

## ENTREPRENEURSHIP IN CONSTRUCTIONS SECTOR – EXPLANATORY ECONOMIC FACTORS AND FORECASTS FOR ROMANIA

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**Abstract:** *Entrepreneurship is an active field of study; however entrepreneurship in the field of construction has been relatively neglected in recent research. The construction sector's importance lays in its multiplier effect, through employment, consumption of materials and by providing infrastructure for further economic development. In order to maximize this effect, innovation and entrepreneurship in construction are critical factors. We have investigated the relation of several economic factors with entrepreneurship in construction and have found that the volume of construction works, the number of construction workers, building permits and the subjective opinion of the businesspersons in the construction industry, expressed through a conjecture index, have a long and medium term positive relation with it, while unemployment, Consumer Price Index, Construction Cost Index and Closure of construction companies have a negative relation with entrepreneurship in construction, taking into account different time lags for each variable. The negative relation in the case of unemployment and inflation, on the other side, have long time lags (15 and 21 months, respectively) suggesting that these economic phenomena might have long term negative consequences on entrepreneurship in construction, and by extension on the construction industry as a whole. We performed several forecasts (based on ETS (M,N,M) and ARIMA methods) and we have concluded that the level of entrepreneurship in construction in Romania for the next 2 years will remain relatively unchanged, save for intra year seasonal variances. Therefore external intervention will be required if one wants to encourage growth in this field. Taking into consideration the relations that we have uncovered in the first section of the paper, these external interventions should focus not only on encouraging entrepreneurship through various individual or company level measure, but on a larger scale, for instance through construction cost related inflation control, and by encouraging construction works, for instance through infrastructure projects.*

**Keywords:** *entrepreneurship, construction, forecast*

**JEL classification:** L26; L74;

### 1. Introduction

Innovation and entrepreneurship play an important role in the economic growth, as well as in countering unemployment and increasing living standards. While in the past the sources of innovation were often thought to be large companies, in the recent period small and medium enterprises (SMEs) are now considered to be the sources of innovation and growth (Faria et al., 2010). With SMEs accounting for 99% of the total number of companies in the European Union, and providing employment for 2/3 of the total working population (Badulescu D., 2014, Dodescu and Badulescu A., 2009), understanding their evolution and genesis has become an important endeavor. Current theories and research seem to indicate that entrepreneurship is a critical factor in the economic growth (Glaeser et al., 2010), however the connection between entrepreneurial

activity and growth in the developing countries seems to be qualitatively different than in the case of the developed countries, as it involves different determinants, government policies and even entrepreneurial profiles (Keilbach et al., 2009). In line with this hypothesis, we decided to investigate the economical factors connected to entrepreneurial activity in Romania, and more specifically in the construction sector, since it has been relatively overlooked by current research.

### **1.1. Entrepreneurship**

What is entrepreneurship and how wide its field of study should be is still an open question, as researchers in the field use different criteria for distinguishing entrepreneurial activity from other economic activities.

One of the first definitions of entrepreneurship comes from Schumpeter, and it focuses on innovation: “the doing of new things or the doing of things that are already being done in a new way” (Schumpeter, 1947: p. 151). However this definition has the drawback of restricting the field of study to a relatively small number of enterprises. Current research into entrepreneurship is focused on a wider field, that of all new enterprises. In line with this point of view, the entrepreneur is seen as either self-employed or the individual that starts a new company (Rocha, Sternberg, 2005; Van Der Sluis et al., 2008).

In our paper we choose to use the latter definition, as it is easily measured and comparable between countries and in time. We will include in our entrepreneurship measure all new companies and newly registered self-employed persons in a certain time frame. While this runs the risk of not being complete, as some persons might not be registered, we prefer to use the official reported figures, rather than estimates of total activity, as we believe that in the case of Romania the two are highly correlated, and that the vast majority of enterprises are included in the official statistics.

### **1.2. Constructions and the economy**

The constructions sector is both an important contributor to economic growth and recovery and an important focus of government policy (Myers, 2008). The European (EU27) construction sector comprises of 3.1 million enterprises, 95% of which are small and medium enterprises (SME) with less than 20 employees. Its importance to economic development stems from its direct contribution to the domestic product, the construction sector accounted for 9.1% of the EU27 GDP in 2013 and 49.9% of the EU27 Gross Fixed Capital Formation, from its absorption of labour force, in 2013 it accounted for 6.8% of EU27 total employment, and it was the biggest industrial employer, with 30.2% of all industrial employment and also from its multiplier effect, as 1 person working in the construction industry provides work for 2 persons working in other sectors (all statistics taken from the European Construction Industry Federation, FIEC, annual report 2013).

