Territorial aspects of the degree of novelty of the innovation in Brazil

Abstract: This paper explores the effect of territorial factors in shaping firm innovative performances by using an original firm and regional-level dataset. Rooted in the geography of innovation literature, this paper put more light the debate on Brazil's innovation and the role of geography. The empirical results indicate that territorial factors are amongst the determinants of firm's' innovative performances, even in developing countries such as Brazil. Our evidence suggests that local human capital and regions level of wealth play a key role in shaping the generation of higher degrees of novelty of the innovation in Brazil. Besides, these factors present greater effect on the innovations introduced in industry.

Keywords: Degree of Novelty of Innovation, Geography and Innovation; Local Knowledge Spillovers; Regional Productive Structure; Local Human Capital.

Código JEL: O31; O18; R12

Introdução:

This paper aims to analyse how territorial factors affect the ability of Brazilian firm to introduce innovation. In particular, the purpose of the study is to deepen and complement the discussion of how regional factors in which the firm is embedded can generate innovative differential to them. That is, as firms similar in some aspects may differ in generating innovation due to its location. In particular, it analyses how local knowledge spillovers, agglomeration, human capital, and the productive structure affect the degree of novelty of innovation. The main hypothesis of this study is that regional characteristics, such as knowledge spillovers, agglomeration, regional production structure and the availability of local resources can affect the degree of novelty of innovation that it is introduced by firms in Brazil. We distinguished the degree of novelty of the innovation by the firms did not innovate, firms that introduced innovation a *new to the firm*, firms that introduced innovation *new to the domestic market*, and firms that introduced innovation a *new to the world*. So, we not look only if there is innovation or not, but also the degree of novelty innovation in terms of market.

In the recent literature here is a lively debate on the drivers ability of firms to innovate is the subject of several studies in recent years. The literature suggests that innovation is highly related to the ability that firms have to absorb and transform the resources related to knowledge. These capabilities are closely linked to the firms' financial and human resources and its internal organization. In addition, external factors, such as production structure and knowledge spillovers, can also affect innovative performance of the firm. It should be noted that knowledge, especially tacit knowledge, is an important factor of the geography of innovation. Knowledge is largely tied to the perception of those who transfer and those who receive, so that the proximity between the agents tends to facilitate the acquisition and dissemination of knowledge and thus innovation. The location can also affect innovation, as several studies pointed it out. Empirical studies have proposed indicators of production and innovation to analyse the relations between innovation and territory.

Econometric analysis of the relation between regional characteristics and innovation is widespread and widely discussed. However, until the 1990s, debate on territory and innovation has been focused on developed countries. Recently increasing attention has been

given to emerging countries (CRESCENZI; JAAX, 2015; CRESCENZI; RODRÍGUEZ-POSE; STORPER, 2012; PLECHERO; CHAMINADE, 2016). In Brazil, previous studies have been directed to understand how innovation is distributes among regions, their heterogeneity and which factors can affect their distribution. However, studies that directly relate firm-level innovations and geography are still scant. This work addresses this gap by applying a Knowledge Production Function (KPF) to examine how firm-level and regional-level factors affect the degree of novelty of innovation in Brazil, using PINTEC microdata.

Results show that territorial factors play an important role in shaping firm innovative performance, even in developing countries, such as Brazil, where innovations tend to be mostly new to the firm. This indicates that firms located in places with more human capital and relative wealth are more likely to introduce innovations with higher degree of novelty than firms located in others places. This implies that firms in more rich regions and with higher share of qualified workforce are able to generate innovation with higher degree of novelty, as new to the world.

This paper is organized into four sections, excluding this introduction. The first section presents the main conceptual debates regarding the geography of innovation. Section two presents the empirical model, variables and proxies. Section three presents the empirical results. Finally, section five presents final remarks.

1. Background

The relationship between innovation and geography has been studied by several authors in different contexts (AUDRETSCH; FELDMAN, 1996a; CARLINO; CHATTERJEE; HUNT, 2007; CRESCENZI; RODRÍGUEZ-POSE; STORPER, 2007; JAFFE et al., 1993). In general, the main assumption for the importance of geography lies on the fact that the knowledge, main input of innovation, often requires spatial proximity to be better understood and shared. This is mainly due to the fact that knowledge has both a tacit and codified component. In particular, tacit knowledge is not easily transmittable across space because is conditioned to the perception and awareness of receiver and transmitter. Thus, the proximity between the agents is fundamental for the assimilation of tacit and complex knowledge, that would otherwise be impossible and very expensive to encode (BRESCHI; LISSONI, 2001; GERTLER, 2007; MASKELL; MALMBERG, 1999; POLANYI, 1966; STORPER; VENABLES, 2004). In this sense, the innovation process is characterized by severe degrees of division of labour and knowledge flows that are more easily accessible in a locality where the actors interact more frequently and have direct contacts. Therefore, the innovative activities are strongly influenced by local context. Thus, in certain circumstances, location play a key role in shaping firms innovative performances.

Although it is understood that the mere exposure to knowledge does not guarantee that the firm will innovate, the concentration of agents tends to increase possibilities for combination and lower costs of knowledge exchange, which make individuals (firms) more productive and innovative than in other places. Thus, the literature points out that even within regions that spend the same amount on R&D, the innovation levels may differ, especially when they have different degrees of agglomeration. In other words, a "critical mass" of agglomeration is necessary in order to expect substantial local economic effects of the innovation efforts (AUDRETSCH; FELDMAN, 1996a; CARLINO; CHATTERJEE; HUNT, 2007; DURANTON; PUGA, 2000; VARGA, 2000). Thus, it is expected that firms inserted in driver centres of innovation enjoy advantages in comparison with firms in other regions.

The importance of local agglomerations was initially treated in Marshall's work. Marshall (1920) argues that the spatial concentration of firms is justified by the easy access to a range of benefits that are important to increase market competitiveness of these firms

(AUDRETSCH; FELDMAN, 1996a; CARLINO; CHATTERJEE; HUNT, 2007; FRITSCH; SLAVTCHEV, 2010; JAFFE et al., 1993; MARSHALL, 1920; ROSENTHAL; STRANGE, 2001; VARGA, 2000). In this context, knowledge spillovers are seen as an important element that reinforces the importance of local context to appropriate innovation. That is, important portions of the knowledge generated in the firms go beyond their limits and become available to other agents in surroundings. In this sense, through knowledge spillovers, the firms' innovation efforts may end up benefiting the innovative activities of all agents nearby. Similarly, the new knowledge generated in the local is more accessible to local agents. Thus, if firms have the ability to take ownership of knowledge from different sources, the knowledge spillovers become an essential source of knowledge for innovation (AUDRETSCH; FELDMAN, 2004; BRESCHI; LISSONI, 2001; COHEN; LEVINTHAL, 1990).

