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Firm's strategies of innovation and the effect of economic crisis

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Firm's strategies of innovation and the effect of economic crisis

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Firm's strategies of innovation and the effect of economic crisis

Abstract:

The economic and financial crisis has brought firms, territories and countries before a set of restrictions to a greater or lesser extent, function as the conditioners of economic activity for several agents, also affecting their activities associated with the development of its innovation process. Innovation is a highly complex process, very contingent and onerously demanding. With innovation as a key source of high economic performance, it is important to understand to what extent the current economic crisis is to constrain the innovation of firms and thus, the process of wealth creation. The main objective of this paper is to show that the economic crisis has a different effect on firms, depending on the type of innovation strategies adopted. For this, we identify some relevant relations between the economic crisis and the critical factors of the innovation process, namely knowledge networks and context costs, special dimensions that we associate with the efficiency of institutional and relational capital. These objectives will be achieved using several statistical and econometric techniques, with information found in a database obtained through a business survey. Our main results show some interesting findings: first we find evidence that the most dynamic firms recognize less impact of the economic crisis. Second, we find empirical evidence that the knowledge networks can be taken as a resilient mechanism of firms to manage the negative impacts of the crisis. Finally, firms that recognize more importance to the reduction of context cost seems more resilient to economic crisis. We finish with some recommendations for regional policy.

Key words: *knowledge networks, innovation process, economic crisis, context costs, territorial resilience, regional policy*

Introduction

The importance of the innovation process in the wealth creation and competitiveness of countries and regions is a topic widely studied in the literature and in the political sphere itself, both national and internationally. Assuming that innovation is a key element in the economic performance of firms, regions and countries, is important to understand to what extent the current economic crisis affects firms' innovation process. The crisis will have an impact (negative) on the process of firm's innovation? What relationships can be established between the impact of the crisis and the nature of the innovation strategies adopted by firm's?

Using as conceptual background a wide view of firm's innovation processes this paper aims to develop a reflection about the impact of the crisis on dynamic innovative businesses, focused mainly in Portugal. This article mainly aims to show that the economic crisis has a different effect on firms, depending on the type of innovation strategies adopted. We identify some relevant relations between the economic crisis and the critical factors of the innovation process, namely knowledge networks and context costs, special dimensions that we associate with the efficiency of institutional and relational capital. These assumptions will be tested using several statistical and econometric techniques, with information found in a database obtained through a business survey that takes place in 2010 and 2011. The database has 397 observations stratified by five levels of technological intensity, three firm size and three Portuguese regions. The paper is organized into four sections. In the first section we identify a brief conceptual framework about the economic crisis and the innovation processes. The second section presents the database and the main methodological options. The third part deals with the empirical research, including the significant variables used to test the hypotheses, the econometric models used and the specifications for each one. Finally, we discuss the main results and conclude with the presentation of some proposals concerning regional policy.

1. The economic and financial crisis and the framework of innovation processes

The explanation and description of the economic and financial crisis in its multiple dimensions is not part of the objectives of this article. On the subject see, for example, Krugman (2009) and (2012); Akerlof and Shiller (2009); Raguram (2011); Roubini and Mihm (2010); Kaletsky (2011). For the explained objectives, we take as a starting point the following fact: the financial crisis has put new obstacles to firms, territories and countries economic activities. These obstacles are usually related with the difficulty to obtain resources to promote innovation or with fall of the demand, or with the negative expectations about the future (see, for example, OECD, 2009; Filippetti and Archibugi, 2011). These constraints are usually associated with important channels and mechanisms, directly related to matters of firms financing efforts and their innovation activities, reduced in investment and demand (internal and external) and expectations regarding the opportunities of future returns and depreciation of human capital.

The theoretical framework adopted here has been previously tested on Nunes (2012); Nunes, Passos e Lopes (2012); Nunes e Lopes (2012a) and (2012b); Nunes, Dias and Lopes (2012). As we said, in this paper we intent to analyze some relations between the (negative) impact of the financial crisis and the firms' innovation process. Previously we must clarify the conceptual understanding of innovation adopted.

