WHEN INNOVATION DOESN'T RHYME WITH AGGLOMERATION

THE CASE OF PERIPHERAL SWISS REGIONS

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Ai miei genitori,

che con fede, amore e sacrificio, hanno creato i presupposti
che mi permettono di camminare sul sentiero della vita
in maniera saggia, altruista e felice!

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PART II: INNOVATION IN ABSENCE OF AGGLOMERATIONS: ATTITUDE TO INNOVATION OF FIRMS SETTLED IN PERIPHERAL REGIONS

PART III: INNOVATION'S DETERMINANTS AND SWISS PERIPHERAL REGIONS

INTRODUCTION

This work deals with the economic dimension of two multi-disciplinary phenomena: innovation and the absence of agglomeration. Their common scientific field is certainly expressed by the so-called regional economy, which joins the economic science with other non economic disciplines such as geography, sociology and institutionalism.

Innovation has been the object of several economic studies conducted to detect its importance on job creation and economic development. The fundamental contribution to innovation theory are Joseph Schumpeter's works (1883-1950), which are still the major theoretical reference for present economic research in this field. Being the innovation capacity of the firm the consequence of entrepreneurial strategic choices based on the market situation and at the same time the engine of economic growth, its study fascinates and challenges economists because it forces to consider the interdependences of micro- and macro-economic dynamics.

Agglomeration of firms that geographically cluster to mutually reinforce one another is likely the main traditional concept of regional economics and goes back to Alfred Marshall's original work on agglomeration economies (1920). More recently, the advantages which regions and countries can gain from clustering were emphasised by Porter's works (1990). According to Marshall and several regional economists' contributions, clustering encourage specialisation which leads to an increase of efficiency in production, it reduces risks for both workers and employers by increasing mobility between firms and the confidence in a future development of the local economy, and it strongly facilitates research and innovation activities.

While the literature about agglomeration's positive effects on innovation is quite well diffused, it is relatively harder to find scientific researches focusing their analysis on innovation in areas where no agglomeration are present. The scarcity of this literature has lead many researchers and policy makers to consider innovations introduced by firms located in urban and peripheral areas as having similar strategic objectives and being favoured by the same incentives.

The originality of this work is to release this often unconscious assumption and to stress how the specific characteristics of peripheral areas do not allow the researcher to assume space as homogeneous in modelling firms' attitude to innovation. In particular, we argue and show that in peripheral areas the needs and the strategic goals of innovative firms are different from those located in urban areas. Thus, the role of space as innovation's determinant will be investigated.

The aim of this work is therefore to provide an empirical contribution to the scientific investigation of the attitude to innovation of firms located in peripheral areas. Moreover, we would like to indirectly contribute to what is considered the current regional economists' main objective: to introduce spatial dimension in regional economic development models.

Part I offers an overview of the territorial, socioeconomic and political characteristics of the Canton Ticino (Switzerland), whose firms' innovative attitude will be analysed in the third part of this dissertation. In particular, the reasons to consider Ticino as a peripheral regions will be highlighted. Moreover, using data obtained through dedicated surveys we will present the profile of firms located in these regions and the spatial distribution of innovative firms in Ticino and Switzerland.

In Part II we will consider the major issues arising from the literature on the attitude to innovation of firms: the "classical" innovation determinants, the strategic objectives of innovation, the

economical reasons for agglomerate in one place rather than another, proximity advantages and disadvantages on innovation activities and the differences observable between the attitude to innovation of firms situated in urban and those located in peripheral areas.

In Part III the innovation's determinants of firms located in peripheral areas will be investigated through multivariate analyses. The empirical analysis will be focused on three Ticino's regions and Swiss peripheral areas.

The three Ticino regions considered in the analyses are:

- Locarnese and Vallemaggia Region (RLVM);
- Mendrisiotto and Valle di Muggio Region (RMVM);
- and Tre Valli Region (RTV).

The data was collected sending questionnaires[1] to firms located in the three regions (about 8'000), 2076 of which replied. The first survey was conducted in 2001 in the RLVM, the second in 2002 in the RMVM and the third in 2003 in the RTV. The information obtained concerns: firms' strategic decisions (localisation, innovations, markets, etc.), firms characteristics (qualifications of employees, supplier locations and number, ICT's used, innovation capacity and so on) and employers judgements on the local socioeconomic resources (availability and quality), the transport infrastructures and the institutional context.

The results of these three surveys were integrated in three applied research projects named Monitoreg, carried out by the Istituto di Ricerche Economiche and focused on the economic specialisations and regional development potential of the three regions (Alberton and Bossi 2001, 2003, 2004). Even if one will partly refer to the conclusions of Monitoreg projects, the aim of this dissertation is different. In fact, while in Monitoreg one gives an overview of the elements that contribute to the local territorial competitiveness and the key activities to trigger the local development, in this dissertations the focus is on the contribution of several innovation determinants (micro- and macroeconomic) on the innovation activities of the firms.

Data on Swiss firms' innovation activities employed in our analysis are carried out each three years by the Konjunkturforschungsstelle of the Eidgenössische Technische Hochschule Zürich. Thanks to the availability of data collected in 2002, it has been possible to compare the national situation to the Ticino's one.

[1] A copy of the questionnaire used in RTV is reproduced in the Appendix 1.

PART I
TERRITORIAL CHARACTERISTICS, SOCIOECONOMIC RESOURCES, POLITICAL POSITIONING AND INNOVATIVE ACTIVITIES OF THREE PERIPHERAL REGIONS IN A PERIPHERAL CANTON

The main issue we would like to investigate in this work is the impact of the territorial and socioeconomic characteristics of a peripheral area on the innovative activities of the firms. To afford the empirical part of this dissertation (Part III), it is important to have a good knowledge of the international, national and regional context in which the investigated firms are located. On one hand, this knowledge will allow us to distinguish and characterise peripheral and non-peripheral areas. On the other hand, other researchers will obtain useful information to evaluate if the model presented in Part III fit other realities avoiding wrong generalisations.

As we will see in Part II, the periphery is a multidimensional and not well defined concept. However, the aim of this work is not to find a universal definition of it, but rather to explore the impact of specific characteristics of "stereotyped periphery's definition" on innovation. In particular, we suggest to distinguish the impact of two main aspects of a periphery: the "relative" and the "absolute" dimension.

In relative terms, an area can be peripheral to another, which in turn is peripheral to another one. As we will see in Part II, this dimension is mainly considered (more or less consciously) by economists when they analyse the role of agglomerations (degree of spatial concentration or density) or more in general of space (distance) in economic models. In these cases, the definition adopted refers to a relative concept: one region is peripheral if the rest of the area considered in the study has a major concentration of socioeconomic resources.