Another issue pointed out in the literature is the importance of the local productive structure and its influence on the innovative performance of firms. The productive structure in one place can be considered specialized or diversified. The externalities of the specialized (referred to as Marshallian) regions are associated with the proximity between firms of the same industry (CABRER-BORRAS; SERRANO-DOMINGO, 2007; CRESCENZI; RODRÍGUEZ-POSE; STORPER, 2012; VAN DER PANNE, 2004). According to this view, a firm located in a specialized region has a set of assets available for the generation and propagation of knowledge, with positive effects on innovation. In diversified regions it is from the variety or diversity of economic activities that the positive externalities are derived, following the work of Jacob (1969). This view is based on the hypothesis that the most relevant innovations are associated with the exchange of knowledge between agents from different sectors. In this way, be located in diverse regions is what offers greater capacity to a company to incorporate quickly advances of other sectors and of other areas of knowledge (CARLINO; CHATTERJEE; HUNT, 2001; CO, 2002; FELDMAN; AUDRETSCH, 1999; FRITSCH; SLAVTCHEV, 2010). However, as FRENKEN et al. (2007) argue, this diversification cannot be completely disconnected, so it is important that the local industries are different but related, since regions hosting related industries can more easily engage in recombinant innovation (FRENKEN; VAN OORT; VERBURG, 2007).

Another local factor that can sustain the firms' innovative performance is the qualification of the local workforce. Human capital can determine the ability of the firm to generate innovation and absorb knowledge that is crucial for innovation. Thus, firms located in places with better pool of skilled workers should have greater chances of innovating, since they have greater opportunities of choice. Moreover, the availability of a skilled workforce allows costs to be reduced with qualification and training. This reduction can be advantageous and make other investments available in other factors that are also important in the innovation process. Therefore, the local skilled labour available in the places where the firms are inserted can represent a differential so that they can improve their innovative potential, introducing innovations with better degree of novelty (COHEN; LEVINTHAL, 1990; HENDERSON, 2003; RODRÍGUEZ-POSE; VILLARREAL PERALTA, 2015; TEECE; PISANO, 1994a; VARGA, 2000).

In short, firm’s capacity to innovate is determined by its accumulated knowledge generated from past activities, coming from R&D activities, human capital, organizational structure and environment in which the firms are embedded. According to the learning abilities theory this arguably due to the fact firms' internal efforts that enables them to realize and take advantage of new knowledge, providing them competitive advantage (TEECE; PISANO, 1994b). Furthermore, it depends on a number of external factors that may or may not accelerate

innovation. In other words, firms do not innovate just with their internal resources, but also depend on the availability of a set of factors that may or may not speed up innovation. Therefore, innovation should not occur in the same way everywhere, usually with heavy reliance of the surroundings where the company is located.

2. Empirical Model

2.1 Data

In this section, we provide brief details of the datasets used, followed by a discussion of the dependent variable, the variables of interest and control variables. To examine how the territorial factors, affect the degree of novelty of the innovation in Brazil we used a specific dataset, with 7,172 firms, derived mainly from **two** data sources.

First, we gathered our firm-level data from the Innovation Research in Brazil (PINTEC[1]). This dataset is maintained by the Brazilian Institute of Geography and Statistics (IBGE).and it is a cross survey that covers the information about activities of innovation in Brazil, such as expenditure, sources of financing, the impact of innovations. **Second**, we collected our regional-level data from the Annual Report on Social Information (RAIS) of the Ministry of Labour. This dataset contains the register of all establishments and its employees, which allows constructing regional variables. This register is also used at the firm level to allocate a region (city or micro-region) to a firm (using code of the firm headquarters identifier), since PINTEC data does not allow to identify firm location.

For this research, we used PINTEC and RAIS 2008, and PINTEC 2011. So, it was studied in this work only the firms present in both PINTEC surveys. The main reason for the use of both surveys is the fact that innovative efforts (inputs) do not translate into innovation output immediately but it requires some period. In this sense, the PINTEC 2011 is used as innovation outputs (degree of novelty of innovation), while the PINTEC 2008 and RAIS 2008 are used as inputs[2].

2.2 Dependent variable.

This aim of this paper is to examine how the territorial factors, affect the degree of novelty of the innovation in Brazil. Therefore, the dependent variable is the degree of novelty of the innovation. This is categorical ordinal variable that assess the degree of a firm's innovation. This information comes from PINTEC 2011, which ask to the firm to indicate if introduced, between 2009 and 2011, innovation. If the answer is yes, the firm was asked to indicate the degree of novelty of that innovation in terms of the market. The options were *new to the firm* (new goods or services already available from its competitors in the domestic market), *new to the industry* or *domestic market* (new goods or services, but already available in other markets) and *new to the world* (if the firm introduced new goods or services to the global market before its competitors).

In order to distinguish the degree of novelty of the firm innovative performances our dependent variable takes the value equal to 0 when the firm not introduced innovation, equal to 1 when the firm introduced a good new to the firm (new to the firm, but existing in the

[1] The IBGE conducted and published a total of six editions of Innovation Research, which were PINTEC 2000 that covers the triennium 1998-2000, PINTEC 2003 (triennium 2001-2003), PINTEC 2005 (triennium 2003-2005), PINTEC 2008 (triennium 2006-2008), PINTEC 2011 (triennium 2009-2011) and PINTEC 2014 (triennium 2012-2014).

[2] It should be pointed out that time references are made of different ways for the different variables. In general, the variables which do not involve value record are accounted in three consecutive years, i.e, from 2006 to 2008 for PINTEC 2008 and from 2009 to 2011 for PINTEC 2011. Variables with value are measured in the last year of the reference of the survey.

domestic market), equal to 2 when the firm introduced a good new to the domestic market, and equal 3 the firm introduced good new to the world.

It should be emphasized that this type of measure, although more detailed, has been little used due to the difficulty of obtaining this data, some exceptions are (AMARA et al., 2008; BLOCH; MORTENSEN, 2008; HARIRCHI; CHAMINADE, 2014; NIETO; SANTAMARÍA, 2007; PLECHERO; CHAMINADE, 2010; VEGA-JURADO et al., 2008).

