurs can seize.

Before drawing further conclusions however we decided to investigate if our model meets the assumptions of the regression method.

The assumptions tested were linearity, homoskedasticity, and normality of the error distribution.
We resorted to a residuals versus predicted values plot to visually asses both linearity and homoskedasticity.
Normality of the error distribution was tested with the Shapiro-Wilk test, which rejected the hypothesis that this condition is met by our model ($p < 0.01$). This raises some questions regarding the model, and might be an indication of a non-linear relation between the variables.
The Breusch-Pagan test for homoskedasticity in this case (BP = 302.3, $p < 0.01$) indicated the presence of heteroskedasticity (Breusch & Pagan, 1979). Under these circumstances we resorted to testing a corrected model. We used the "arellano" heteroskedasticity-consistent covariance estimators. Under the corrected model the GDP coefficient remained significant ($p = 0.0002$).
Another issue that can appear in panel date regression is cross-sectional dependence. This was investigated using the Pesaran CD test, which failed to reject the null hypothesis ($p = 0.60$) and thus we have little reason to suspect that cross-sections dependence was present.
The last potential error source investigated was the stationary property of the series. The Augmented Dickey-Fuller test in this case rejected the hypothesis that the series has a unit root, and therefore we can assume it is indeed stationary.
In conclusion the proposed model only partly meets the required assumptions of the linear panel regression methods used and there are indicators that another model, a non-linear one, might better explain the relation between these variables.
In light of other studies postulating a quadratic model (Wennekers et al., 2005) we decided to test this as an alternative model, and the results are presented in Table 2.

Table 2: The quadratic model regressing entrepreneurial activity on GDP

Test	Statistic	Value
Anova	F(2,205)	27.6591
	p	<0.01
Linear Coefficient	Estimate	6,6917e-04
	t	6.38
	p	<0.01
Quadratic coefficient	Estimate	-3,7820e-09
	t	-3.68
	p	<0.01

The quadratic model has coefficients that significantly differ from 0, as it is shown from the Anova and t tests presented in Table 2.
The linear and quadratic models show little differences when it comes to model fit, however the Wald test shows that the quadratic model does add a significant ($p<0.01$) amount of information to the model.
The quadratic model shows better linearity of the error distribution graphically, however the Shapiro-Wilk test continues to reject the normality hypothesis.
Homoskedasticity was also rejected (BP = 311.34, $p <0.01$), however again the heteroskedasticity consistent coefficients were significantly different from 0.
After our analyses we conclude that there is evidence of a quadratic relation between GDP and entrepreneurial density in the case of the European Union. The interesting issue here is the sign of the quadratic coefficient. While generally the postulated relation is U shaped, in our case it was observed to be upside-down.

In the case of the European Union between 2004 and 2012, as it can be observed in Figure 1, it would seem that the relation between GDP and entrepreneurial density is positive (according to our quadratic model). Entrepreneurial density seems to be low in the case of low GDP, then to increase rapidly up to a maximum, to be reached around 88500$/capita GDP, as predicted by our equation. This maximum was not present in our sample.

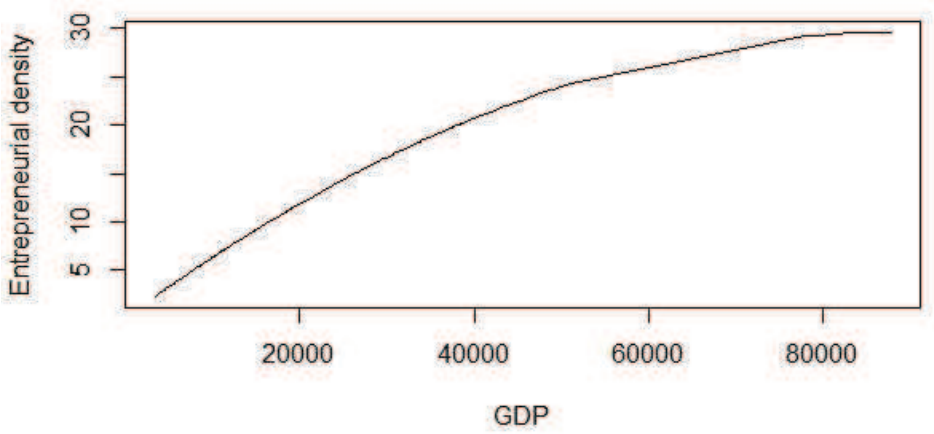

Figure 1. Graphical representation of the quadratic function between GDP and entrepreneurial density

The implications of these results from a more pragmatic perspective are that an increase in GDP (up to the threshold of 88500$/capita) will be related with a positive development of entrepreneurial density, and this impact should be maximized in the case of the lowest GDPs in the European Union.