According to the European Commission (1996: 54), innovation can be defined as “*the commercially successful exploitation of new technologies, ideas or methods through the introduction of new products or processes, or through the improvement of existing ones. Innovation is a result of an interactive learning process that involves often several actors from inside and outside the companies*”. This is the definition of innovation that will be adopted in this paper, which means, in particular, the explicit recognition of innovation as a process, an interactive learning process. Before proceeding further, we should discuss what the nature of that process. According to Fischer (2006:1), the concept of innovation “*has changed dramatically in recent years as the focus of attention has shifted from the single act philosophy of innovation to the complex mechanisms that underline the production of new products and new production processes*”. It is a highly contingent process through which firms seek to develop innovations with economic consequences in other organizations and in different markets (Acs, 2002). To Pavitt (2005: 86), the "innovation process" should be divided into sub-processes, partially overlapped, consistent with two of the most important

characteristics of innovation: its procedural nature and the intrinsic uncertainty that is inherent in the development of that process. With regard to business innovation, the main concern should focus on three sub-processes: the production of knowledge, transforming knowledge into products and services and, thirdly, the placement of products and services into the market. The nature and extent associated with the transformation of knowledge into useful goods and services to society vary from sector to sector, over time, depending on the nature of the products, production methods and end-users. Ultimately it depends from the type of economic model accepted and pursued by contemporary societies. In the competitive capitalist system, organizational and technological practices have been evolved with the markets, as reflections of the evolution of society. The proposal of deconstructing the "innovation process" in three generic processes clearly identified enables to stress that the creation of knowledge does not mean innovation per se. The production of economic knowledge without application is not very useful (Baumol, 2002) to the economic system, particularly to its component business.

In short, innovation is necessarily uncertain, given the inability to predict accurately the cost and performance of new products and consumer reaction to them. It is thus inevitable that involves learning processes, through experimentation (trial and error) or improvements in understanding the genesis and processes (theory) that support its existence. Some of this learning is specific to organizations and their internal dynamics of interactions, although mostly clearly outweighs this context, projecting to external contexts. Antonelli (2003: 53) emphasizes this aspect, stressing that nowadays innovation is *"the result of complex alliances and compromises between groups of heterogeneous agents."* It is then expected that the creation, dissemination and use of new ideas and knowledge comes from the articulation of tacit and codified knowledge, generated by the interaction of internal and external different contexts (Keeble and Wilkinson, 1999; Antonelli, 2001, 2005a and 2005b).

This innovation process gains efficiency when the different actors are heavily involved in knowledge networks, through mechanisms of formal and informal interaction. When the actors do it, they are transforming the Territory into a critical factor in the innovation process, because the mode of governance of these networks stems from the culture of the social fabric, and because the tacit knowledge has a territorial nature.

In summary, our conceptual framework regards innovation as an interactive learning process that uses tacit and codified knowledge as their main resource, as consequence, this process is in nature collective and territorial. Then, the knowledge networks (special the territorial ones) plays a key role in the economic and innovative performance of firms (Nunes, 2012).

2. The data and methodological issues

The database used in this paper is constituted by a representative sample drawn from a universe of 981¹ firms that simultaneously satisfy the following criteria: in 2008 had a turnover of more than € 1 million and an increase in turnover of at least 5% between 2007 and 2008. It was intended to thereby identify a group of more dynamic firms, from the point of view of their economic performance. It is possible to stratify the universe by the following variables:

- Levels of technological intensity and knowledge services: high-technology (HT), medium-high technology (MHT), medium-low technology (MLT) and low-technology (LT). We also considered in our analyses the knowledge services (KS) firms. These are variables that aim to capture the sectoral structure of our analysis. This typology was chosen because it is the most commonly used in the internationally literature, mainly by reference entities, such as the OECD and the European Union;
- Firms' size – classified in Micro (0-9), SMEs (10-250) and large firms (> 250) by the number of employees (2008). This variable tries to capture the organizational structure under analysis;
- NUTS III (Grande Lisboa and Península de Setúbal, Pinhal Litoral and Grande Porto). This variable intends to capture the regional structure under analysis.