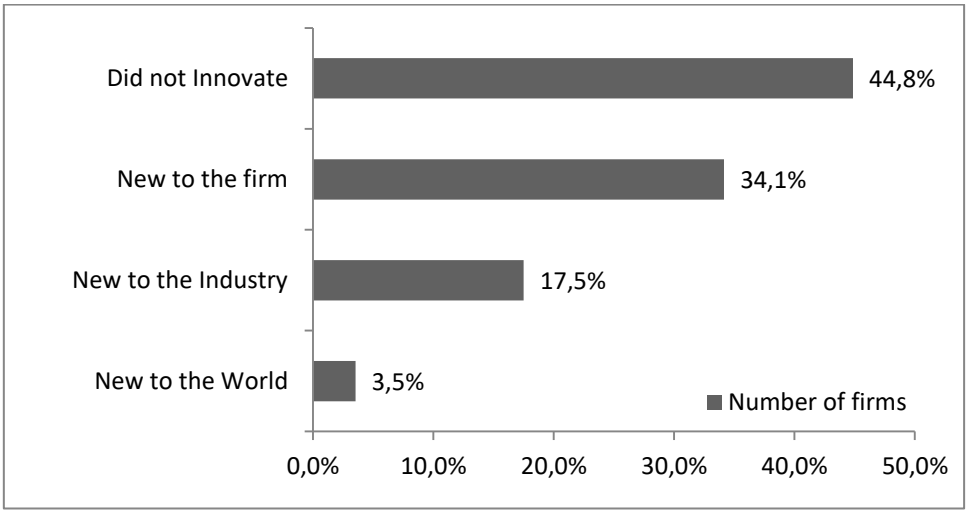

Figure 1 - Degree of Novelty of the Innovation in Brazil - 2009 to 2011

Figure 1 illustrates the innovation in Brazil. What stands out in Figure 1 is the low number of firms that have introduced innovations new to the world (only 3.5%). On the other hand, there are many firms that have not introduced any innovations in the period that we are considering. This shows the low level of innovation in Brazil.

The innovation, like all complex reality, depends on a wide range of factors that enable this process to be successful or not. In Brazil, this is not different, thus the reasons for the low innovative dynamism can be several. Among them, we can point the weak engagement of firms in technological activities, particularly in Research and Development (R&D). In contrast to what is seen in other countries, the universities, not the firms, which account for most of the expenditure on R&D and employ scientists and engineers. In addition, the competitive conditions in the economy combined the heterogeneity of Brazilian regions also affect technological activities. Looking at innovation from the point of view of location, the drives are diverse and can vary. It is for this reason that several works, like this, are seeking to understand how and why different local factors can make firms more prone to innovate.

2.3 Explanatory Variables.

It is possible to divide the independent variables into two main levels of analysis: region and firm. At a regional level we study six regional characteristics.

The first characteristics is knowledge spillovers – $\boldsymbol{WRD_{r,08}}$. The literature suggests that the innovations efforts not only increase the capacity to generate new knowledge, as also it can give them the ability to internalize knowledge from other sources. In this sense, if the firms have this capability, the knowledge spillovers can represent an important input of your

innovative activity[3]. To measure the knowledge spillovers we used the sum of innovation efforts in the city where the firm is located, except innovation efforts of firm itself.

The second characteristic is agglomeration. We use two measure to agglomerations: Population density – $\boldsymbol{AggP_{r,08}}$ and Firm`s density – $\boldsymbol{AggF_{r,08}}$. Densely populated areas play an important role in the flow of ideas, making firms located in these areas more innovative than others located elsewhere.

The third variable is a relative wealth proxied by the GPD per capita of the firm's city - $GDP_{r,08t}$.

The four variable is the productive structure of the region in which the firms operate, $StructProd_{r,08}$[4]. This variable captures the degree of local specialization or diversification where the firm is located or the relation of the sectors in regions. To do this, we used two indexes. The first is the Krugman index, calculated by the number of employees in the manufacturing in the regions (CRESCENZI; RODRÍGUEZ-POSE; STORPER, 2007; PALAN, 2010). The Krugman index is calculated as follows:

$$Kindex_{r,t-T} = \sum abs\left(v^{k}_{r,t-T} - v^{-k}_{r,t-T}\right) \qquad with \quad v^{k}_{r,t-T} = \frac{\sum_{j \neq r} x^{k}_{r,T-t}}{\sum_{k}\sum_{j \neq r} x^{k}_{r,T-t}}$$

Thus, $\boldsymbol{v^{k}_{r,T-t}}$ is part of a sector *k* in the region *r* on all firms in this region and $\boldsymbol{v^{-k}_{r,T-t}}$ is part of the same industry of all other different regions of *r* divided by all firms of other regions of different *r*. The index has a value close to zero if the micro-region is more diversified and a maximum of 2 if more specialized. The inclusion of this variable seeks to assess whether there is a different impact on the ability to innovate in firms located on regions with specialized or diversified productive structure.

Another index that we included in the model is related and unrelated variety. Related variety is industrial sectors that are related in terms of shared or complementary competences that both require communication and interactive learning (BOSCHMA; IAMMARINO, 2007; FRENKEN; VAN OORT; VERBURG, 2007; KRAFFT; QUATRARO; SAVIOTTI, 2014; NOOTEBOOM, 1999). Following Frenken et al. (2007), we make use of the entropy measure to indicate both types of variety at different levels of sectoral aggregation, based on the existing classification of sectors. Again, we used the number of employees in the manufacturing and extractive in the micro-regions at the 3 digit level. The related and unrelated variety ($\boldsymbol{RV_{r,08}}$ and $\boldsymbol{UR_{r,08}}$) are calculated as follows:

$$RV_r = \sum_{c=1}^{C} P_c H_c \quad and \quad UR_r = \sum_{c=1}^{C} P_c \log_2\left(1/P_c\right) \qquad with \quad P_c = \sum p_d \quad and \quad H_c = \sum_{d \in S_c} \frac{p_d}{P_c} \log_2\left(p_c / p_d\right)$$

Unrelated variety per region is indicated by the entropy two-digit aggregate for Castellacci class distribution and related variety is indicated by the weighted sum of the entropy at the three-digit level within each Castellacci Taxonomy and added Extractive Industry[5].

Rounding out the list of variables at the regional level there is an indicator that aims to capture the structure of productive resources available in firm's city, named Human Capital -

[3] This indicator may be representing by the functional form following: $\mathrm{WRD}_{r_i 08} = \sum_{r_i}\left[Invest\ Innovation / Gross\ Sales\right]_i,\ i \neq j$

[4] It should be pointed out that unlike other regional variables this variable is calculated for micro-regions, and not city, since that indicator is the better represented at this level.

[5] Castellacci Taxonomy is presenting annex.

