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Economic crisis and the firms´ innovation process[1]

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.

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1. 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. Will the crisis have an adverse impact on innovation process? What relationships can be established between the impact of the crisis and the nature of the innovation strategies adopted by firms?

Using as conceptual background a wide view of innovation processes, this paper examines the impact of the crisis on dynamic innovative businesses in Portugal. Its main aim is to show that the economic crisis has affected firms differently according to the type of innovation strategies they adopt. We identify some relevant relations between the economic crisis and the critical factors of the innovation process, namely knowledge networks, innovation modes and context costs. These assumptions will be tested using several statistical and econometric techniques, with information found in a database obtained through a business survey that took 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 has five sections. After an introduction we set out a conceptual framework for the economic crisis and innovation. The third section describes the database and the main methodological options. The forth section deals with the empirical research, including the significant variables used to test our 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.

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2. 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 (2012a); Nunes e Lopes (2012b) and (2012c); Nunes, Dias and Lopes (2013). 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*[2]*, 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

[2] The innovation process includes the organizational dimension with the following components: new business practices, new management systems, new methods of labour organization and new methods of organizing external relations.

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partially overlapping sub-processes, consistent with two of the most important characteristics of innovation: its procedural nature and the uncertainty that is inherent in the 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, bringing products and services to market. The nature and extent of the transformation of knowledge into goods and services useful to society vary from sector to sector over time, depending on the nature of the products, production methods and end-users. Ultimately it depends on the type of economic model adopted and pursued by contemporary societies. In the competitive capitalist system, organizational and technological practices have evolved with the markets, as reflections of the development of society. The proposed deconstruction of the "innovation process" into three clearly identified generic processes enables us to stress that the creation of knowledge does not mean innovation per se. The production of economic knowledge without application is not very useful to the economic system (Baumol, 2002), particularly to its component businesses.

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 becomes more efficient when the different actors are heavily involved in knowledge networks, through mechanisms of formal and informal interaction. When those actors innovate, they make the territory 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 tacit knowledge is territorial in nature.

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

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3. THE DATA AND METHODOLOGICAL ISSUES

The database used in this paper is made up of a representative sample drawn from a universe of 981[3] firms that simultaneously satisfy the following criteria: had a turnover of over € 1 million in 2008 and an increase in turnover of at least 5% between 2007 and 2008. Our intention was to identify a group of more dynamic firms, from the point of view of their economic performance. It is possible to stratify the universe according to 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 took knowledge services (KS) firms into account. This typology was chosen because it is the most commonly used in the international literature, mainly by reference entities such as the OECD and the European Union;
- Firms' size – classified into Micro (0-9), SMEs (10-250) and large firms (> 250) by number of employees (2008);
- NUTS III (Greater Lisbon and Setubal Peninsula, Pinhal Litoral and Greater Porto). This variable seeks to capture the regional structure under analysis.

As it is not financially possible to carry out an investigation of the entire population, a representative sample was subsequently chosen. This was obtained by stratification and proportional affixation, from telephone interviews conducted by an independent specialized company in late 2010 and early 2011. The survey included key components in line with the theoretical framework developed, covering the following aspects: description of the firm, innovation activities, internal resources and performance, activities involving different modes of innovation, external resources, types of proximity and aspects related to the crisis in the innovation process. This produced a database containing 397 observations, representative of the population on which the statistical and econometric work of this paper is based.

4. EMPIRICAL ANALYSIS: THE ECONOMIC CRISIS AND THE INNOVATION PROCESSES

We begin this exploratory analysis by examining some statistical results and then put forward two econometric models which allow us to test in a more robust way some significant connections between the innovation process and the current economic and financial crisis. First we recall that, as our survey shows, the international crisis had a negative impact on

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

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approximately 65% of firms, and this is true across the three control variables, as we can see in Table 1 (see section 3 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				
Greater Lisbon and Setubal Peninsula		**Pinhal Litoral**	**Greater Porto**	
63,6		66,2	66,3	

Source: Author´s own compilation based on the Business Survey.

In table 2 we identified the possible interaction channels that firms could use to interact with external actors. In the business survey we asked firms to identify the channels they normally used and then the importance they recognize to each channel used (Likert scale 1-5). These channels can be classified by its nature in market, institutional and personal channels. For each channel we also asked firms to identify and classify (in the same way as previous) the nature of interaction mechanism, like formal and informal mechanisms.