As it is not financially possible to carry out an investigation to the entire population, was subsequently designed a representative sample of the universe, obtained by stratification and proportional affixation, which was respectively questioned – via phone – during late 2010 and early 2011. The survey included the key components that, according to the theoretical framework developed, covering the following aspects: firm

¹ The reference population was obtained from COFACE SERVICES PORTUGAL, SA. View, please www.coface.pt.

characterization, firms' innovation activities, internal resources and performance, activities about different modes of innovation, external resources, types of proximity and some aspects related to the crisis in the innovation process. This process resulted in a database with 397 observations, representative of the population that supports the statistical and econometric work of this paper.

3. The nature of the innovation process and the impact of the crisis on firms: Empirical analysis

We begin this exploratory analysis for examining some statistical results and then we will present two econometric models which allow us to test in a more robust way some relevant relations between the innovation process and the current economic and financial crisis.

First of all we remember that, in accordance with our survey, the international crisis had a negative impact on approximately 65% of the firms, and this is true across the three control variables, as we can see in Table 1 (see section 2 for the different categories).

Table 1 – Negative impact of the crisis on firms (%)

Level of Technological Intensity				
LT	MLT	MHT	HT	KS
65,0	66,4	68,6	64,5	58,8
Firms Size				
Micro		SME	Large	
57,1		65,6	63,5	
Regional NUT III				
Grande Lisboa		Pinhal Litoral	Grande Porto	
63,6		66,2	66,3	

Font: Author's own elaboration based on the Business Survey

All the firms affected and not affected by the crisis, can use four contexts in which they can develop knowledge networks through multiple channels and mechanisms of interaction (see Table 2 and 3): regional, national, and international context, and the context without territorial reference (CWTR). Table 1 shows the aggregate importance – by context and mechanism of interaction – of the different knowledge channels used by firms in the crisis management. These importance can ranges from 0,2 to 1.

Table 2 – Relevance of contexts and interaction mechanisms

<i>Contexts</i>	<i>Total</i>	<i>Mechanisms</i>	
		<i>Formal</i>	<i>Informal</i>
• Regional	0,505	0,519	0,491
• National	0,487	0,449	0,525
• International	0,412	0,392	0,431
• CWTR	0,369	0,375	0,363
Total	0,443	0,434	0,453

Font: Author's own elaboration based on the Business Survey

We can point out three important aspects from table 1: First, a greater valuing of the regional context as privileged context of handling of the crisis by firms. Second, a decreasing valorization of the different contexts, if taken according to the criterion of the traditional spatial proximity. Finally, the informal mechanisms have a greater value compared to formal, with the exception of the regional context, where the formal mechanisms of interaction are the most valued, albeit with a difference not significant. Informal mechanisms of interaction had been clearly identified as highly relevant to the process of firms' innovation process (Lorenz, 2000; Fuller-Love, 2009; Nunes and Lopes, 2012b). In this case, it should be noted also the recognition of its importance in the adaptation of the firms to the negative impacts of the crisis. In summary, these results show us that informal mechanisms of interaction play a key role in the innovation. Moreover show us that the territory is an important factor in the innovation process. Indeed, companies attach importance to the spatial contexts of innovation that is greater the greater the geographic proximity. This will be explained by various reasons documented by the specialty literature, mainly because of geographical proximity is typically associated with institutional and cultural proximity, facilitating collaborative relationships, whether informal or formalized but cemented in interpersonal trust. This explains the relevance of formal mechanisms at "regional" and "national."

The following table shows, by decreasing level of importance, the interaction channels (and the mechanisms underlying them) more important in firms' crisis management.