$HC_{i,T-t}$, as Crescenzi et al, 2007 and 2012. The Human Capital Index is constructed through Principal Component Analysis (PCA)[6] of the individual variables that represent the workforce employed in firm's city and that should make a firm more or less innovation prone. The individual variables are:

- the qualification of employees measured by share of the workforce who have completed tertiary education (include masters and PhDs) in firm's city -***Educ***.
- the resources in Science and Technology measure by percentage the workforce employed in technological and science occupations in firm's city- ***ST***[7]**.**
- the demographic structure of employment measured by share of employees who are age between 15 and 24 in firm's city - ***Age***.

The combination of individual variables into one single composite indicator (*the 'Human Capital Index'*) develops a quantitative variable of the local structure of labour force, making it possible to compare the social filter conditions of different regions. We use the first principal component. All the variables enter the first principal component, which explain 46% of variation in the variables with the expected sign. The tertiary education and S&T variables are positively associated with the composite social filter variable, while the percentage of young employees has the negative sign. The level of educational attainment of the employees has the strongest association with the composite variable whereas the weakest is related to the percentage of young employees (Appendix A).

Regarding at the level of the firm, we employ a number of control variables which are correlated with the creation of knowledge and thus with innovation. The first variable is the innovation efforts - $\boldsymbol{RD_{i,T-t}}$ that represent total (internal and external) expenditure in activities of innovation . This variable is measure by the sum of expenditure activities of innovation divided by gross sale.

The second variable is the size of the firm- $\boldsymbol{Size_{i,T-t}}$. This variable allows capturing differentials generated by more staff which can raise the possibility of combinations of knowledge.

The third variable is the measure of productivity of the firm - $\boldsymbol{Prod_{i,t-T}}$. As shown by Cohen and Levithal (1990) and Teece and Pisano (1994) innovations are dependent on the trajectory of accumulation of firms, thus enabling differentiated gains. In this sense, this variable is measured by industrial added value divided by total employees.

The fourth, fifth, sixth, seventh and eighth variables are dummies to control regions, sector, public funding, collaborations and capital origin. So, $\boldsymbol{PublicFund_{i,t-T}}$, the fourth variable, is a measure if firms receive or not public funding to help its innovative activities.

$\boldsymbol{Coll_{i,t-T}}$, the fifth variable, is a measure of collaboration between the agents involved in the innovation process. According to Teese and Pisano (1994), collaborations and partnerships can be a learning path for the firm. Thus, this variable assumes binary value, 1 if the firm has been involved in cooperative arrangements with other(s) organization(s) for developing innovative activities and zero otherwise.

The sixth variable is $\boldsymbol{CCO_{i,t-T}}$ that control specificities of the firm's controlling capital origin, and assumes value 1 if the firm's controlling capital is national; 2 if firm's controlling capital is foreign; and 3 if firm's controlling capital is both.

[6] The Principal Component Analysis is a technique which combines measures in a non-correlated order of importance, and describes the data variation.

[7] The data were selected from the 2002 Brazilian classification of Occupations (CBO2002) at subgroup level: 20-Polyscientific Researchers and Professionals; 21-Professionals in the exact sciences, physics and engineering; and 22-Professionals in the biological sciences, health and related.

The seventh variable is industry dummy - $\boldsymbol{Sector_{i,t-T}}$ that controls the idiosyncrasies of each sector that may affect the ability of firms to innovate. To select the sector we used Castellacci taxonomy and added the extractive industry.

Finally, the eighth variable at the firm level is the firm's macro-region - $\boldsymbol{MacroR_{i,t-T}}$ which controls the idiosyncrasies of each region.

Thus, the model in this work can be represented by the following form:

$$Degree_{i,09\text{-}11} = \beta_0 + \beta_1 \ln(WRD_{r_i,08}) + \beta_2 \ln(AgglP_{r_i,08}) + \beta_3 \ln(AgglF_{r_i,08}) + \beta_4 StrucProd_{r_i,08} + \beta_5 HC_{r_i,08} + \beta_6 \ln(RD_{i,08}) + \beta_7 \ln(Size_{i,08}) + \beta_8 \ln(Prod_{i,08}) + \beta_9 Coll_{i,08} + \beta_{10} CCO_{i,08} + \beta_{11} Sector_{i,08} + \beta_{12} MacroR_{i,08} + \varepsilon \quad [1]$$

In table 1 is shown the summary of the variables.

Table 1 - Variables Summary

VARIABLE	DESCRIPTION	DEFINITION/PROXY	SOURCE
DEGREE	Degree of novelty of Innovation in Product or/and Process	The firm no introduced new product and/or process	PINTEC
		Product and/or process new for the firm	PINTEC
		Product and/or process new for the domestic market	PINTEC
		Product and/or process new for the world market	PINTEC
WRD	Spillovers	Total all other of firms' Innovative Expenditure/Gross Sales in firm's city	PINTEC
AggP	Population Density	Population/ region area in firm's city	IBGE
AggF	Firm`s Density	Number of Firms/ region area in firm's city	IBGE
RW	Relative Wealth	GDP per capita in firm's city	IBGE
KindexM	Measure of specialization regional	The index is calculated by share employment on the basis of the 29 major industry divisions (2 digit) - manufacture and extractive of the CNAE - Brazilian Standard Industrial Classification in in firm's micro-region.	RAIS
RV	Related Variety		RAIS
UV	Unrelated Variety		RAIS
HC	Human Capital (PCA)	% employees with completed tertiary education in firm's city	RAIS
		% of employees aged 15-24 in firm's city	RAIS
		% of employees in technologies activities in firm's city	RAIS
RD	R&D	Total expenditure on Inovative Actitvities as a % of Gross Sales	PINTEC
Size	Size of Firm	Number of Employees	PINTEC
Prod	Productivity	Industrial Added Value/ Number of employees	PINTEC
PublicFund	Dummy for Public Funding	Not	PINTEC
		Yes	PINTEC
Coll	Dummy for Collaboration with others agents	Not	PINTEC
		Yes	PINTEC
CCO	Dummy for Firm's controlling capital origin	National	PINTEC
		Foreign	PINTEC
		Share (National and Foreign)	PINTEC
Sector	Dummy for industries (Castellacci Taxonomy+ Extractive)	AKP	PINTEC
		Extra	PINTEC
		MPG	PINTEC
		Others	PINTEC
		PGS	PINTEC
		SIS	PINTEC
MacroR	Dummy for firm's Brazilian macro-region	N	RAIS
		NE	RAIS
		S	RAIS
		SE (without SP)	RAIS
		CW	RAIS
		SP	RAIS

4. Empirical Results

Table 1 provides the results of our analysis. We have two sets of estimates. In the first set are the results of the estimates that use the Krugman Index and in the second set are the results of the estimates that consider the related and unrelated variety. In both sets we present the coefficients and the marginal effect in each category of degree of novelty of the innovation.