The literature suggests that a relationship exists between construction output and the growth of the economy as a whole (Zhang, Yao, 2013), however there are some divergent opinions regarding the direction of the causal relationship: from construction to the economy (Lopes et al., 2002), bidirectional (Chan, 2001; Zheng, Liu, 2004), from economy to construction (Tse, Ganesan, 1997), or complex and non-linear – during economic growth the economy seems to lead construction, while during economic downturns, the construction sector seems to lead the economy (Kargı, 2013; Lewis, 2009). While the relationship has been extensively investigated and a consensus on the direction of the relation has not yet been achieved, all researchers emphasize the importance of the construction sector and the need for research in the field.

In general, the construction sector seems to grow faster than the national economy in developing countries, as many investments are needed in infrastructure and new buildings, while in developed countries most of the construction output is focused more on maintenance and repair and the construction sector contributes less significantly to

the economic growth (Giang, Sui Pheng, 2011; Lewis, 2009; Myers, 2008). A more recent view on the fields is that the nature of the construction sectors is changing in the last few years, and as such other variables may have entered the equation, such as market size and population density, alongside economic growth (Gregori, Pietroforte, 2011).

### **1.3. Entrepreneurship and the construction industry**

Entrepreneurial activity and innovation requires a certain level of infrastructure, both in regard to the scientific development of the region, leading to spill-over effects from the academic field, but also, and more importantly, from the physical infrastructure, such as transportation, access to power, water and raw materials, real estate costs and local construction costs. In areas where the physical infrastructure is lacking, even if rich in innovation, entrepreneurial activity will be low, due to increased risks and costs. Entrepreneurs will prefer to implement their innovative ideas in other areas and this will lead regional stagnation and even local depression. The construction and especially housing sectors vitality is seen even as a barometer of the regions private sector, with low property values and new construction rates signalling regional decline (Bates, 2008). The current tendencies in the field of construction favor entrepreneurial activity. The focus on small companies and networks of self-employed persons cooperating on specific projects, in order to lower costs and share risk, has led to more and more specialized workers being pushed into entrepreneurial activity (Rath, 2002). The subcontracting tendencies, combined with low entry barriers, low level of qualification required for workers (at least at the bottom level), the need for flexibility and project-based work create an optimum environment for the potential entrepreneur to develop and start his business (Walton-Roberts, Hiebert, 1997).

Current research in the field of entrepreneurship in construction seems to be focused on the social aspects and determinants, such as immigration and communities (Feagin, Imani, 1994; Rath, 2002; Walton-Roberts, Hiebert, 1997) or on sustainability (Klein Woolthuis, 2010), however little research is available into the influence of other factors, such as unemployment, inflation, demand and offer on the construction market.

As noted previously, especially in developing countries, the construction sector could be an important factor of growth, especially during economic downturns (Kargı, 2013; Lewis, 2009; Lopes et al., 2002). Based on this theory, we believe that stimulating the construction sector, especially through a focus on innovation and entrepreneurship, could lead to sustainable economic growth in the case of Romania. Therefore we try to investigate the economic factors involved in entrepreneurial activity in the construction sector, as well as try to forecast the future evolution of this activity.

## **2. Research methodology**

Based on our review of the literature, we expect that entrepreneurial activity in the field of construction will be at least partly influenced by the changes in demand and supply in this sector. As such we take into account several economic indicators related to this dynamics, such as unemployment and employed workforce, building permits issued and completed projects, inflation and the costs of construction, the number of new enterprises as well as the number of closed companies in the field.

### **2.1. Indicators**

When measuring construction output a major issue is the availability of data. Since many construction projects are small scale and provided by SMEs or even individuals (such as do-it-yourself DIY projects), the sector is predisposed to miss-reporting. For instance in many countries as much as 20-28% of total construction output is estimated to be missed by the official reports (Myers, 2008). Taking into consideration these limits, we have

regardless decided on using the official records, as they provide a consistent view of the field and are precisely calculated.