3.2 Inflation - HICP

We resorted to a similar analysis in the case of inflation, as measured by HICP, and the fixed effects model's coefficients are significantly different from 0 (Table 3).

Table 3: Fixed effects linear model of entrepreneurial density regressed on HICP

Test	Statistic	Value
Anova	F(1,206)	27.544
	p	<0.01
Coefficients	Estimate	0.034
	t	5.2482
	p	<0.01

We resorted to testing the assumptions of the model, as done previously in the case of GDP, We found that using heteroskedasticity consistent coefficients was again necessary, however the coefficient remained significant after the Arellano correction. Normality of the error distribution could not be demonstrated (Shapiro-Wilk p value <0.05) however the standardized residuals plot in this case is very close to the expected configuration, so we consider the impact of this violation to be minimal.

The relation between inflation and entrepreneurial activity is postulated to be negative (Arin et al., 2014; Fogel, Hawk, Morck, & Yeung, 2006; Georgiou, 2009; Gnyawali & Fogel, 1994) due to the relationship between inflation and uncertainty. However this might

hold only for high inflation fluctuations and not the increase of inflation values in itself. The changes in HICP were, on average, slightly over 3% (std. deviation 2.2) yearly in the investigated area and time frame. Under these circumstances it might be possible that a small increase in inflation has a positive impact on entrepreneurship, for instance as postulated by some authors that it might happen in the case of inelastic labour supply (He, 2011).
A non-linear model (quadratic) was tested, to see if the relation could reflect previous results in the literature on a certain section of the function, however no such model could be fitted on our data.
We believe that in this case we are experiencing the effects of a sample bias, as inflation over the investigated time frame did not present enough variation to allow us to properly assess, for instance, the direction of the relationship in the case of high inflation and volatility.
We conclude that in the case of an inflation rate of around 3% there is a significant, positive, relation between HICP and entrepreneurial density.

3.3 Ease of starting a business

We used three indicators to measure the ease of starting a business: the number of procedures, the time and cost of registering a new company. These indicators were significantly correlated with each other and including them into a model simultaneously might have unjustifiably inflated the model fit. So we chose to use only the cost of registering a new company (the models for the other two variables had similar fit).
From Table 4 one can observe that the model has adequate fit and the relation is negative, as expected.

Table 4: Fixed effects linear model of entrepreneurial density regressed on ease of starting a business

Test	Statistic	Value
Anova	F(1,206)	16.7194
	p	<0.01
Coefficients	Estimate	-0.097
	t	-4.08
	p	<0.01

Testing the assumptions of the model yielded similar results to the HICP analysis, with normality of error distribution being rejected by the Shapiro-Wilk test and partly supported by the standardized residuals plot. Heteroskedasticity was present, and the coefficient remained significant after correction.
In this case the relation is present and in the direction we have expected. Clearly rising the costs (or number of procedures or time required) that involve starting a business has a negative impact on the entrepreneurial activity. All these factors act as barriers between the potential entrepreneur and the implementation of his plans.

3.4 Cost of financing

As a indicator of the cost of financing a business we used lending rates as reported by the World Bank. Despite the initial concern of comparability, due to various terms and conditions tied to loans that are country specific, a valid model could be constructed.

Table 5: Fixed effects linear model of entrepreneurial density regressed on lending interest rates

Test	Statistic	Value

Anova	F(1,111)	3.662
	p	0.05
Coefficients	Estimate	-0.066
	t	-1.913
	p	0.05

Our model indicates the fact that there is a negative, significant, relation between lending interest rates and entrepreneurial density. Regarding the assumption of the linear regression method used, linearity was tested both with a visual inspection of the standardized residuals plot, which shown satisfactory distribution, and with the Shapiro-Wilk test, that rejected our normality hypothesis.
Homoskedasticity was rejected by the Breusch-Pagan test, however the coefficient remained significant even after applying the "Arellano" method.
Overall the model meets the assumption of the linear model (with some reserves as to the normality of the error distribution) and we find it adequate.
This confirms our initial assumptions and provides evidence for the fact that access to lower cost financing could be a means of stimulating entrepreneurship.

3.5 Unemployment

In the case of unemployment our preliminary analysis indicated that model fit could not be achieved (Table 6). This was surprising, as we expected to be able to replicate other studies where unemployment was found to be a strong correlate or predictor of entrepreneurial activity.