Table 2 - Ordered Probit Estimation – Degree of Novelty of Innovation Brazil, 2008-(2009-2011).

		Degree of Novelty of the Innovation									
			Marginal Effects					Marginal Effects			
			No	New to the				No	New to the		
	VARIABLES	Coef.	Innovation	Firm	Industry	World	Coef.	Innovation	Firm	Industry	World
Regional Level	***Knowledge Spillovers (ln)***	-0.054	0.019	-0.005	-0.010	-0.0036	-0.056	0.020	-0.006	-0.010	-0.004
		(0.042)	(0.015)	(0.004)	(0.008)	(0.003)	(0.043)	(0.015)	(0.004)	(0.008)	(0.003)
	GDP per capita (ln)	**0.164***	**-0.059***	**0.016***	**0.032***	**0.011***	**0.165***	**-0.060***	**0.017***	**0.032***	**0.011***
		(0.092)	**(0.033)**	**(0.009)**	**(0.018)**	**(0.006)**	**(0.091)**	**(0.033)**	**(0.009)**	**(0.018)**	**(0.006)**
	Population Density (ln)	-0.062	0.023	-0.006	-0.012	-0.004	-0.052	0.019	-0.005	-0.010	-0.004
		(0.085)	(0.031)	(0.008)	(0.016)	(0.006)	(0.086)	(0.031)	(0.009)	(0.017)	(0.006)
	Firm`s Density (ln)	0.067	-0.024	0.007	0.013	0.005	0.056	-0.020	0.006	0.011	0.004
		(0.085)	(0.031)	(0.009)	(0.016)	(0.006)	(0.086)	(0.031)	(0.009)	(0.017)	(0.006)
	Human Capital	**0.089****	**-0.032****	**0.009****	**0.017****	**0.006****	**0.104****	**-0.037****	**0.010****	**0.020****	**0.007****
		(0.040)	**(0.014)**	**(0.004)**	**(0.008)**	**(0.003)**	**(0.043)**	**(0.016)**	**(0.004)**	**(0.009)**	**(0.003)**
	Krugman index	0.059	-0.021	0.005	0.011	0.004					
		(0.166)	(0.060)	(0.017)	(0.032)	(0.011)					
	Related Variety						0.038	-0.014	0.004	0.007	0.003
							(0.073)	(0.026)	(0.007)	(0.014)	(0.005)
	Unrelated Variety						-0.117	0.042	-0.012	-0.023	-0.008
							(0.130)	(0.047)	(0.013)	(0.025)	(0.009)

Continue

VARIABLES		Degree of Novelty of the Innovation									
			Marginal Effects					Marginal Effects			
			No	New to the				No	New to the		
		Coef.	Innovation	Firm	Industry	World	Coef.	Innovation	Firm	Industry	World
Firm's Level	***Innovation expenditure(ln)***	0.348**	-0.126**	0.035**	0.068**	0.024**	0.348**	-0.126**	0.035**	0.068**	0.023**
		(0.155)	(0.056)	(0.016)	(0.030)	(0.011)	(0.155)	(0.056)	(0.016)	(0.030)	(0.010)
	Size (ln)	0.361***	-0.102***	0.028***	0.055***	0.019***	0.282***	-0.102***	0.028***	0.055***	0.019***
		(0.094)	(0.012)	(0.005)	(0.00640)	(0.0026)	(0.035)	(0.012)	(0.005)	(0.006)	(0.003)
	Productivity	0.282***	-0.130***	0.036***	0.070***	0.024***	0.359***	-0.130***	0.036***	0.070***	0.024***
		(0.035)	(0.033)	(0.010)	(0.018)	(0.007)	(0.093)	(0.033)	(0.010)	(0.018)	(0.006)
	Public Funding	0.177**	-0.064**	0.016**	0.035**	0.013**	0.175**	-0.063**	0.015**	0.035**	0.013**
		(0.071)	(0.025)	(0.006)	(0.014)	(0.006)	(0.071)	(0.025)	(0.006)	(0.014)	(0.006)
	Collaboration	0.203***	-0.073***	0.017***	0.041**	0.015**	0.205***	-0.074***	0.017***	0.041***	0.015**
		(0.077)	(0.028)	(0.006)	(0.016)	(0.006)	(0.077)	(0.028)	(0.006)	(0.016)	(0.006)
	Controlling Capital Origin (Foreign)	0.269***	-0.096***	0.019***	0.055***	0.022**	0.265***	-0.095***	0.019***	0.054***	0.021**
		(0.095)	(0.033)	(0.005)	(0.020)	(0.009)	(0.096)	(0.034)	(0.006)	(0.021)	(0.009)
	Controlling Capital Origin (Share)	-0.197	0.073	-0.025	-0.037	-0.010	-0.202	0.074	-0.026	-0.037	-0.011
		(0.199)	(0.073)	(0.029)	(0.035)	(0.009)	(0.199)	(0.073)	(0.029)	(0.035)	(0.009)
	Sectoral Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Macro region Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Cut1	1.845***					1.805***				
		(0.595)					(0.565)				
	Cut2	2.874***					2.835***				
		(0.595)					(0.564)				
	Cut3	4.007***					3.968***				
		(0.598)					(0.573)				
	Pseudo-R^2	0.065					0.065				
	Chi^2	291.1					294.9				
	Ll	-7710					-7708				

***** p<0.01, ** p<0.05, * p<0.1**

In general, in regional level the results show that only local human capital and relative wealth affect the degree of novelty of innovation, while others territorial factors have no significance. Specifically, the coefficient R&D spillover (***WRD***) is not significant. Although nothing can be said of the relationship between spillovers and innovation in Brazil, it should be pointed out that this result is inconsistent with the primary conceptual assumptions presented on the discussion which firms tend to take advantage of spillovers to innovate. We can point to two possibilities for this result. First, the innovative efforts of neighbour firms are not potential inputs for innovation, since there are low amounts spent on R&D by firms in Brazil. Second, it is that the level of aggregation used to capture the spillovers is unable to measure them.

Looking at the role of agglomeration effects, both population density ($\boldsymbol{AggP_{r,T-t}}$) and firms density ($\boldsymbol{AggF_{r,T-t.}}$) are not significant. So, the agglomeration does not emerge as a differential factor to degree of novelty of innovation in Brazil. Possibly, in a context of low labour mobility and skill as in the Brazil the local interaction density (population density) does not seem to stimulate innovation.