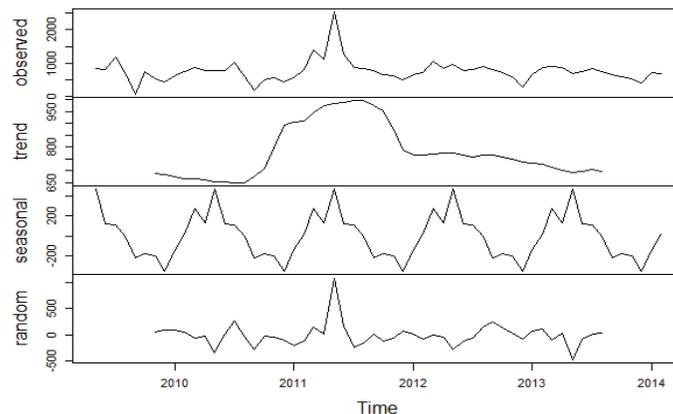
All indicators cover the May 2009 – February 2014 period and have monthly availability. Since in 2008 there was a change in the classification of companies based on activity type, most of the time series were not backwards compatible.

In order to measure the volume of entrepreneurial activity we choose as an indicator the number of new companies being registered into The National Trade Register Office (ONRC) each month. The data was collected from the online platform of the Office (ONRC, 2014). We used two time series, one for Total entrepreneurial activity and one for the Construction entrepreneurial activity. As evidenced from Figure 1, the entrepreneurial activity in construction has a seasonal aspect, following a 12 month period. Also, since 2011, it is on a descending trend.

The indicator chosen for unemployment were the monthly national unemployment rate. The data was collected from the online platform of the National Employment Agency. We also used the number of individuals employed in the field of construction, as provided by the National Statistics Institute.

For the construction output we used the Indices of Construction Works – base year 2010 time series (CNS105F) and the Building permits – square meters useful area time series (LOC108B) as provided by the National Statistics Institute (INS, 2014). In both cases we used the total values, for the sake of simplicity.

As a measure of inflation, we used the Consumer Price Index (CPI) and the Construction Cost Index (CNS107B) as provided by the National Statistics Institute.



**Figure 1:** Decomposition of Entrepreneurship in construction based on seasonal and trend components

Source: Author's calculation based on data from The National Trade Register Office

We have also included a subjective indicator, the Trend of activity compared to the previous months as reported by the construction business. This indicator used in conjuncture analysis was collected from the time series "ei\_bsbu\_m\_r2", available from Eurostat (Eurostat, 2014).

## 2.2. Testing the factors

The relationship between Construction Entrepreneurship and the economic factors of interest was investigated using the Cross-Correlation Function (CCF) method as implemented in the stats R package (Venables, Ripley, 2002). We used this method to investigate the optimum time lag between two time series, and to provide us with the significance and size of the relation between pairs of variables.

The results of the CCF analysis for all pairs of variables are presented in Table 1. In the interest of simplicity we only indicate the correlations at the chosen lag values, which are the local minimum or maximum points.

**Table 1:** Results of the CCF analysis - optimum lags and correlation values

Predictor	Lag (k)	Correlation at lag k (significant at $p = 0.05$ )
Unemployment	-15	0.39
Closure	-9	-0.35
Construction works	-8	0.29
	-1	-0.42
General Entrepreneurship	0	0.38
Construction workers	-22	0.41
	-3	-0.53
Building permits	-11	0.36
	-3	-0.39
CPI	-21	-0.32
CCI	-22	-0.28
Conjuncture index	-8	0.35
	-2	-0.34

Source: Authors' calculation based on data available from Eurostat, the National Trade Register Office and the National Statistics Institute

From Table 1 one can notice several interesting facts:

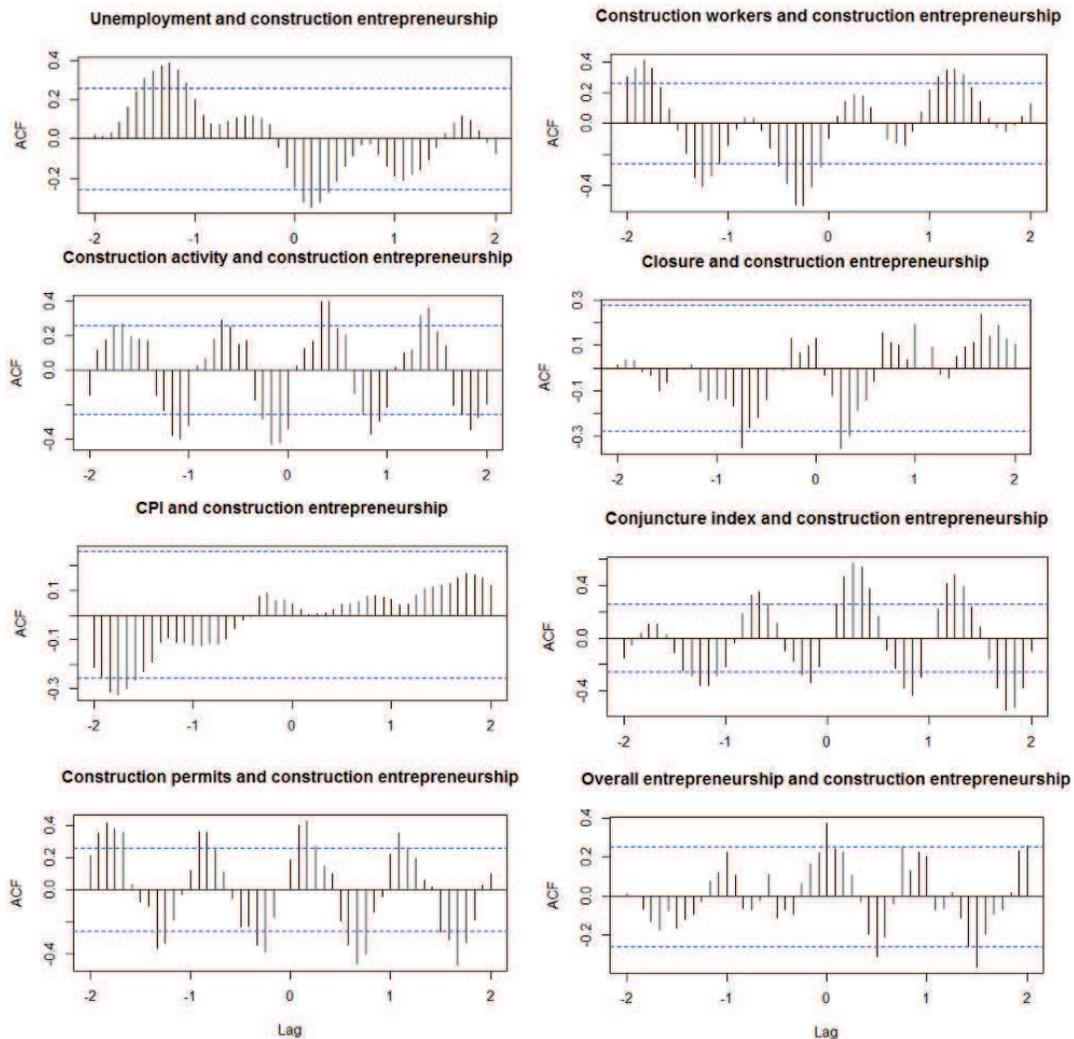
- Unemployment (-15) has a positive relation with construction entrepreneurship
- CPI (-21), CCI (-22) and Closure of construction companies (-9) have a negative relation with construction entrepreneurship
- Construction works, Number of construction workers, Building permits, Conjuncture have a non-linear effect: on the long term they relate positively and on the short term negatively with construction entrepreneurship

As previous research indicated (Șipoș-Gug, Bădulescu, 2013; Sipos-Gug, 2012) there is a direct link between unemployment and entrepreneurship. The link is bidirectional, as the CCF also indicated a positive k value of 2 (correlation -0.35), suggesting that both the push and pull effects reported by previous research can also be found in the construction sector in Romania (see Figure 2). The positive correlation at the -15 lag suggests that when unemployment is high, entrepreneurship in construction will also increase 15 months later. The relatively long time lag can be explained by several factors. Firstly in Romania one can benefit from financial support for the first 12 months of unemployment, and starting an enterprise can also be a lengthy process.

The Consumer Price Index (CPI) is negatively related to entrepreneurship in construction, 21 months later. The long time lag can be explained by the fact that price changes can take a while to propagate through the economy and ultimately affect demand for construction. Since construction projects are long term projects, taking several months or years to complete, inflation can lead to losses and as such increase in inflation can discourage potential entrepreneurs. Infrastructure projects funded by the Government or the European Union are especially vulnerable to CPI changes, as the payments are usually delayed several months after completion. We believe that a similar phenomenon explains the long time lag (-22) in the case of the Construction Costs Index (CCI) as the two are expected to behave in a similar fashion.