In absolute terms, periphery's definition implies specific territorial and socioeconomic characteristics. Differently from the relative approach, the absolute one requires subjective criteria that leads to what we will call a "stereotyped definition" of periphery. This dimension is more diffused among geographers, regionalists and territory's planners, which should characterise peripheries not only by considering the degree of spatial concentration of the economic resources, but mainly by explaining the quality of local resources and actors (firms, workers, etc.) present in the area and their more or less institutionalised interactions (exchanges of knowledge, capitals and goods).

Our implicit assumption is that both these dimensions have an effect on the innovative attitude of the firms settled in these areas. The empirical analyses will therefore consider variables accounting for the relative and the absolute dimension of peripheral areas. The three Ticino regions, whose firms' behaviours will be investigated in Part III, are a good example to illustrate what these two dimensions of periphery imply in concrete. In fact, on one hand they are located in peripheral areas of a Canton which is in turn on the national borders of Switzerland and contiguous to the suburbs of Milan's metropolis. On the other hand, the territorial and socioeconomic descriptions that we will consider, reveals specific characteristics of Canton Ticino if compared to other Swiss Cantons and the closest Italian Regions, as well as of the three regions if compared to the rest of Ticino.

To explore these peripheral realities, in Chapter 1 we will give prominence to the cantonal endowment with socioeconomic resources, the spatial distribution of economic agents (firms, workers, consumers, etc.) across the territory, the political positioning and the functional

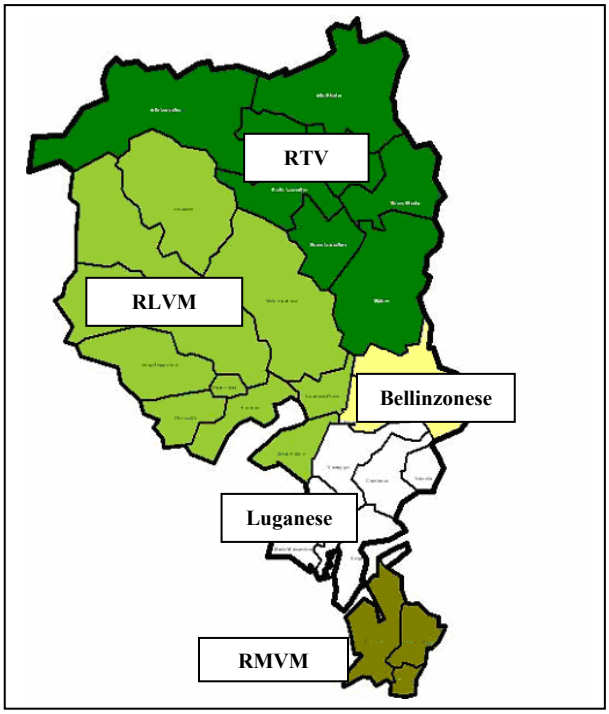
relationships among local agents and between them and extra-regional ones (national and international). In Chapter 2, we will shift the analyses to the regional level, describing the territorial and socioeconomic characteristics of the three Ticino regions. In addition, to start introducing the main research issue of this work, we will present the diffusion of innovative firms: in the three Ticino regions as well as in the rest of Switzerland, distinguishing urban and rural areas according to Swiss Federal Office of Statitstics (SFSO). This diffusion will be analysed using dedicated surveys conducted in the recent years by the Konjunkturforschungsstelle (KOF) of the Eidgenössische Technische Hochschule Zürich (ETH) and the Istituto di Ricerche Economiche (IRE). As we will see, this first overview on the geographical distribution of innovation activities will allow us to exclude the simplistic idea that the absence of agglomeration is associated with a lower presence of innovations.

CHAPTER 1: A PERIPHERAL CANTON

The Canton Ticino is composed by an economic centre (Lugano), a political centre (Bellinzona) and three peripheral regions on which we are going to focus our empirical analyses[2] (Figure 1):

- The Locarnese and Vallemaggia Region (hereafter RLVM);
- The Mendrisiotto and Valle di Muggio Region (hereafter RMVM);
- and The Tre Valli Region (hereafter RTV).

Figure 1: Canton Ticino and its five regions



Source: personal elaboration

Before considering in details the territorial and socioeconomic characteristics of the three regions' (Chapter 2), it is opportune to consider the cantonal, national and international context in which they are located. In this Chapter, we will therefore present secondary statistics at the national level distinguishing Cantons and conurbations areas[3], while at the international level we will focus our attention on two Italian Regions (Lombardia and Piemonte), which borders on Canton Ticino. This territorial and socioeconomic overview of the national and international context will allow us to stress its peripheral dimension.

1.1 The main socioeconomic characteristics of Ticino and Switzerland

According to the last national census conducted in 2000 by the Swiss Federal Statistical Office (hereafter SFSO), the population of Canton Ticino is of 306'846 inhabitants and it represents the

[2] As explained in the introduction, the available data are fruit of three dedicated surveys conducted to complete the analyses of Monitoreg projects focused on the economic specialisations and the regional development potential of RLVM, RMVM and RTV. Since no projects were committed to study the region of Bellinzona and Lugano, no surveys were conducted in these two regions.

[3] Conurbations is the term adopted in 1997 by the Swiss Federal Statistical Office to distinguish urban and rural areas. The definition will be given in section 1.2.1.

4,2% of the Swiss population (Table 1). The more populated Cantons are Canton Zürich and Canton Bern, which respectively represent the economic and political capital of Switzerland. The average cantonal population is 280'308. This means that 8 Cantons (Ticino included) are over the cantonal average value.

Table 1: Cantonal distribution of population (in 2000), firms and employees (in 2001)

Cantons	Population in 2000	Firms in 2001	Employees 2001	GDP 2000 in mio. USD (PPP 1997,1990 prices)	GDP per head in USD
Zürich	1247906	69716	746751	40989,82	32846,88
Bern	957197	46667	472513	22188,74	23180,95
Vaud	640657	31806	287689	12747,13	19896,96
Aargau	547493	26618	248366	11540,68	21079,14
St. Gallen	452837	23264	222197	9578,55	21152,31
Genève	413673	22034	236024	13417,51	32435,06
Luzern	350504	16363	164043	6825,77	19474,16
Ticino	**306846**	**19206**	**158813**	**7189,55**	**23430,49**
Valais	272399	15157	117024	5104,45	18738,88
Basel-Landschaft	259374	11960	115240	6372,71	24569,58
Solothurn	244341	11354	109069	4759,13	19477,4
Fribourg	241706	10978	95889	4318,5	17866,73
Thurgau	228875	11525	94515	4300,83	18791,19
Basel-Stadt	188079	11032	154664	10619,88	56465,02
Graubünden	187058	12092	91650	3889,8	20794,61
Neuchâtel	167949	8684	81163	3416,72	20343,82
Schwyz	128704	7289	51776	2350,44	18262,37
Zug	100052	8408	66356	3418,4	34166,23
Schaffhausen	73392	3936	35063	1541,12	20998,54
Jura	68224	3571	30622	1346,64	19738,46
Appenzell A.Rh.	53504	821	5213	971,56	18158,63
Glarus	38183	2104	17492	914,87	23960,13
Nidwalden	37235	2239	17784	708,6	19030,26
Uri	34777	1500	13921	668,9	19233,85
Obwalden	32427	1666	13715	514,08	15853,58
Appenzell I.Rh.	14618	2989	20916	226,07	15465,31
Switzerland	7288010	382979	3668468	179920,4	24687,18

Source: Swiss Federal Statistical Office (SFSO) and BAK, Basel 2003

In terms of population, firms and employees present in the cantonal territory, the ranks of Canton Ticino is around the 7th and 8th rank. The firms located in Ticino are equivalent to the 5% of national firms, whereas the employees to the 4,3%. The average of inhabitants, firms and employees per Canton is respectively of 280'308, 14'730 and 141'095. Thus, Ticino is over the average values.