We identify a positive and statistically significant association between relative wealth ($\boldsymbol{GDP_{r,T-t.}}$) and degree of novelty of the innovation. This result shows that firms located in economically dense regions are more likely to generate innovations higher degree of novelty than firms located elsewhere. So, the relative concentration of wealth can be a differential source of competitive advantage for firms to promote innovation and better degree of novelty. This result is similar to that found by Crescenzi et al. (2007) that analyses the territorial dynamics of innovation in the United States and Europe, which showed that population agglomeration is not significant while economic agglomeration is positive and significant. However, this result differs from several studies that point to the importance of urban agglomeration in the innovation process and, it shows that agglomerations are places efficient to create new ideas and innovation (ARAUJO, 2014; AUDRETSCH; FELDMAN, 1996b; CARLINO; CHATTERJEE; HUNT, 2001; RODRÍGUEZ-POSE, 2011; ROSENTHAL; STRANGE, 2004).

Specifically, looking the magnitude of the coefficients, a 1% increase in relative wealth in cities (GDP per capita) decrease the chance that firms do not innovate by 6 percentage points (pp). In other categories, 1% more in relative wealth in cities increases the probability of the firm generating innovation by 1.6pp to the firm, 3.2pp to the industry and 1.1pp to the world.

The human capital coefficient ($\boldsymbol{HC_{r,T-t.}}$) is positive and significant. Our finding suggests that increases in the regional level of human capital may rise the degree of novelty of the innovations that firms introduce in Brazil. That is, firms located in cities that have more human capital, based on the combination of higher numbers of employees with higher education and technology activities, and a lower number of employees between the ages of 15 and 24, are more likely to introduce innovations with a higher degree of novelty, as to the world. This result corroborates the assertion that human capital is crucial to the innovation process because it is the concentration of firms and skilled workers that increases the creation and diffusion of knowledge that is essential in the innovation process (ACS; ANSELIN; VARGA, 2002; ACS; AUDRETSCH, 1987; CARLINO; CHATTERJEE; HUNT, 2006; COHEN; LEVINTHAL, 1990; GRILICHES, 1979; TEECE; PISANO, 1994b).

Regarding the magnitude of the coefficients in each group, we showed that raising 1 unit of human capital in the cities reduces the probability of a firm not to innovate by 3.7 percentage points. In the categories of firms that introduced innovation, an increase by 1 percentage point in local human capital increases the probability of the firms to introduce innovation to the firm by 1.0 pp, to the industry by 2.0 pp and to the world by 0.7 pp.

The highest magnitude in the category of firms that do not innovate, both in human capital and relative wealth, reveals that territorial factors may lead mainly to firms failing to innovate. The category innovation to the industry is the second largest magnitude. Following are innovation to the firm and to the world. In this sense, territorial factors reinforce especially innovations generated to the industry. In addition, the smallest effect is seen in the category innovation to the world.

Finally, the variables in regional level, Krugman Index and related and unrelated variety are not significant.

Regarding the firm level variables, the coefficients are positive and significant, the exception of the dummy to firms with shared capital. This demonstrates the strong relationship between innovation and firms characteristics, as pointed out by several authors (POLANYI, 1966; NELSON and WINTER, 1982; COHEN and LEVINTHAL, 1990; TEECE and PISANO, 1994; AUDRETSCH, 1998; PENROSE, 2006). In particular, we find that firms that collaborate (***Coll***) with others agents are more innovation prone than the ones that do not. Besides, the greater is the chance to innovate when the firm is controlled by foreign capital (***CCO_F***) than national.

In particular, concerning innovation efforts (***RD***), as expected, there is positive and significant relationship with innovation, reaffirming that firms are more likely to innovate when making greater efforts in R&D. In additional, the larger firms and more productive ones are more innovative. Looking the magnitudes, a 1% increase in innovation investments decrease the probability of the firms not to innovate by 12.6 pp. In the categories of the firms that introduced innovations (to the firm, to the industry and to the world), a 1% increase in the innovation expenditures rise the chance to introduce innovations to the firm by 3.5 pp, to the industry by 6.8pp and to the world by 2.3pp.

Conclusions

The relationship between innovation and territory has been the subject of increasing attention in the literature because there is an increasingly perception that factors related to location can play an important role in fostering and stimulating innovation. However, this discussion has paid little heed in emerging countries. In this way, this paper sought to contribute to decrease this gap by examine how the territorial factors affect innovation in Brazil, applying the Knowledge Production Function (KPF) in firm and regional level.

The main results that comes off of our analysis is that, even in developing countries where the innovation levels are low and characterized mostly by imitation strategies, the territorial factors are important predictors of innovation. More specifically, the results of the estimated model indicate that the degree of novelty of innovation is related to two factors of the territory: relative wealth and local human capital, while others territorial factors, as agglomeration, knowledge spillovers and related and unrelated variety, are not significant. Thus, the innovation process in Brazil is associated to firms' location, since firms located in regions more rich and with better human capital are more prone to generate innovations with a higher degree of novelty than firms located in other locations. In others words, positive changes in regional human capital increase the chance that firms introduce innovations with higher degree of novelty.

This suggests that it is not enough to have urban agglomeration for innovation, it is necessary that the local have human capital to generate and foster innovation. That is, urban concentration, people or firms, is not enough to generate innovations with a higher degree of novelty, but rather the regional human capital resources. Therefore, more than a critical mass is necessary in order to expect substantial innovative effects of the territories factors. It is essential that the local have skilled employees to absorb and disseminate the knowledge for

the innovation to occur. Besides, the effects of these factors are essentially important for firms that do not introduce innovations, followed by those that generate novelty to the industry, to the firm and to the world.

Regarding variables at the firm level, as expected, our results show that the degree of novelty of the innovation is directly related to the characteristics of the firm and its innovative efforts. Therefore, variations, both related to regional and firm's factors, affect the degree of novelty of the innovation in Brazil, in particular, for no innovation and innovation to the industry.

These results have implications for the debate on firms' innovative performance in Brazil and recent innovation policies. The most obvious policy levers emerging from our analysis concern the local human capital and firms factors. First, policies aimed at raising the level of novelty introduced by Brazilian firms should be aimed at firms located in rich regions and more local human capital. This leads to the second proposition, that training of the local workforce is an important instrument to promote innovation in its various degrees. Thus, policies should encourage the qualification of the workforce, through S&T activities and education. This support can enable firms to be able to generate innovations with a high degree of novelty, as for the world. These two results together point out that innovation is especially linked to large centres. Thus, policies will be more effective if they are able to stimulate firms located in these centres, marked by economic agglomeration and the availability of skilled labour, to be able to incorporate this set of differentiated assets. Finally, policies that stimulate the innovative efforts of firms will always be crucial to support and to foster the innovation.