Table 3 – Five most important interaction channels in crisis management

Total Contexts		
Total	Formal	Informal
Consultants	Suppliers	Consultants
Suppliers	Consultants	Competitors
Clients	Clients	Innovation Regional Centers
Competitors	Competitors	<i>Labor Market</i>
Innovation Regional Centers	Higher Education	Clients
Regional Context		
Total	Formal	Informal
Consultants	Suppliers	Consultants
Suppliers	Innovation Regional Centers	Competitors
Clients	Clients	Higher Education
Competitors	Consultants	<i>Labor Market</i>
Innovation Regional Centers	Research Laboratories	Professional Associations
National Context		
Total	Formal	Informal
<i>Labor Market</i>	Competitors	<i>Labor Market</i>
Competitors	<i>Labor Market</i>	Higher Education
Clients	Clients	Research Laboratories
Higher Education	Higher Education	Clients
Innovation Regional Centers	Suppliers	Innovation Regional Centers
International Context		
Total	Formal	Informal
<i>Labor Market</i>	Clients	Higher Education
Clients	Research Laboratories	<i>Labor market</i>
Research Laboratories	Suppliers	Competitors
Competitors	Consultants	Research Laboratories
Higher Education	<i>Labor Market</i>	Suppliers
Context without territorial reference		
Total	Formal	Informal
Suppliers	Clients	Suppliers
Clients	Suppliers	Clients
Consultants	Higher Education	<i>Labor Market</i>
Competitors	Competitors	Consultants
Higher Education	Consultants	Competitors

Font: Author's own elaboration based on the Business Survey

Taking Table 3 as a reference point, there are four aspects that should be noted. Firstly, there is clearly a high diversity of interactions among multiple players in the different contexts considered. The collective nature and interactive (formal and informal) of the learning process (also) in the context of economic crisis should be emphasized. Second, we should emphasize the importance of access (formal and informal) to specific channels of knowledge as way of crisis management. This is the case of interactions with consulting firms, regional innovation centers, higher education institutions or research laboratories. Third, the firms widely recognize the importance of the

interaction with suppliers, clients and competitors, namely the informal way of interaction. Finally, in convergence with Roper and Love (2006), our results stress the important role of labor market as channel of management of the crisis, especially as space of informal relationship. Probably this means that labor market allow firms to access external knowledge who is strategic to the readjustment of the innovation process in an economic framework of crisis.

If we analyze the impact of the crisis not only on the innovation process, but also related with the results, it is possible to observe that, in terms of aggregated economic performance, the impact of the crisis proved to be lower in the most dynamic firms (Table 4).

Table 4 – Crisis’ impact and Aggregate Economic Performance

Aggregate Economic Performance	Impact	N	%
Zero Indicator	No	8	29,6
	Yes	19	70,4
	Total	27	100,0
One Indicator	No	31	34,8
	Yes	58	65,2
	Total	89	100,0
Two Indicators	No	35	34,0
	Yes	68	66,0
	Total	103	100,0
Three Indicators	No	43	35,8
	Yes	77	64,2
	Total	120	100,0
Four Indicators	No	23	39,7
	Yes	35	60,3
	Total	58	100,0

Font: Author’s own elaboration based on the Business Survey

Table 4 allows us to analyze de impact of the economic crises on the firms’ aggregate economic performance. By the survey, we obtained information about the economic performance of companies in the following four dimensions: increasing its turnover, increased volume of employment, increasing the share of exports and increase the volume of orders in the last five years respectively. With the respective answers, we build up the variable "Aggregate Economic Performance", ranging from "zero indicators" (if the company did not record any increase in the indicators explained) and "four indicators" (if the company had increased simultaneously in all indicators

explained). The results suggest that as economic performance increases, the impact of the crisis on businesses reduces.

Clarified the contexts and mechanisms of interaction, then we discuss the relationship between the impact of the crisis in the innovation process and the dynamics of interaction developed by firms. After this we test the relationship between the impact of the crisis and the valorization of context costs. For this we adjusted the two econometric models which are presented below.

Impact of crisis and intensity of networking

The Model 1 aims to test the nature of the relationship between the impact of the crisis and the involvement of firms in knowledge networks. The model takes as the dependent variable the "*Impact of Crisis in Innovation*". This is an ordinal variable that can assume three values: "1" if the company indicated that the crisis has had an impact "*little relevance*" in their innovation process, "3" if the company indicated that the impact of the crisis was "*very important*" and "5" if the answer was "*fundamental*". As independent variable we took the "intensity of networking". This variable is a composite variable that results from the joint consideration of the different channels of interaction (13 channels, see table 2) used by firms and the degree of importance assigned to each of them (1 to 5). This variable ranges from 0.2 – if the firm recognizes the minimum value for each channel (Likert =1) and 1 – if the firm recognizes the maximum value for each channel (Likert = 5). The higher the intensity of networking more variable is close to 1. Given the nature of the dependent variable, we estimated Model 1 using an ordered logistic regression and the estimation results can be analyzed in table 5 (all estimations were made using the statistic package “Stata 10.1”).