The aggregate Gross Domestic Product (hereafter GDP) generate by Canton Ticino in 2000 represent the 4% of the national GDP. Thus, its share is very close to the share of population (4,2%), firms and employees. The GDP per head distribution reveals that the higher values are those of Cantons, whose socioeconomic characteristics are for instance influenced by a particular fiscal policy (see the case of Zug whose financial policy induce many big national and international firms to locate their headquarters in this Canton) or an economic specialisation in high value added activities (see the case of Basel-Stadt, where are present many biochemical and pharmacological industries which are high value added activities).

The average national GDP per head is 24'682 USD (PPP 1997) and only four Cantons generate a more high value per head.

1.2 Swiss urban and rural areas' socioeconomic characteristics

Socioeconomic resources of Switzerland are not homogenously spatially distributed, but concentrated in few areas. These areas are not well identified by the cantonal frontiers, which are institutionally and historically defined. Thus, to describe the socioeconomic dynamics of these agglomerations, the use of cantonal territories is not appropriate. For this reason, in this section we will present secondary statistics appealing to the definition of conurbations that in 1997 was introduced by the Swiss Federal Statistical Office (SFSO).

1.2.1 The Swiss conurbations

The definition of urban municipality is based on several criteria that should be filled by a municipality to be part of the conurbation, according to a definition (adopted by the SFSO) which differ from the NUTS regions[4]: a minimum number and spatial concentration of inhabitants and employments, spatial contiguity with the main municipality, population growth rate, importance of commuters flows, low presence of workers in the primary sector, etc.. If these criteria are not fulfilled, the municipality is considered rural.

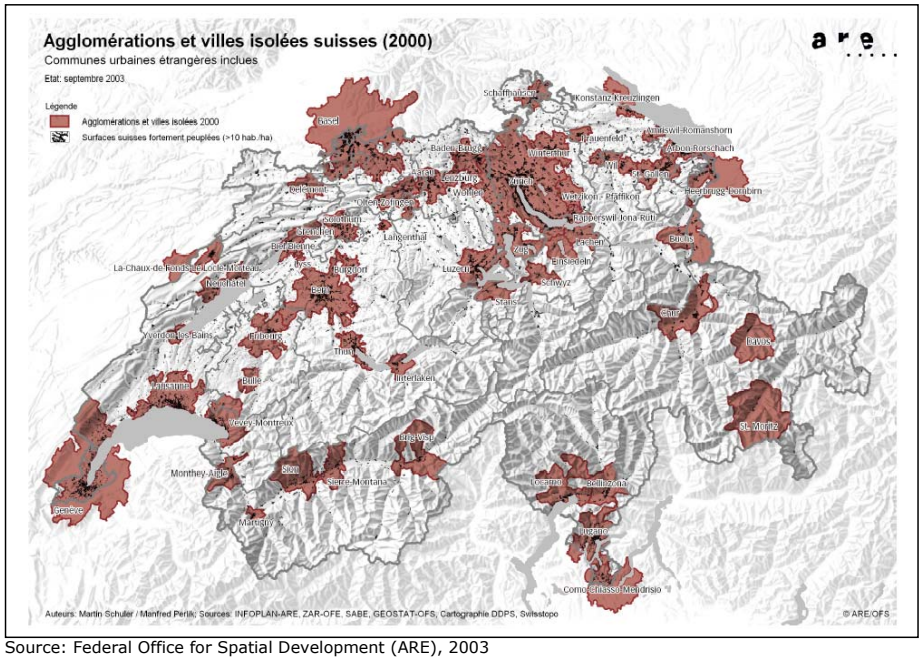
Applying this definition to the Swiss municipalities of 2000, the result is the one exposed in Figure 2: 34% of the 2'896[5] Swiss municipalities are considered urban, while the rest (66%) rural. In each Canton these percentages are different. The extreme cases are represented by cantons completely rural (Cantons Appenzell A. Rh, Glarus, Obwalden and Uri) and those totally urban (Canton Basel-Stadt). The median case is Canton Schwyz, in which urban and rural municipalities are exactly one half of the total. In Canton Ticino the situation is similar to the median one: 133 municipalities in urban areas, and 112 (the 46% of the total) in rural ones[6].

[4] See Appendix 2

[5] In the last ten years Canton Fribourg, Thurgau, Luzern, and Ticino have started a reform of municipalities institutions that overall imply merges of them. In fact, about 1/5 of Swiss municipalities was thinking about a merge in 2001, and 8% of them already was already involved in a merging project. Thus, the number of municipalities in Switzerland will certainly decrease in the future (Ladner A., 2001).

[6] For more details see Appendix 3

Figure 2: Swiss Conurbation in 2000



Source: Federal Office for Spatial Development (ARE), 2003

In terms of population, firms and employees, the biggest conurbation of Canton Ticino is Lugano (Table 2), which is followed by those of Locarno, Bellinzona and Chiasso-Mendrisio. However, as we will see in Chapter 2, only a part of the municipalities of the RLVM and RMVM are considered urban.

Table 2: Socioeconomic characteristics of Ticino's conurbations and rank among Swiss conurbations[7]

Name of the conurbation	Population in 2000	Rank	Active pop. in 2000	Rank	Firms In 2001	Rank	Employees in 2001	Rank
A5192 Lugano (CH)	120800	9	60048	10	8345	8	70633	8
A5113 Locarno	53682	24	25949	27	3268	21	25328	26
A5002 Bellinzona	45196	29	21860	30	2509	28	21652	29
A5250 Chiasso-Mendrisio (CH)	44827	30	21285	31	2863	25	27880	23

Source: Swiss Federal Statistical Office (SFSO)

Finally, it is relevant to observe that conurbations shape is not limited by institutional frontiers, but only by socioeconomic criteria. Thus, sometimes their extension exceed the cantonal frontiers as well as the national ones[8]. The more extended trans-national conurbations are those of Basel, Genève, Heerbrugg and the south of Ticino.

[7] For details on the other Swiss conurbations are exposed in Appendix 5
[8] For more details see Appendix 4

1.2.2 Socioeconomic characteristics of conurbation and rural areas by canton

In 2000, nearly ¾ of the Swiss population lived in conurbation areas (Table 3). This means that 5,4 millions of inhabitants were concentrated on the 23% of the national territory, where the density reached the number of 594 persons per km^2.