Referências:

Acs, Zoltan J, Luc Anselin, and Attila Varga. 2002. "Patents and Innovation Counts as Measures of Regional Production of New Knowledge." *Research Policy* 31 (7): 1069–85. doi:http://dx.doi.org/10.1016/S0048-7333(01)00184-6.

Acs, Zoltan J, and David B Audretsch. 1987. "Innovation, Market Structure, and Firm Size." *The Review of Economics and Statistics* 69 (4): 567–74.

Amara, Nabil, Réjean Landry, Nizar Becheikh, and Mathieu Ouimet. 2008. "Learning and Novelty of Innovation in Established Manufacturing SMEs." *Technovation* 28 (7): 450–63. doi:10.1016/j.technovation.2008.02.001.

Araujo, Veneziano. 2014. "Dimensão Local Da Inovação No Brasil : Determinantes E Efeitos de Proximidade." Universidade de São Paulo - USP.

Audretsch, D., and M. Feldman. 2004. "Knowledge Spillovers and the Geography of Innovation, in Handbook of Regional and Urban Economics." *Handbook of Regional and Urban Economics* 4 (December 2002): 2713–2739.

Audretsch, David B., and Maryann P. Feldman. 1996a. "R&D Spillovers and the Geography of Innovation and Production." *American Economic Review* 86 (3): 630–40. doi:Article.

Audretsch, David B, and Maryann P. Feldman. 1996b. "R&D Spillovers and the Geography of Innovation and Production." *The American Economic Review* 86 (3): 630–40. doi:Article.

Bloch, Carter, and Ps Mortensen. 2008. "Development and Analysis of Innovation Indicators in the Nordic Countries Based on CIS Surveys." *NIND Project Report*, no. February. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Development+and+Analysis+of+Innovation+Indicators+in+the+Nordic+Countries+based+on+CIS-surveys#0.

Boschma, Ron, and Simona Iammarino. 2007. "Related Variety and Regional Growth in Italy." *Science and Technology Policy Research* 62: 1–24.

Breschi, Stefano, and Francesco Lissoni. 2001. "Knowledge Spillovers and Local Innovation Systems: A Critical Survey." *Industrial and Corporate Change* 10 (4): 975–1005. doi:10.1093/icc/10.4.975.

Cabrer-Borras, Bernardi, and Guadalupe Serrano-Domingo. 2007. "Innovation and R&D Spillover Effects in Spanish Regions: A Spatial Approach." *Research Policy* 36 (9). Elsevier: 1357–71.

Carlino, Gerald, Satyajit Chatterjee, and Robert Hunt. 2001. "Knowledge Spillovers and the Nwe Economy of Cities." 01–14. *Federal Resere Bank of Philabelphia*.

———. 2006. "Urban Density and the Rate of Invention." 04–16/R.

Carlino, Gerald, Satyajit Chatterjee, and Robert M. Hunt. 2007. "Urban Density and the Rate of Invention." *Journal of Urban Economicsournal of Urban Economics* 61 (3): 389–419. doi:10.1016/j.jue.2006.08.003.

Co, Catherine. 2002. "Evolution of the Geography of Innovation: Evidence from Patent Data." *Growth and Change* 33 (4). Wiley Online Library: 393–423.

Cohen, Wesley M, and Daniel a Levinthal. 1990. "Absorptive Capacity : A New Perspective on Learning and Innovation Wesley M . Cohen ; Daniel A . Levinthal Absorptive Capacity : A New Perspective on Learning and Innovation." *Administrative Science Quarterly* 35 (1): 128–52. doi:10.2307/2393553.

Crescenzi, Riccardo, and Alexander Jaax. 2015. "Innovation in Russia : The Territorial Dimension." *Utrecht University, Section of Economic Geography*. doi:10.1080/00130095.2016.1208532.

Crescenzi, Riccardo, Andrés Rodríguez-Pose, and Michael Storper. 2007. "The Territorial Dynamics of Innovation: A Europe-United States Comparative Analysis." *Journal of Economic Geography* 7 (6): 673–709. doi:10.1093/jeg/lbm030.

———. 2012. "The Territorial Dynamics of Innovation in China and India." *Journal of Economic Geography* 12 (5): 1055–85. doi:10.1093/jeg/lbs020.

Duranton, Gilles, and Diego Puga. 2000. "Diversity and Specialisation in Cities: Why, Where and When Does It Matter?" *Urban Studies* 37 (3): 533–55. doi:10.1080/0042098002104.

Feldman, Maryann P., and David B. Audretsch. 1999. "Innovation in Cities: Science-Based Diversity, Specialization and Localized Competition." *European Economic Review* 43 (2): 409–29. doi:10.1016/S0014-2921(98)00047-6.

Frenken, Koen, Frank G Van Oort, and Thijs Verburg. 2007. "Related Variety, Unrelated Variety and Regional Economic Growth." *Regional Studies* 41 (5): 685–97. doi:10.1080/00343400601120296.

Fritsch, Michael, and Viktor Slavtchev. 2010. "How Does Industry Specialization Affect the Efficiency of Regional Innovation Systems ?" *The Annals of Regional Science* 45 (1): 87–108. doi:10.1007/s00168-009-0292-9.

Gertler, Meric S. 2007. "Tacit Knowledge in Production Systems: How Important Is Geography?" *The Economic Geography of Innovation*, 1–42. doi:10.1017/CBO9780511493386.005.

Griliches, Zvi. 1979. "Issues in Assessing the Contribution and Development of Research to Productivity Growth." *The Bell Journal of Economics* 10 (1): 92–116. doi:10.2307/3003321.

Harirchi, Gouya, and Cristina Chaminade. 2014. "Exploring the Relation between the Degree of Novelty of Innovations and User-Producer Interaction across Different Income Regions." *World Development* 57. Elsevier Ltd: 19–31. doi:10.1016/j.worlddev.2013.11.013.

Henderson, J Vernon. 2003. "Marshall's Scale Economies." *Journal of Urban Economics* 53 (1). Elsevier: 1–28.

Jaffe, Adam B, Manuel Trajtenberg, Rebecca Henderson, and Francis Narin. 1993. "Geographic Localization of Knowledge Spillovers As Evidenced By Patent Citations."

Quarterly Journal of Economics 108 (August): 577–98. doi:10.2307/2118401.

Krafft, Jackie, Francesco Quatraro, and Pier Paolo Saviotti. 2014. "The Dynamics of Knowledge-Intensive Sectors' Knowledge Base: Evidence from Biotechnology and Telecommunications." *Industry & Innovation* 21 (3): 215–42. doi:10.1080/13662716.2014.919762.