Table 5 – Model 1: estimation results

<i>ICI</i>	<i>Coefficients</i>	<i>Impact of Crisis in Innovation</i>		
	<i>Odds Ratio</i>	<i>(marginal effects)</i>		
		1 – little relevant	3 – very important	5 – fundamental
Intensity of Networking	0.0238*** (0.00332)	84,8	-22,9	-61,9
Observations	397			

Font: Author’s own elaboration

*Robust pvalue in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

The results from the previous table allow emphasize the following point: increasing the intensity of networking has a positive effect in reducing the probability of the crisis has a negative impact on innovation activities of firms. The analysis of the marginal effects allows us to affirm that as firms increase the intensity of networking, the marginal effect on the probability of the firm being in class 3 (crisis have a little relevance) increases 84.8%, being in class 4 decreases 22.9% and to be in class 5 (crisis have a fundamental relevance) decreases 61.9%, respectively. Put it another way, firms that were involved in more intense interaction dynamics have seen reduced the probability of the crisis constraining their innovation process negatively. In short, we can say that as firms engage more intensely in knowledge networks its resilience to the crisis seems to increase.

Impact of crisis and context costs

The second model is intended to capture the relationship between crisis and an understudied aspect in the literature: the context costs associated with the effectiveness of the innovation process. In general terms, context costs include the costs related to institutional restrictions that hinder the achievement of the innovation process, including rules, regulations and bureaucracies (access to public entities, complexity of the tax system, access to public or private financing mechanisms, courts and justice), with high opportunity costs in the effectiveness of the innovation process. The dependent variable is the same as we use in the previous models and the independent variable is the “*importance of context costs reduction*” that can assume five likert scales: 1 – “irrelevant” to 5 – “fundamental”. As we did before, we estimated Model 2 using an ordered logistic regression and the estimation results of model 3 can be analyzed in table 6.

Table 6 – Model 2: estimation results

<i>importance of context costs reduction (ICCR)</i>	<i>Odds Ratios</i>	<i>Impact of Crisis in Innovation (marginal effects) – significant values on bold</i>		
	<i>Coefficients</i>	1 – little relevant	3 – very important	5 – fundamental
<i>Irrelevant – 1 – Reference</i>				
<i>ICCR – 2 (little important)</i>	0.230** (0.0253)	35,1	-18,3	-16,8
<i>ICCR – 3 (Indifferent)</i>	0.382 (0.105)	21,6	-5,7	-15,8
<i>ICCR – 4 (very important)</i>	0.320* (0.0585)	26,5	-9.6	-16,8
<i>ICCR – 5 (fundamental)</i>	0.164** (0.0157)	41,9	-24,3	-17,5
Observations	397			

Font: Author's own elaboration

*Robust pvalue in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

The interpretation of the results constant in Table 6 allow us to say that, as firms value the context cost reduction there is a decrease in marginal terms on the probability of the crisis affect more intensively the firms' innovation process. The analysis of marginal effects shows us that, for example, a firm stating that the context cost reduction is "fundamental" to their process of innovation sees an increase of 41.9% in the probability of the crisis impact be " little relevant" in their innovation process. Simultaneously, the probability of the crisis has an impact "very important" and "fundamental" in their innovation process is reduced by 24.3% and 17.5%, respectively.

4. Main results and conclusions

The analysis developed in this paper allowed us to identify some relevant aspects about the relationship between the impact of the economic crisis and the firms' innovation process, particularly:

1. Most firms (65%) recognize that the economic crisis has had a negative impact on their innovation process. (This cuts across the level of technological intensity, the firms' size and the regions considered);
2. The firms use multiple channels and interaction mechanisms as a means to obtain external knowledge, and these interactions revealed an important way to manage the impact of the crisis in the firms;

3. The firms with a lower negative impact of the economic crisis are the most dynamic ones, particularly those whose innovation process is supported by a strong networking interaction; as a corollary of the networking relevance, the territorial context have a strong role to reduce the impact of the crisis in the firms' innovation process;
4. We found empirical evidences that the valuation of the context costs reduction is associated with the decreasing of the impact of the crisis in the innovation process.