The density of the population in the conurbations is generally higher than the average density of the whole Swiss territory, which is about of 182 inhabitants per km^2. The only conurbation population density under this value is that of Canton Graubünden. Among rural areas, only those of two Cantons have a population density higher than the average one: Aargau and Genève.

Table 3: Population' spatial distribution by Cantons and conurbation/rural areas in 2000

	Conurbation				Rural areas			
Cantons	% of Cantonal population	% of Cantonal surface	Population per km2	Density rank	% of Cantonal population	% of Cantonal surface	Population per km2	Density rank
Basel-Stadt	100%	100%	5083	1	0%	0%		
Genève	99%	93%	1803	2	1%	7%	188	2
Luzern	52%	11%	1177	3	48%	89%	133	7
Zürich	95%	73%	975	4	5%	27%	141	5
Basel-Landsch.	92%	60%	771	5	8%	40%	102	9
Bern	62%	13%	764	6	38%	87%	72	16
Thurgau	49%	19%	675	7	51%	81%	167	3
Aargau	65%	38%	668	8	35%	62%	222	1
St. Gallen	67%	23%	660	9	33%	77%	101	10
Vaud	75%	26%	657	10	25%	74%	75	15
Neuchâtel	75%	28%	620	11	25%	72%	83	14
Schaffhausen	74%	30%	603	12	26%	70%	92	11
Switzerland	**73%**	**23%**	**594**	**13**	**27%**	**77%**	**63**	**19**
Solothurn	77%	45%	532	14	23%	55%	127	8
Zug	96%	87%	532	15	4%	13%	163	4
App. A.Rh.	53%	24%	491	16	47%	76%	136	6
Ticino	**86%**	**27%**	**362**	**17**	**14%**	**73%**	**21**	**25**
Fribourg	56%	24%	355	18	44%	76%	88	12
Nidwalden	87%	45%	299	19	13%	55%	36	22
Schwyz	79%	40%	298	20	21%	60%	52	21
Jura	30%	10%	233	21	70%	90%	64	18
Valais	57%	15%	195	22	43%	85%	27	24
Graubünden	50%	15%	87	23	50%	85%	16	26
App. I.Rh.	0%	0%	0	24	100%	100%	85	13
Glarus	0%	0%	0	24	100%	100%	56	20
Obwalden	0%	0%	0	24	100%	100%	67	17
Uri	0%	0%	0	24	100%	100%	33	23

Source: Swiss Federal Statistical Office (SFSO)

In Ticino 86% of the population live in conurbation, but the density is relatively low (362 inhabitants per km^2, rank 17). At the same time, rural areas represent the 73% of the cantonal surface and they host the 14% of the inhabitants. Thus, even in rural areas the density is quite low (21 inhabitants per km^2, rank 25) and lower than the national average (63 inhabitants per km^2). The population density in Ticino is therefore under the Swiss mean.

Table 4: Averages of the high, medium and low populated conurbations

	Percentage of active population not in the main town of the conurbation	***Percentage of active population in the main town***
Average of the 6 **higher** populated conurbations	64,8%	35,2%
Average of the 6 **median** conurbations	67,7%	32,3%
Average of the 6 **lower** populated conurbations	52,7%	47,3%
Average of the 4 Ticino's conurbations	**74,7%**	**25,3%**

Source: Swiss Federal Statistical Office (SFSO) and personal computations

Moreover, inside conurbations inhabitants are not homogenously distributed. In Table 4 are reported the average shares of the active population living in the main municipality of the conurbations. Comparing Ticino's conurbations structure to the other Swiss conurbations, it appears a very low percentage of active population living in the main town (25,3%). Thus, in the conurbations' areas of Ticino the active population is relatively dispersed.

By contrast, while population is quite dispersed, in Ticino the share of firms and employees located in conurbation is among the higher of Switzerland (Table 5). In fact, while at the national level about 68,2% of the firms and 74,1% of the employees operate in urban areas, in Ticino these shares are respectively of 88,5% and 92%.

Table 5: Firms and employees of conurbations by cantons

	Firms 2001			*Employees 2001*		
	In conurbations	*In rural areas*	*Share in the conurbations*	*In conurbations*	*In rural areas*	*Share in the conurbations*
Zürich	66819	2897	95,84%	729948	16803	97,75%
Bern	30247	16420	64,81%	353064	119449	74,72%
Vaud	24424	7382	76,79%	238105	49584	82,76%
Genève	21944	90	99,59%	235359	665	99,72%
Aargau	17918	8700	67,32%	183254	65112	73,78%
Ticino	**16985**	**2221**	**88,44%**	**145493**	**13320**	**91,61%**
St. Gallen	16118	7146	69,28%	167296	54901	75,29%
Basel-Landschaft	11064	896	92,51%	110295	4945	95,71%
Basel-Stadt	11032		100,00%	154664		100,00%
Solothurn	8998	2356	79,25%	92441	16628	84,75%
Luzern	8909	7454	54,45%	100339	63704	61,17%
Valais	8489	6668	56,01%	77118	39906	65,90%
Zug	8236	172	97,95%	65233	1123	98,31%
Neuchâtel	6636	2048	76,42%	67992	13171	83,77%
Fribourg	6504	4474	59,25%	67794	28095	70,70%
Schwyz	6110	1179	83,82%	45057	6719	87,02%
Graubünden	5757	6335	47,61%	53743	37907	58,64%
Thurgau	5744	5781	49,84%	53956	40559	57,09%
Schaffhausen	2946	990	74,85%	29460	5603	84,02%
Nidwalden	2016	223	90,04%	16711	1073	93,97%
Appenzell A.Rh.	1617	1372	54,10%	12064	8852	57,68%
Jura	1224	2347	34,28%	11230	19392	36,67%
Appenzell I.Rh.		821	0,00%		5213	0,00%
Glarus		2104	0,00%		17492	0,00%
Obwalden		1666	0,00%		13715	0,00%
Uri		1500	0,00%		13921	0,00%
Switzerland	289737	65033	81,67%	3010616	657852	82,07%

Source: Swiss Federal Statistical Office (SFSO)

The spatial concentration of firms and employees per hectare of settlement areas reveals that in conurbations and rural areas of the Canton Ticino the firms and employees densities are under the national mean (Table 6): in conurbations firms' density is at the 11th rank, whereas the employees' at the 14th (over 22 Cantons since 4 of them do not have any conurbation areas). In rural areas firms' density is at the 24th rank and employees' density at the 25th rank (over 25 Cantons, since Basel-Stadt is completely urban).