Table 2 – Channels of interaction: typology and nature

Typology	Nature
Suppliers	Market
Clients	Market
Consulting Services	Market
Labor Market	Market
Competitors	Market
Universities	Institucional
Polytechnics	Institucional
Research Laboratories	Institucional
Regional Innovation Center	Institucional
Professionals Associations	Institucional
Public Institutes	Institucional
Personal Relations	Personal

Source: Author´s own compilation.

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: regional, national, and international context, and the context without territorial reference

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(WTR). For each context we have constructed a variable synthesis that results from the following transformation: in the numerator we have the sum of the classification attributed by each firm to each channel (by the nature of interaction mechanism) and in the denominator would be the maximum that can be assigned. This variable ranges from 0.2 – if firms acknowledge the importance of each channel to a minimum (Likert=1) – and 1 – if such recognition is maximum (Likert=5). The importance allocated to each context increases as the value of the variable approaches 1.

Table 3 shows the aggregate importance – by context and mechanism of interaction – of the different knowledge channels used by firms in the crisis management.

Table 3 – Relevance of contexts and interaction mechanisms

Contexts	*Total*	*Mechanisms*	
		Formal	*Informal*
• Regional	**0,505**	**0,519**	0,491
• National	0,487	0,449	**0,525**
• International	0,412	0,392	0,431
• WTR	0,369	0,375	0,363
Total	**0,443**	**0,434**	**0,453**

Source: Author´s own compilation based on the Business Survey.

There are three important aspects to Table 3: first, the regional context is more highly valued as firms' favoured context for handling the crisis. Secondly, the decreasing importance attributed to the different contexts, if taken according to the criterion of traditional spatial proximity. Finally, informal mechanisms are valued more highly then the formal, with the exception of the regional context, where formal mechanisms of interaction are the most highly valued, albeit with an insignificant difference. Informal mechanisms of interaction have previously been clearly identified as being highly relevant to the process of innovation in firms (Lorenz, 2000; Fuller-Love, 2009; Nunes and Lopes, 2012b). In this case, we should also note the recognition of its importance for firms' adjustment to the negative impact of the crisis. In summary, these results show us that informal mechanisms of interaction play a key role in innovation, and that territory is an important factor in the innovation process. Indeed, the closer they are geographically, the more companies attach importance to the spatial contexts of innovation. There are various reasons for this, as documented in the specialty literature, mainly because geographical proximity is typically associated with institutional and cultural proximity, facilitating collaborative relationships which may be formal or informal, but are cemented in interpersonal trust. The following table shows, by decreasing level of importance, the most important channels of interaction (and the mechanisms underlying them) in firms' crisis management.

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Table 4 – 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	*Labor Market*
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	*Labor Market*
Innovation Regional Centers	Research Laboratories	Professional Associations
National Context		
Total	**Formal**	**Informal**
Labor Market	Competitors	*Labor Market*
Competitors	*Labor Market*	Higher Education
Clients	Clients	Research Laboratories
Higher Education	Higher Education	Clients
Innovation Regional Centers	Suppliers	Innovation Regional Centers
International Context		
Total	**Formal**	**Informal**
Labor Market	Clients	Higher Education
Clients	Research Laboratories	*Labor market*
Research Laboratories	Suppliers	Competitors
Competitors	Consultants	Research Laboratories
Higher Education	*Labor Market*	Suppliers
Context without territorial reference		
Total	**Formal**	**Informal**
Suppliers	Clients	Suppliers
Clients	Suppliers	Clients
Consultants	Higher Education	*Labor Market*
Competitors	Competitors	Consultants
Higher Education	Consultants	Competitors

Source: Author´s own compilation based on the Business Survey.

Taking Table 4 as a reference point, there are four aspects that should be noted. First, there is clearly a high diversity of interactions among multiple players in the different contexts. The collective and interactive nature of the learning process (in both formal and informal terms) in the context of economic crisis should be emphasized. Secondly, we should emphasize the importance of (formal and informal) access to specific channels of knowledge as a form of crisis management. This is true for interactions with consulting firms, regional innovation centres, higher education institutions and research laboratories. Thirdly, most firms recognize the importance of interaction with suppliers, clients and competitors, particularly informal interaction. Finally, in line with Roper and Love (2006), our results stress the important role of

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the labour market as a channel in managing the crisis, particularly its role as an informal relationship space. This probably means that the labour market allows firms to access external knowledge which is of strategic importance for readjusting the innovation process against a background of economic crisis.

If we analyze the impact of the crisis not only on the innovation process, but also in relation to results, it is possible to observe that, in terms of aggregate economic performance, the crisis had less of an impact on the most dynamic firms (Table 5).