Closure of construction companies is also negatively related to entrepreneurship in construction 9 months later. This is to be expected, as an increase in the closure rates of

the sector can discourage potential entrepreneurs, while a high success rate, signaled by a low closure rate, can encourage more individuals to open enterprises. The 8 months lagged positive relation between Construction works with entrepreneurship in the field of construction is to be expected. Assuming the increased construction output is a result of higher demand, this would naturally attract more entrepreneurs to the field, and as such within 8 months they would become active. However the 1 month lagged negative relation is more difficult to explain. One possible interpretation is that there might be an interference from the seasonal nature of construction work. As the season progresses, there is more and more construction output, however less chance that a company will be opened, especially passed the middle of the season. So on the very short term, an increase in output can be inversely related to entrepreneurship.



**Figure 2:** CCF between construction entrepreneurship and the factors investigated. Blue lines are the limits of the 95% confidence interval. Lags are expressed in years. Source: Authors' calculation using R, based on data available from Eurostat, the National Trade Register Office and the National Statistics Institute

The 22 months lagged positive relation between the number of construction workers in Romania and entrepreneurial activity in the field of construction can be explained by the fact that a large specialized workforce will be more likely to produce a larger number of

potential entrepreneurs, while at the same time being a signal that there is high demand in the field. We explain the negative correlation on the short term (3 months) by the fact that prior to starting a company the entrepreneur is very likely assessing the labor market for potential employees. If there is an increase in the number of workers in the field, he might have difficulties in recruiting valuable candidates, and delay the start up of the firm. While if there is a decrease in employment, he will have little difficulty in finding qualified and low cost labor.

The 11 months lagged positive relation between construction permits and entrepreneurial activity in construction can be explained by the fact that when considering a start-up in the field, the potential entrepreneur is influenced by the previous years demand level, as evidenced by the number of building permits. The 3 months negative relation could be explained by the fact that entrepreneurs will start companies in the field at the beginning of the construction season, anticipating an increase in activity, and not during periods of high activity, such as in the middle of the season.

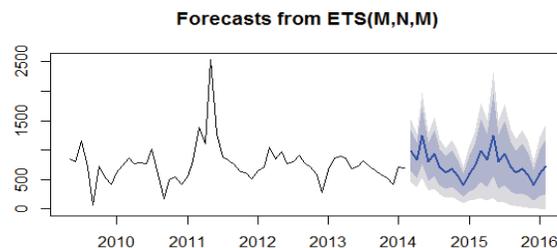
The 8 months lagged positive relation with the Conjuncture index can be explained by the fact that the index reflects a subjective confidence of the companies in the field, and as such this subjective confidence could be transmitted to potential entrepreneurs outside the field, either attracting them or discouraging their initiatives. On the short term however the effect might be reversed. A high level of confidence of growth from existing companies will likely encourage them to invest and expand, and recruit potential entrepreneurs, thus removing them from the entrepreneurial market. Indeed this is noticeable if one investigates the CCF between the conjuncture index and employment in the field of construction, we see a positive relation with k values of 1 and 2 (correlations of 0.3 and 0.2, respectively).

### 2.3. Forecast of construction entrepreneurship

In order to forecast entrepreneurial activity we used several alternative methods. The first method we employed was using an Exponential smoothing state space model (ETS). Since the ETS model family has a number of 30 proposed models, we used the function “ets” in r to select the optimal model type based on Akaike’s Information Criterion (AIC) values of each of the 30 potential models, as it is recommended in the research literature (Hyndman et al., 2008, 2002). The resulted model was of the type ETS(M,N,M) and has the Smoothing parameters  $\alpha = 0.3157$  and  $\gamma = 0.0001$  and a sigma of 0.2697. The AIC for the model was 874.

According to standard notation, this refers to a model with multiplicative error type, no trend and multiplicative seasonal type. Based on this model, the forecast entrepreneurial activity in construction is available in Figure 3.

The forecasted values, save for seasonal variation, suggest that the entrepreneurial activity in the field of construction will remain relatively stable.