Table 6: Firms and employees density in settlement areas[9] of urban and rural areas (2001)

Canton	Conurbation areas		Rural areas	
	Firms per hectare	Employees per hectare	Firms per hectare	Employees per hectare
Aargau	1,51	15,45	0,89	6,64
Appenzell I.Rh.	0,00	0,00	1,15	7,27
Appenzell A.Rh.	1,90	14,16	1,15	7,42
Bern	1,88	21,97	0,74	5,42
Basel-Landschaft	1,55	15,43	0,70	3,86
Basel-Stadt	4,21	59,03	0,00	0,00
Fribourg	1,28	13,38	0,63	3,94
Genève	2,64	28,27	0,44	3,24
Glarus	0,00	0,00	1,16	9,66
Graubünden	1,53	14,26	0,69	4,15
Jura	1,31	12,06	0,61	5,01
Luzern	2,21	24,87	0,88	7,51
Neuchâtel	1,90	19,44	0,78	5,03
Nidwalden	1,85	15,35	0,89	4,27
Obwalden	0,00	0,00	1,05	8,67
St. Gallen	1,70	17,66	0,88	6,76
Schaffhausen	1,69	16,94	0,69	3,90
Solothurn	1,34	13,74	0,76	5,39
Schwyz	1,71	12,61	0,90	5,16
Thurgau	1,46	13,70	0,81	5,67
Ticino	**1,71**	**14,63**	**0,51**	**3,03**
Uri	0,00	0,00	0,82	7,61
Vaud	1,67	16,26	0,60	4,02
Valais	1,21	11,01	0,72	4,31
Zug	3,05	24,19	0,82	5,35
Zürich	2,15	23,54	0,78	4,53
Switzerland	**1,86**	**19,30**	**0,76**	**5,35**

Source: Swiss Federal Statistical Office (SFSO)

[9] Excluding territories in which firms are not allowed to be located (forest, woods, lakes, rivers, etc.). Thus, considering only "Settlement and urban areas" as defined by the SFSO.

In Ticino interactions between firms and employees therefore require an important effort of mobility, since their spatial distributions is quite dispersed. As we will see in Chapter 2, this last aspect can play an important role in terms of innovation attitude of the firms.

1.2.3 Swiss metropolitan areas

From a functional point of view, conurbations could result too small to explain the reasons of economics dynamics. Because of that, even if an universal definition does not exist, many countries have introduced the term of "metropolitan areas"[10]. In Switzerland, the Swiss Federal Statistical Office (SFSO) defines them as composed by "a main conurbation (usually with more than 250'000 inhabitants) and a group of conurbations, which are part of a metropolitan area if the percentage of commuters working in the main conurbation is at least the 8,3% (1/12) of the total flows of commuters. According to the close relationships with the Milan metropolitan areas, the SFSO considers Ticino conurbations as part of a metropolitan area even if not all criteria are fulfilled[11] .

In each metropolis there is a main conurbation that could be considered the heart of the area. Besides, the metropolitan area can include foreign municipalities. This is the case of Basel, Genève-Lausanne and Ticino metropolis (Table 7). Moreover, it should be noticed that in the case of Basel the metropolitan area is equivalent to the main conurbation, while in Ticino it includes several conurbations among which the main conurbation is Lugano.

Table 7: Conurbations and isolated cities included in metropolitan areas

Metropolitan area	Conurbations and isolated cities included in metropolitan areas (in bold: main conurbations)
Zürich	**Zürich (ZH, SZ, AG)**, Wetzikon-Pfäffikon (ZH), Winterthur (ZH), Rapperswil-Jona-Rüti (SG, ZH), Lachen (SZ), Einsiedeln (SZ), Zugo (ZG), Wohlen (AG), Lenzburg (AG), Baden-Brugg (AG), Frauenfeld (TG), Sciaffusa (ZH, SH, Germany)
Bern	**Bern (BE, FR)**, Burgdorf (BE), Thun (BE), Bienne (BE) (dal 2000), Friborgo (FR) (dal 2000), Lyss (BE) (dal 2000)
Basel	**Basel (BS, BL, AG, SO ,Germany, France)**
Genève-Lausanne	**Genève (GE, VD, France)**, Lausanne (VD), Vevey-Montreux (VD, FR), Yverdon-les-Bains (VD)
Ticino	**Lugano (TI, Italy)**, Bellinzona (TI), Locarno (TI), Como-Chiasso-Mendrisio (TI, Italy)

Source: Federal Office for Spatial Development (ARE), 2003

The most populated metropolis of Switzerland, even if "transnational", are mainly composed by Swiss municipalities: in Zürich the contribution of the foreign areas is limited to one municipality

[10] A general definition is given by The Free Dictionary (http://encyclopedia.thefreedictionary.com): "The metropolitan area is a large population center consisting of a large city and its adjacent zone of influence, or of several neighboring cities or towns and adjoining areas, with one or more large cities serving as its hub or hubs. A metropolitan area usually combines an agglomeration (the contiguous built-up area) with peripheral zones not themselves necessarily urban in character but closely bound to the centre by employment or commerce; these zones are also sometimes known as a commuter belt, and may extend well beyond the urban periphery depending on the definition used".

[11] More precisely, according to the SFSO Ticino is a metropolis because of strong relationship with Milan metropolis (in particular in labour market), but it is not part of it. Similarly to Ticino metropolis, the SFSO is considering to include Mulhouse, Müllheim and Bad-Säckingen in the metropolitan area of Basel.

(Büsingen am Hochrhein included in the conurbation of Canton Schaffhausen), whereas in Bern there is no foreign municipalities at all. The other metropolis located near the national frontiers include a share of foreign inhabitants that represent about 1/3 of the metropolis population (Basel and Genève-Lausanne), while in Ticino this share reaches ½ [12].

Swiss metropolis' population, grew between 1990 and 2000[13]. However, the increase is not uniform inside each metropolitan areas (except for Basel as the main conurbation is the metropolitan area itself): in Zürich and Bern (the two non-transnational metropolis) suburbs tend to grow more than the main agglomeration, whereas in Ticino and Genève-Lausanne the main agglomerations knew an important increase during the last ten years of the 20th century. In the main conurbation of Ticino (Lugano) the rate of increase is the highest recorded in Switzerland (+10,5%).