Table 5 – 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**

Source: Author´s own compilation based on the Business Survey

Table 5 allows us to analyze the impact of the economic crisis on firms' aggregate economic performance. The survey gave us information on the economic performance of companies in the following four areas over the last five years: turnover, volume of employment, share of exports and order volumes. The survey responses have helped us to construct the "Aggregate Economic Performance" variable, which ranges from "zero indicators" (where there was no increase), to "four indicators" (where all four increased). The results suggest that as economic performance increases, the impact of the crisis on businesses reduces.

Having clarified the contexts and mechanisms of interaction, we go on to discuss the relationship between the impact of the crisis on the innovation process and the dynamics of interaction in firms. After this we test the relationship between the impact of the crisis and the relative importance which firms attach to context costs. Finally we test the relationship between

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the impact of the crisis and the different innovation modes performed by firms. To this end we developed the three econometric models below.

4.1. 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 "*low impact*" in their innovation process, "3" if the company indicated that the impact of the crisis was "*significant impact*" and "5" if the answer was "*high impact*". 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 (12 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 6 (all estimations were made using the statistic package "Stata 10.1").

Table 6 – Model 1: estimation results

Impact of Crisis in Innovation	*Coefficients*	*Impact of Crisis in Innovation*		
	Odds Ratio[4]	*(marginal effects)*		
		low impact	*significant impact*	*high impact*
Intensity of Networking	**0.0238*** (0.00332)**	**84,8***	**-22,9****	**-61,9****
Observations	397			

Source: Author´s own compilation *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

[4] When we are interpreting the output in the metric of odds ratio we can say that "*For a unit change in x_k, the odds are expected to change by a factor of exp($_k$), holding other variables constant*". The odds ratios are multiplicative, so positive effects are greater than one and negative effects are between zero and one (see, for example, Long and Freese, 2006). In this case, read it in percentage, when we increased the "Intensity of Networking" in one unit the odds of be in higher categories (where the impact of the crises is higher) decreases by 97,6% [(1-odds ratio*100)] face to belong to lower categories (where the impact of the crises is lower).

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firms increase the intensity of networking, the marginal effect on the probability of the firm being in class 1 (crisis have a low impact) increases 84.8%, being in class 2 decreases 22.9% and to be in class 3 (crisis have a high impact) 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.

4.2. *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 contextual 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), and which have high opportunity costs in relation to the effectiveness of the innovation process. The dependent variable is the same as the one we used in the previous models, and the independent variable is the "*importance of reducing context costs,*" which may take on five values on a Likert scale: 1 – "*very little importance*" to 5 – "*very great importance*". As before, we estimated Model 2 using an ordered logistic regression, and the estimation results of model 3 are analyzed in Table 7.

Table 7 – Model 2: estimation results

Importance of reducing context costs (IRCC)	*Odds Ratios* / *Coefficients*	*Impact of Crisis on Innovation (marginal effects) – significant values in bold*		
		Low impact	*Significant impact*	*High impact*
Very little importance – *Reference*				
IRCC – (Little importance)	**0.230** (0.0253)**	**35.1****	**-18.3***	**-16.8*****
IRCC – (Indifferent)	0.382 (0.105)	**21.6***	-5.7	-15.8
IRCC – (Great importance)	**0.320* (0.0585)**	**26.5***	-9.6	**-16.8****
IRCC – (Very great importance)	**0.164** (0.0157)**	**41.9*****	**-24.3****	**-17.5*****
Observations	397			

Source: Author's own compilation *Robust pvalue in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

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We may interpret the results in Table 7 to say that, to the extent that firms stress the importance of reducing context costs, there is a marginal decrease in the probability of the crisis affecting the innovation process. The analysis of marginal effects shows us that, for example, a firm stating that context cost reduction is "very great importance" to their process of innovation sees an increase of 41.9% in the probability of the impact of the crisis being of "low impact" to their innovation process. Simultaneously, the probability of the crisis having a "significant impact" or a "high impact" on their innovation process is reduced by 24.3% and 17.5% respectively.

4.3. *Impact of crisis and innovation modes*

Model 3 intends to test the relationship between the impact of the crisis and different modes of innovation. About different modes of innovation, see, for example, Nunes, Lopes and Dias, 2013, Gokhberg, Kuznetsova and Roud, 2012; Parrilli and Elola, 2011; Parrilli, González and Peña, 2012; Corrocher, Cusmano and Morrison, 2011; Marlon and Lambert, 2009; Žížalová, 2009; Jensen *et al*., 2007; Lundvall, 2007. These authors, at different degrees, were able classify different types of firms (and their behavior about innovation process) between two pure modes of innovation: Science-Technology-Innovation (STI-mode) and Doing-Using-Interacting (DUI-mode). The dependent variable is the same as we use in Model 1 and the independent variable is the "innovation mode" that can assume three different innovation modes: 1 – "*Moderate DUI*" mode, 2 – "*Moderate DUI/STI*" mode and 3 – "*Low learning DUI*" mode of innovation.