Marshall, Alfred. 1920. "Industry and Trade." *Journal of the Royal Statistical Society* 83: 292. doi:10.2307/2341084.

Maskell, Peter, and Anders Malmberg. 1999. "Localised Learning and Industrial Competitiveness." *Cambridge Journal of Economics* 23 (2): 167–85. doi:10.1093/cje/23.2.167.

Nieto, María Jesús, and Lluis Santamaría. 2007. "The Importance of Diverse Collaborative Networks for the Novelty of Product Innovation." *Technovation* 27 (6–7): 367–77. doi:10.1016/j.technovation.2006.10.001.

Nooteboom, B. 1999. "Innovation, Learning and Industrial Organisation." *Cambridge Journal of Economics* 23 (2): 127–50. doi:10.1093/cje/23.2.127.

Palan, Nicole. 2010. "Measurement of Specialization -The Choice of Indices." Vol. 62.

Plechero, Monica, and Cristina Chaminade. 2010. "From New to the Firm to New to the World. Effect of Geographical Proximity and Technological Capabilities on the Degree of Novelty in Emerging Economies," 1–38.

———. 2016. "Spatial Distribution of Innovation Networks, Technological Competencies and Degree of Novelty in Emerging Economy Firms." *European Planning Studies* 24 (6). Taylor & Francis: 1056–78. doi:10.1080/09654313.2016.1151481.

Polanyi, Michael. 1966. "The Tacit Dimension."

Rodríguez-Pose, Andrés. 2011. "Economists as Geographers and Geographers as Something Else: On the Changing Conception of Distance in Geography and Economics." *Journal of Economic Geography* 11 (2): 347–56. doi:10.1093/jeg/lbq034.

Rodríguez-Pose, Andrés, and Edna M. Villarreal Peralta. 2015. "Innovation and Regional Growth in Mexico: 2000-2010." *Growth and Change* 46 (2): 172–95. doi:10.1111/grow.12102.

Rosenthal, Stuart S., and William C. Strange. 2001. "The Determinants of Agglomeration." *Journal of Urban Economics* 50 (2): 191–229. doi:10.1006/juec.2001.2230.

Rosenthal, Stuart S, and William C Strange. 2004. "Evidence on Teh Nature and Sources of Agglomeration Economies." *Handbook of Regional and Urban Economics - Vol 4* 4 (4): 2120–67. doi:10.1016/S0169-7218(04)07049-2.

Storper, Michael, and Anthony J. Venables. 2004. "Buzz: Face-to-Face Contact and the Urban Economy." *Journal of Economic Geography* 4 (4): 351–70. doi:10.1093/jnlecg/lbh027.

Teece, David, and Gary Pisano. 1994a. "The Dynamic Capabilities of Firms." *Handbook on Knowledge Management* 3: 195–213. doi:10.1093/icc/3.3.537-a.

———. 1994b. "The Dynamic Capabilities of Firms: An Introduction." *Industrial and Corporate Change* 3 (3): 537–56. doi:10.1093/icc/3.3.537-a.

Van Der Panne, Gerben. 2004. "Agglomeration Externalities: Marshall versus Jacobs." *Journal of Evolutionary Economics* 14 (5): 593–604. doi:10.1007/s00191-004-0232-x.

Varga, Attila. 2000. "Local Academic Knowledge Transfers and the Concentration of Economic Activity." *J. Regional Sci.* 40 (2): 289–309. doi:10.1111/0022-4146.00175.

Vega-Jurado, Jaider, Antonio Gutiérrez-Gracia, Ignacio Fernández-de-Lucio, and Liney Manjarrés-Henríquez. 2008. "The Effect of External and Internal Factors on Firms' Product Innovation." *Research Policy* 37 (4): 616–32. doi:10.1016/j.respol.2008.01.001.

Appendix A. Local Human Capital Analysis

Table A - Principal component analysis: correlation matrix and principal components' coefficients

Component	HC1	HC2	HC3
Eigenvalue	1.383	1.027	0.590
Difference	0.356	0.437	.
Proportion	0.461	0.342	0.197
Cumulative	0.461	0.803	1

Eigenvectors PCA

Variable	HC1	HC2	HC3
Education of the workforce - ***Educ***	0.719	-0.006	0.695
Employment in S&T - ***ST***	0.517	0.673	-0.528
Young employ – ***Age***	-0.465	0.739	0.487

Obs.=5560 (*cities*)

Appendix B. Sectors Division - Castellacci Taxonomy + Extractive Industry`

Table B - **Sector Classifications**

Sectorial Caterogory		**Cod. CNAE**	**Economic Activity Classification (CNAE)**
Castellacci (2008)	Advanced Knowledge Providers (AKP)	28	Machinery and Equipment Manufacture
		33	Maintenance, Repair and Installation of Machinery and Equipment
		62	Information Technology Services Activities
		63	Provision of Information Services Activities
		71	Architecture and Engineering Services; Testing and Technical Analysis
		72	Research and Scientific Development
	Mass Productions Goods (MPG)	19	Coke, Petroleum Products and biofuels Manufacture
		20	Chemical Products Manufacture
		21	Pharmaceutical and Phytochemical Products Manufacture
		22	Rubber and Plastic Products Manufacture
		23	Non-metallic mineral Products Manufacture
		24	Metallurgy
		25	Metal Products, except Machinery and Equipment Manufacture
		26	Computer, Electronic and Optical Equipment Manufacture
		27	Electrical machinery, apparatus and equipment Manufacture
		29	Motor vehicles, trailers and bodywork Manufacture
		30	Other transport equipment, except motor vehicles Manufacture
	Supporting Infrasctructure Services (SIS)	61	Telecommunications
	Personal Goods and Services (PGS)	10	Food Products Manufacture
		11	Beverage Manufacturing
		12	Tobacco products Manufacture
		13	Textile Products Manufacture
		14	Articles of clothing and accessories Manufacture
		15	Leather Preparation and Manufacture of Leather Goods, Travel Goods and Footwear
		16	Wood Products Manufacture
		17	Pulp, Paper and Paper Products Manufacture
		18	Printing and Reproduction of Recordings
		31	Furniture Manufacture
		32	Miscellaneous Products Manufacture
Not Catogorazed as Castellacci (2008)	Extractive (Extra)	5	Coal Mineral Extraction
		6	Oil and Natural Gas Extraction
		7	Metallic Minerals Extraction
		8	Non-Metallic Minerals Extraction
		9	Support Activities for Mineral Extraction
	Others (Others)	58	Integrated Print Editing and Editing
		59	Cinematographic Activities, Video Production and Television Programs; Sound Recording and Music Editing
		35	Electricity, Gas and Other Utilities