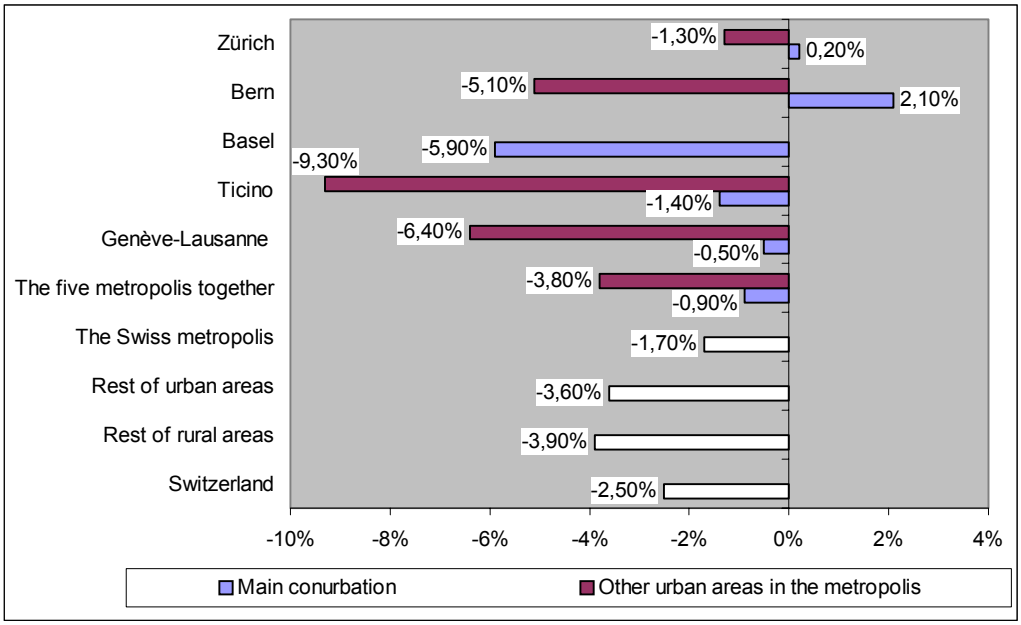
In metropolitan areas are located ½ of Swiss firms and 2/3 of the employments. The 70% of service employments are concentrated in these areas and they are mainly financial, consulting, computer and telecommunication activities[14]. However, in each metropolis could be find a different economic structure: trade services are mainly present in Zürich, Bern and Genève, while in Basel and Ticino the secondary sector (industry + building) is relatively more important than elsewhere (Federal Office for Spatial Development - ARE. Website: http://www.are.admin.ch/are/).

As shown in the Graphic 1, in 1990s the loss of employments in metropolis areas (-1,7%) was inferior than in other Swiss areas (-3,6 in the rest of urban areas and –3,9% in the rest of rural areas). The number of workers in the main conurbations was quite stable (-0,9%), while in the rest of the conurbation, urban and rural areas more than 3% of employments were lost. This favourable situation for the main conurbations was due to an increase of trade services (Federal Office for Spatial Development - ARE. Website: http://www.are.admin.ch/are/). Once again, Ticino produces results that are evidently different from those of in the other four metropolis. In fact, while there was an important decrease of employment (-9,3%) in Locarno, Bellinzona and Chiasso-Mendrisio conurbations, in the main conurbation (Lugano) the lost of work places is close to the average result of Swiss metropolis (-1,40%).

In 2000, 171'000 people commute towards the main conurbation of Swiss metropolis. That means that one active person over nine (11,5%) working in a main conurbation lived in an other region of Switzerland: 38% in the rest of conurbations areas and 62% in rural areas (Federal Office for Spatial Development - ARE. Website: http://www.are.admin.ch/are/).

[12] Personal translation. For more details see Appendix 7.
[13] For details see Appendix 8
[14] For details see Appendix 9

Graphic 1: Evolution (1991-2001) of workers employed by the secondary and tertiary sector in the main conurbation and the in the rest of the metropolitanean area excluding foreign municipalities



Source: Swiss Federal Statistical Office (SFSO)

Furthermore, in metropolis close to national frontiers, the work force include foreign commuters. This is one of the relationships that Genève, Basel and Ticino metropolis have with the closest foreign areas. Collaboration among firms, tourist projects, trade and capital movements could be other forms of interrelationship that generates translational areas, better known as "border regions".

1.3 Political positioning of Canton Ticino

As we will see in Chapter 3, the institutional proximity (defined as norms and values of conduct acting at the macro-level) can affect the innovation capacity of the firms. Thus, to conclude the national contextualisation of Canton Ticino, we propose to consider an original work (based on 182 federal polls' results) that drew an ideological and political portrait of Switzerland highlighting the major political contention and regional differences in terms of opinions, social values and mentalities (Hermann and Leuthold 2003).

In this study, political contention were identified using a factor analysis to classify results of federal polls of the last 20 years (1982-2002). This methodology allowed authors to objectively aggregate municipalities with similar ideology (correlated polls results) and to position them on three main axes: left vs. right, liberal vs. conservative, ecologic vs. technocratic (Table 8)[15].

[15] For more details we invite the reader to consult the book of Hermann and Leuthold (2003) at pages 15-21.

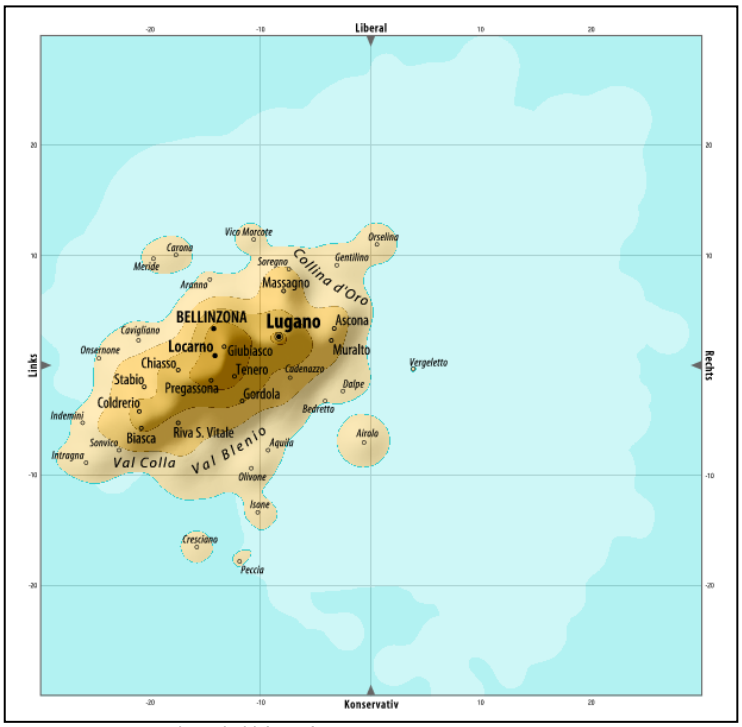
Table 8: The three main ideological dimensions

Politic contentious					
Left	Right	Liberal	Conservative	Ecologic	Technocratic
Welfare State	Individual economic responsibility	External politics openness	National sovereignty	Protection of nature and environment	Use of resources
Right of citizens	Laws and regulation	Foreign integration	Limitations against foreign	Global ethic	Technological progress
Pacifism	Military defence	Public institutions Reform	Preservation of the actual regime		

Source: Hermann and Leuthold 2003; personal translation

Excluding the last dimension (ecologic vs. technocratic) from their publication for technical reasons, the authors identified the main axes of nowadays local ideological contention as a combination of left-right and liberal-conservative dimensions: left and liberal vs. right and conservative; right and liberal vs. left and conservative. Considering only the left-right and the liberal-conservative dimensions to represent the results graphically, the political positioning of Ticino's municipalities led to the shape shown in Figure 3.