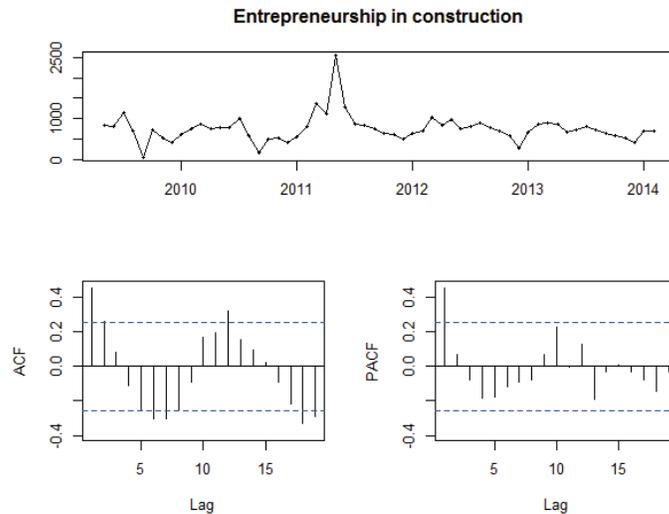


**Figure 3:** Forecast of construction entrepreneurship from ETS model

Source: Authors's calculation using R, based on data available from the National Trade Register Office

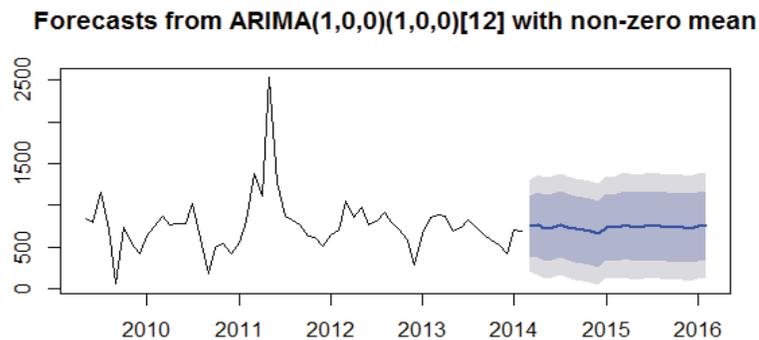
The second method we used was Autoregressive integrated moving average (ARIMA) forecasting. The general form of the model is  $ARIMA(p,d,q)(P,D,Q)m$ , where  $p$ = order of the autoregressive part;  $d$ = degree of first differencing involved and  $q$ = order of the moving average part, with  $P$ ,  $D$  and  $Q$  being the seasonal degrees and  $m$  is the number of periods per season (Hyndman, Athanasopoulos, 2012).

Based on the Augmented Dickey-Fuller Test ( $ADF = -3.5565$ ,  $p = 0.04$ ) and the auto-correlation (ACF) and partial auto-correlation (PACF) plots in figure 4, we concluded that our model is of the  $ARIMA(1,0,0)(1,0,0)12$  type, since the ACF is sinusoidal and there are no significant lags in PACF beyond lag 1.



**Figure 4:** ACF and PACF plots for entrepreneurship in construction  
 Source: Authors' calculation based on data available from the National Trade Register Office

Using these parameters the forecast is available in figure 5. The forecasted values, similarly to the ETS ones, suggest that the entrepreneurial activity in the field of construction will remain relatively stable.



**Figure 5:** Forecast of construction entrepreneurship from ETS model  
 Source: Authors' calculation using R, based on data available from the National Trade Register Office

Since there are no efficient ways of choosing between the two models based on the sample they were created on, we will have to rely on future data, as it becomes available, to support one model over the other.

### 3. Conclusion

Both of our forecasts indicate that on the long term entrepreneurship in construction will very likely remain around the current values. This might have negative long term consequences not only for the construction industry, but the entire national economy.

All of our proposed factors are significantly connected to entrepreneurship in construction, with unemployment, construction works, number of construction workers, building permits and conjecture index having a long and medium term positive relation with it, and CPI, CCI and Closure of construction companies having a negative relation with entrepreneurship. While no causal relations were demonstrated in our study, due to the strong relations and precedence of the factors, they are likely to exist, and changes in these factors might reflect in changes into entrepreneurship.

Taking into consideration the factors related to entrepreneurship in construction that we have identified, there might be several paths of action available in order to stimulate entrepreneurial activity. The main issue would be that of controlling inflation and stabilizing the costs implied by the construction sector. Also providing training and specialization for workers and supplying construction works for local enterprises, perhaps through investments into infrastructure, would also encourage entrepreneurship in this field.

The multiplier effect on the economy of the construction sector and the current struggles for economic recovery are reasons for which the government support for entrepreneurs in this field would be needed and would lead to long term economic growth.

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