Table 6: Fixed effects linear model of entrepreneurial density regressed on unemployment

Test	Statistic	Value
Anova	F(1,206)	2.122
	p	0.14
Coefficients	Estimate	-0.037
	t	-1.456
	p	0.14

However in light of the assumed non-linear relationship between unemployment and entrepreneurial activity it is possible that our model not be the best estimate of the relation between the two variables. Bidirectional and complex models have been proposed, and testing for these was not possible under our current methodology, as using time lags shorter than 1 year are not possible due to data constraints and using a 1 year time lag failed to yield any significant results.

4. Conclusions

We have found support for most of our proposed hypotheses. The models proposed relating GDP to entrepreneurial density have been accepted, as they have significant coefficients and reasonably obey the assumptions of the used panel data regression methods (with the exception of the normality of error distribution, discussed later).
The quadratic model proved to be better in terms of fit, even if when restricting for parsimony it's benefits are only marginal. Lower values of GDP per capita tend to be associated with lower entrepreneurial density. Since we investigated registered business', it would seem that in their case (up to a point) a "richer" economy provides a stimulating effect and encourages more individual to take on the role of the entrepreneur. Lower GPD / capita might provide fewer opportunities, but at the same it may be the case that

economies that have a relatively low GDP / capita rely more on scale economy effects, by focusing on industry for instance, and thus might inadvertently discourage entrepreneurs.
Another issue might be that of the transitional economies, as countries with lower GDP in the European Union tend to be those that have transitioned from a planned economy to a market economy 25 years ago, and thus might not have a proper entrepreneurial culture. Since only one generation has been raised in a market economy, it cannot properly benefit from entrepreneurial models and trans-generational learning and thus entrepreneurship might be viewed either as too risky or too difficult.
As expected higher obstacles to starting a business, when it comes to both start-up procedures (time, cost and number) and financing (loan interest rates) lead to lower rates of entrepreneurial activity. Ease of start-up the easiest factor (out of those that we have investigated) to be influenced by public policy. A reduction with 1 point of the costs to start a business would lead to a increase in entrepreneurial density of 0.097, or to approximately 1 new company founded yearly per 10 000 inhabitants of working age. The number of procedures to start a company for instance has a coefficient of -0.211. So dropping 1 procedure could lead to a little over 2 new companies being found per 10 000 inhabitants of working age.
The positive relation of HICP to entrepreneurial activity has been unexpected. We argue that in the case of the European Union inflation has been relatively stable in the investigated time frame, and thus entrepreneurs could take advantage of the positive impact of small changes in consumer prices. the coefficient value of 0.034 suggests that for a 1 point increase in HICP around 3 companies can be expected to founded for every 100 000 inhabitants of working age, so this effect, albeit statistically significant, would be small for practical purposes.
Another issue is that of sampling. The HICP values have shown relative similar evolutions (in terms of magnitude of change). It is likely that the relationship between HICP and entrepreneurship be non-linear, and at the other end of the inflation stability spectrum the relation to become negative. We expect, as previously stated, that a high inflation fluctuation have a negative impact to entrepreneurship.
Unemployment could not be significantly related to entrepreneurship in our study. As this relationship has been investigated extensively previously we believe that our result is inaccurate. The main potential sources of error that could mask the relationship are time lag effects and country differences. As shown in the literature (Sipos-Gug, 2012) when time lags of fractions of a year are taken into account the relations can be noticed, at least at a national level. The second potential error source is probably the most impactful one. Countries have vastly different unemployment policies that could encourage or discourage individuals to enter the workforce versus becoming an entrepreneur. This issue therefore requires further study.
A common issue with the proposed models has been that of normality of error distribution, which raises some questions regarding the fit of the models, however this can at least partly be attributed to the lack of normality of the distribution of entrepreneurial density itself.
The implications of our results in the practical field involve several potential beneficiaries. Policy makers could (and should) make use of our results in order to guide their decisions. Changing the procedures and costs for start-ups for instance could provide a valuable tool in influencing the entrepreneurial activity. Also the impact of inflation might not be as strong as previously believed, and small changes in inflations might actually be beneficial for the entrepreneurial market. Entrepreneurs, both active and potential, could learn more about the factors impacting their activities from our study, and better prepare for an increase or decrease in competition, for instance, or better follow their interests when lobbying for policy changes.
Further research will be required to confirm our results, as more data becomes available and more complex models could be used to assess the complex interactions between the

investigated variables. However we have provided insights in the impact of macroeconomic factors on the entrepreneurial activity in the European Union, and improved our knowledge and understanding of the economic environment.

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