Figure 3: Ticino mental topography



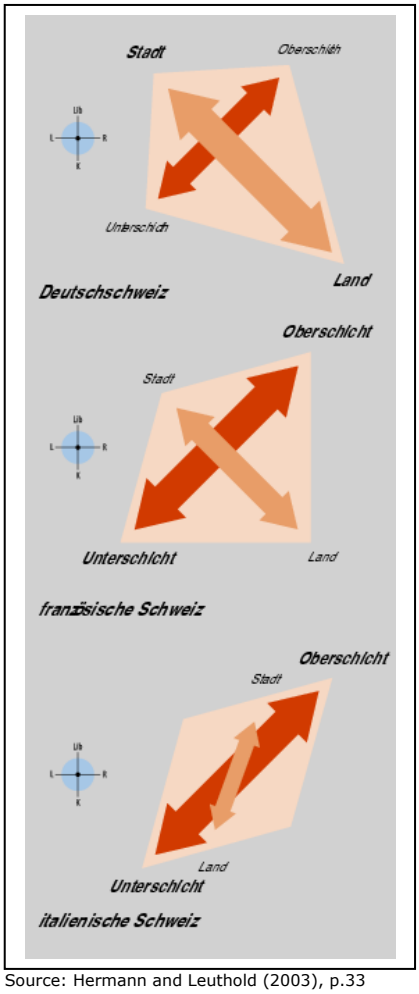
Source: Hermann and Leuthold (2003), p.77

Comparing the results obtained in the three main linguistic regions of Switzerland, it appears a clear and specific political positioning of Ticino (Figure 4).

In the German-speaking region ("Deutschschweiz" in the picture), the opposition of City ("Stadt") and Rural areas ("Land") is dominant. The bigger cities are on the left-liberal corner, whereas poor regions have a social and conservative profile.

In the French-speaking region ("französiche Schweiz"), the social opposition (rich vs. poor regions) is highly developed. The "proletarian" areas stay together with big cities on the left side, whereas rural regions are less conservative than Swiss-German ones.

Figure 4: Mental structure of the three Swiss language-regions



Source: Hermann and Leuthold (2003), p.33

Differently from the other two linguistic regions, Ticino ("italienische Schweiz") has a specific mental structure. In fact, a Stadt - Land cleavage (which is very dominant in the German-speaking part) barely exists here. In Ticino, the ideological division is mainly between richer (right and liberal) and poorer (left and conservative) municipalities. Moreover, according to the authors (Hermann and Leuthold 2003, p.76), the increase of mobility is more and more merging Canton Ticino to the Metropolitan areas of Milan. The fragile equilibrium between the Swiss identity and the economic and cultural orientation is therefore knowing a shift toward Italy.

1.4 The territorial and socioeconomic cradle of Canton Ticino

The issues discussed until now reveal that it is quite hard to consider Ticino as a metropolis in itself as suggested by the SFSO. Compared to the rest of Switzerland this Canton has specific socioeconomic characteristics that are certainly not independent from its recent history (mainly

characterised by rural economic activities and emigration) and its territorial location (characterised by the presence of a mountainous barrier – the Alps – and the Zürich metropolis on the north, and a flat territory – Padania – and the Milan metropolis on the south).

Ticino is geographically close to the suburbs of Milan's metropolis. It is therefore judicious to investigate the effects generated by the proximity of a metropolitan area of 3,8 million people (Milan) and a region (Lombardia) whose aggregate Gross Value Added (hereafter GVA) is higher than Swiss GVA and population.

As one will see in this section, several socioeconomic dynamics of Canton Ticino are directly or indirectly influenced by the proximity of this international metropolis. Indeed, an important number of workers, capital and goods daily move from Lombardia to Ticino along the European North-South axe. In this section one will present these phenomena and relationships in details.

1.4.1 Socioeconomic dimensions of the neighbouring Italian regions: Lombardia and Piemonte

From a geographical point of view, Canton Ticino is on the south of the Alps and wedged between Piemonte and Lombardia regions. Comparing the resident population of Region Lombardia[16] (8'922'463) and Region Piemonte[17] (4'214'677) to the population of Canton Ticino (0,3 mio), one realises that the latter has a more similar dimension to Italian provinces than to one of these two regions.

The neighbouring provinces of Canton Ticino are Varese, Como and Verbano-Cusio-Ossola (hereafter VCO). Varese and Como are more populated than Ticino (respectively 814'055 and 537'046 against 306'846), while VCO has about the half of Ticino's inhabitants (159'040). Furthermore, Varese and Como represent about 15% of the Lombardia's population, which is highly concentrated in Milano and few other provinces close to the heart of the metropolitan area.

In absolute terms, Varese and Como have more firms and employees than Canton Ticino (where in 2001 firms were 19'189 and employees 158'753). Moreover, Lombardia's workers represent the 21,5% of Italian employees and about the 9% in Piemonte. The economic weight of Lombardia is therefore important for the whole Italian economy.

To know the economic structure and the production capacity of Lombardia it is opportune to observe its aggregate Gross Value Added (GVA) per sector (Table 9). The region Lombardia has in fact a production capacity higher than Swiss economy, which is equivalent to the 89% of its GVA in 2001. However, the absolute GVA of Swiss primary and tertiary sectors is higher than Lombardia's GVA in the same sectors. The Italian higher aggregate economy GVA is therefore due to an important level of production in the secondary sector.

[16] See Appendix 10
[17] See Appendix 11

In terms of sectoral shares, the structure of Ticino's economy is more similar to the Swiss structure than Lombardia's one, where the primary and secondary sectors are relatively more important than in Ticino. However, in absolute terms Ticino's economy represents less than the 4% of the Lombardia's economy.

Table 9: Sectoral distribution of GVA in Switzerland, Ticino, Italy and Lombardia in 2001

	SWITZERLAND 2001		TICINO 2001		Italy 2001		Lombardia 2001	
	GVA in mio USD	Share	GVA in mio USD	Share	GVA in mio USD	Share	GVA in mio USD	Share
AGGREGATE ECONOMY (GVA)	183717		7319		985447		205818	
PRIMARY SECTOR	2758	1,5%	55	0,7%	18519	1,9%	2405	1,2%
SECONDARY SECTOR	54160	29,5%	2034	27,8%	297165	30,2%	79135	38,4%
TERTIARY SECTOR	126799	69,0%	5230	71,5%	669762	68,0%	124279	60,4%

Source: BAK, Basel 2003

Considering the GVA per head[18] (Table 10), which avoids distortions due to a different number of inhabitants, we notice that Swiss sectoral GVA per head is generally higher than those generated in Italy by each sector. Only in the secondary sector Lombardia is able to produce an higher level of GVA per inhabitants (8'869 USD against the 7'441 USD generated in Switzerland). In GVA per head terms, Ticino economy produce higher values than Lombardia only in the tertiary sector (17'195 USD against 13'929 USD). Moreover, it is opportune to notice that the GVA per head generated in Italy by the tertiary sector is inferior than in Lombardia. In fact, Milan is also considered the most important financial place in Italy.