The analysis developed allows us to highlight that the business strategies that have proved more resilient to the economic crisis, are strategies supported by intense innovation processes, processes that value the role of the territory and knowledge networks (which we associate with the relational capital), the informal mechanisms' of interaction and the reducing of the context costs (an important component of the institutional capital). These findings highlight the importance of the networking-model vs. the in-house model as governance mechanisms of the innovation strategies. These results have several important implications both for the competitiveness policy either to regional policy and innovation.

In terms of competitiveness policy, these results confirm the importance of innovation as a business strategy. It not only allows firms to achieve higher economic performance as it seems to give firms some resistance mechanisms against economic and financial adverse situations. From the point of view of the regional policy and innovation, the importance given to knowledge networks and contextual factors reinforce the need for formulating policies for the territory supported by resources hard to transfer and capable of strengthening the territorial capital (relational, institutional and social capital). Additionally, public policy faces some new challenges. On the one hand, the valorization of relational capital (promoting different types of networking) and, secondly, the replacement of the austerity policies by policies enhancement of the *milleux* and the firms' context cost reduction, particularly the ones affecting the innovation process.

Another important insight is the key role of the territory. The territory should be regarded as the integration context of innovation and competitiveness policy, working

as a space that gives economic significance to specific combinations of knowledge required for the effectiveness of the innovation process. In summary, Territory is the right place to combine codified and tacit knowledge (see the relevance of the labor market for this), and is the best environment to feed the trust required by the relationship of the agents involved in the innovation process. In this way the Territory is not only a source of critical knowledge to the innovation process, but too a source of the trust that contributes to reduce the opportunistic behavior and the economic risk of the innovation.

If it is true that these results give some indication about the nature of policies to be developed in the medium and long term, it is also true that the current economic situation in Europe brings us towards challenges and dilemmas extremely worrying for the short term. One of these relevant questions stems from reflecting on the role of the "competitive austerity" on the sustainability and development of the innovation process. In Portugal, for example, the "competitive austerity" should be understood as a process of faith from the "troika" and the government, believing that the economy will strengthen its competitiveness through a policy based on the reduction of wages, increased taxes, privatization of public services (many of them are natural monopolies) and the progressive replacement of the welfare state by pure market mechanisms. These kinds of policies associated with "competitive austerity" are against – even destructive – the conditions required for implementation of regional policy supported by innovation strategies. The first result of the "competitive austerity" – unexpected for some – has been the reduction of resources and their quality available in the economy: financial, organizational, human and territorial resources. This decrease of resources is reflected in the short term in the weakening of the relational structures of the economy and of the territories, reducing the confidence of economic agents, the structure of social capital and even the levels of civic participation of the society, increasing the context costs and the fear/cost of development new projects.

The deliberate commitments to reducing wages and disqualify the labor force – and therefore the knowledge that it incorporates – irreparably fragile the sustainability of the innovation process. On the other hand, sends out signals to economic agents regarding to the choices they can make, with respect to a strategic option supported in a "competition-by-price" rather than in a "competition-by-innovation". This is not an option without costs in the present and for the future. This is a fundamental choice that

places business firms and territories in qualitatively different levels of production, wealth creation and political and institutional strength.

The "competitive austerity" irremediably reduces the coherence and consistency of the territorial capital. As a consequence, the reduction of proximity between the different knowledge bases reduces the possibility of exploiting the "adjacent knowledge". Finally, without integration of different knowledge bases is very difficult to obtain minimum thresholds for the effectiveness of the innovation process.

We will finish with a question that we leave in order to reflection and further research. Can we make sure that once broken the relational links that support the innovation process they will be reestablished easily, as the innovation process is a highly uncertain, costly, interactive, cumulative, systemic and a collective process? Or, on the other way, the "competitive austerity" reduces the intensity and complexity of the relational and institutional capital destroying (irremediably for some productive structures and territories) the effectiveness of the innovation process?

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