The estimation results of model 3 can be analyzed in table 8. Given the nature of the dependent variable, we estimated the model using an ordered logistic regression.

Table 8 – Model 3: estimation results

ICI	*Odds Ratios* / *Coefficients*	*Impact of Crisis in Innovation (marginal effects)*		
		Low impact	*Significant impact*	*High impact*
1. ***Moderate DUI – reference***				
2. *Moderate DUI/STI*	**0.496*** (0.00103)**	**16,6*** **	**-6,3** **	**-10,2*** **
3. *Low Learning DUI*	0.760 (0.331)			
Observations	397			

Source: Author´s own compilation *Robust pvalue in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

The estimation results of model 3 reveal that adopting the innovation mode "*Moderate DUI/STI*" reduces the probability of the firms feel more intensively the negative impacts of the

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economic crisis. Moreover, remember, this way of promoting the innovation is associated with a better innovative and economic performance, as we concluded in Nunes, Lopes e Dias (2013).

The analysis of the marginal effects allows us to affirm that firms belonging to the innovation mode "*Moderate DUI/STI*" increases, in marginal terms, 16.6% the probability of the impact of the crisis was "low impact". On the other hand, belonging to the innovation mode "*Moderate DUI/STI*" decreases by 6.3% and 10.2% the probability of firms refers that the crisis had a "significant impact" or a "high impact", respectively. Firms that combine the two types of innovation modes seem to resist better to the economic crisis.

5. 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, in line with other international results (see, for example, Archibugi, Filippetti and Frenz, 2013) 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 (see, in Table 4, the nature of the interaction channels);
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;
5. Finally, we found evidence that firms that combine the two types of innovation modes (DUI and STI) seem to resist better to the economic crisis.

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

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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, our results confirm the importance of innovation as a business strategy. It allows firms to perform better economically because it seems to help them deal with economic and financial adversity. From the point of view of regional policy and innovation, the importance given to knowledge networks and contextual factors reinforces the need for formulating policies for the territory supported by resources which are hard to transfer and may reinforce territorial capital (relational, institutional and social capital) as Camagni (2008) conceptualizes it. Additionally, public policy faces some new challenges. On the one hand, the importance attached to relational capital (promoting different types of networking) and, on the other, the replacement of austerity policies by policies to enhance the *milieus* and achieve reductions in context costs, particularly those affecting the innovation process.

Another important insight is the key role of the territory. The territory should be seen as the context for integrating 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 labour market for this), and is the best environment for developing the trust required by the relationships between the actors involved in the innovation process. In this way the territory is not only a source of knowledge critical to the innovation process, but also a source of the trust which helps to reduce opportunistic behaviour and the economic risks of innovation.

If it is true that these results give some indication of 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 challenges and dilemmas which are extremely worrying in the short term. One of the relevant questions is the role of "competitive austerity" in the sustainability and development of the innovation process. In Portugal, for example, "competitive austerity" should be understood as reflecting the faith of the “troika” and the government, who believe that the economy will become more competitive 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. The policies associated with “competitive austerity” militate against – and may even destroy – the conditions required for implementation of a regional policy supported by innovation strategies. The first – and for some, unexpected result of "competitive austerity" has been the reduction in the quantity and

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quality of financial, organizational, human and territorial resources available in the economy. In the short term this decline is reflected in the weakening of the relational structures of the economy and the territories, a lowering of confidence among economic actors, damage to the structure of social capital, and even to the levels of civic engagement in society, increasing context costs and the fear and cost of developing new projects.

The deliberate commitment to reducing real wages and the labour force economic potential – and therefore the knowledge that it incorporates – irreparably damages the sustainability of the innovation process. In addition, it sends out signals to economic actors, as far as the choices available to them are concerned, that a strategic option has been chosen, based on "competition-by-price" rather than on "competition-by-innovation". This option has costs in the present and 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.

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

We conclude with a question which we hope will lead to reflection and further research. Can we ensure that the relational links underpinning the innovation process, once broken, will easily be re-established, given that the innovation process is a highly uncertain, costly, interactive, cumulative, systemic and collective process? Or, by contrast, will "competitive austerity" reduce the intensity and complexity of relational and institutional capital, destroying (irredeemably for some productive structures and territories) the effectiveness of the innovation process?

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