Table 10: Sectoral distribution of GVA per head in Switzerland, Ticino, Italy and Lombardia

GVA per head (USD)	Switzerland (in 2000)	Ticino (in 2000)	Italy (in 2001)	Lombardia (in 2001)
AGGREGATE ECONOMY (GVA)	25117	23839	17290	23067
PRIMARY SECTOR	386	183	325	270
SECONDARY SECTOR	7441	6460	5214	8869
TERTIARY SECTOR	17290	17195	11751	13929

Source: Swiss Federal Statistical Office (SFSO), ISTAT and BAK, Basel 2003

Piemonte's economy (Table 11) is slightly more tertiarised than Lombardia's one (the sectoral shares are respectively of 62,5% against 60,4%), but far from the shares of GVA generated by the tertiary activities in Switzerland and Ticino (which are about of 70%). Moreover, while the GVA per head of Lombardia's secondary sector is higher than in Switzerland, in Piemonte it is not. However, in Piemonte (as in Lombardia) primary and secondary sectors produce higher GVA per head than Ticino's sectors. Thus, the higher level of aggregate economy GVA per head in Ticino is essentially due to the tertiary sector.

[18] In Switzerland the last population census was in 2000, in Italy it was in 2001. Thus, GVA per head were respectively computed in these two different years.

Table 11: Sectoral distribution of GVA and GVA per head in Piemonte

	GVA in mio USD 2001	*Sectoral share*	*GVA per head (USD) in 2001*
AGGREGATE ECONOMY (GVA)	85766,9		20350
PRIMARY SECTOR	1200,2	1,4%	285
SECONDARY SECTOR	30943,5	36,1%	7342
TERTIARY SECTOR	53623,2	62,5%	12723

Source: Swiss Federal Statistical Office (SFSO), ISTAT and BAK, Basel 2003

1.4.2 The labour market across the frontier

Subscribing a bilateral agreement, Switzerland did a first institutional step to favour the free mobility of European Community citizen and workers across Swiss national frontiers (ALC 1999). However, even before this agreement many residents of neighbour Italian provinces daily crossed the national frontier to go working in Ticino. In 2000 the number of Italian commuters was of 29'899 (Table 12). The other commuter flows (in and out Ticino) are quite irrelevant if compared to this typology of workers. In fact, very few Swiss inhabitants go to work in Italy (478) and commuters from other Swiss Cantons (1'750) are approximately equivalent to Ticino's workers that go working on the North of the Alps (1'272).

Table 12: Commuters of Canton Ticino in 2000

	Origine/Destination	Number in 2000	Settlements
A	From other Swiss Cantons	1.750	
B	To other Swiss Cantons	1.272	
C	**Intercantonal settlement**		**478**
D	From foreign countries	29.899	
E	To foreign countries	429	
F	**Foreign settlement**		**29.470**
	Commuters in (Sum A+D)	31.649	
	Commuters out (Sum B+E)	1.701	
	Commuters settlement (Sum C+F)		**29.948**

Source: USTAT, Censimento federale della popolazione (CFP); IMES, Registro centrale degli stranieri (RCS); in Istat and Ustat 2004

The 43% of commuters coming from Italian provinces work in Lugano region and the 42% in the RMVM (Table 13). In the RLVM, Bellinzonese and RTV, the number of commuters is inferior because of the distance from the frontier and the laws that define the region in which they can work[19]. Moreover, the majority of these workers live in Como and Varese (88%), while about 11% of them come from VCO's province and work in Locarno's region. In absolute terms, commuters were 28'889 in April 2000 and they represented about the 18% of the Ticino's work force.

Commuters working in Ticino are mainly employed in the secondary sector (60% in 2002), but in the last years there is an increasing number of commuters working in the tertiary. In fact, while

[19] Commuters could work only in firms located in the south of Claro and Preonzo municipalities. However, after the 1st June 2007 this restrictions will be abolished and commuters will be free to work on the whole Swiss territory.

they were the 36% in 2000, in 2002 they represent the 39% (implying an increase of 24% against the increase of 9% in the secondary sector).

Table 13: Commuters per residential province and working region (April 2000)

	Como		*Varese*		*Verbano-Cusio-Ossola*		*Other regions*		*Total*	
RMVM	6167	52.5%	5953	43.5%	13	0.4%	12	21.8%	12145	42%
RTV	2	0.0%	13	0.1%	5	0.1%	0	0.0%	20	0%
RLVM	64	0.5%	513	3.7%	3150	93.1%	3	5.5%	3730	13%
Bellinzonese	106	0.9%	437	3.2%	134	4.0%	2	3.6%	679	2%
Luganese	5414	46.1%	6783	49.5%	80	2.4%	38	69.1%	12315	43%
Canton	11753	100%	13699	100%	3382	100%	55	100%	28889	100%

Source: Alberton and Bossi (2003)

The free mobility of workers across national frontiers allow Ticino's firms to engage workers paying lower wages (since the cost of living is at the moment lower in Italy than in Switzerland) and to screen a wider labour market pool to find workers with the specific skills they need. As we will see in Chapter 3, innovation activities are "knowledge intensive" and depending on the innovation strategy require a different mix of skilled workers. Thus, the more qualified workers can be engaged by a firm, the more its innovative capacity will potentially increase. For this reason, it is relevant to know the labour market of neighbour Italian provinces in terms of human capital qualifications.

As shown in Table 14, in absolute terms the number of annual graduates in Varese and Como provinces is higher than in Canton Ticino. However, the rates of graduations over the inhabitants in "age of graduation" reveal a similar share in Ticino and in Italian provinces (except for VCO). Moreover, looking at the evolution of the last years (2000-2002), the availability of high qualified human capital in Ticino is increasing. The presence of a new University since 1996 is therefore producing positive results.

Table 14: Annual high degrees graduations[20] and rate[21]

	Number of high degree annual graduations			**Rate**		
	In 2000	**In 2001**	**In 2002**	**In 2000**	**In 2001**	**In 2002**
Canton Ticino	562	737	831	15,5	20,9	24,2
Verbano-Cusio-Ossola	261	283	303	11,9	14,3	16,4
Varese	2175	2292	2479	17,9	20,9	23,8
Como	1445	1516	1590	18,2	20,8	23,1
Total	**4443**	**4828**	**5203**	**63,5**	**76,9**	**87,5**

Source: USTAT, Statistiche sull'università (Svizzera), MIUR, Rilevazione sull'istruzione universitaria (Italia)

[20] These titles concern: Universities, Polytechnics and High schools of applied sciences in Switzerland; Corsi di laurea (vecchio e nuovo ordinamento), Corsi di diploma universitario (vecchio ordinamento), Corsi di laurea specialistica e a ciclo unico (nuovo ordinamento) in Italy.

[21] The rate is computed dividing the annual number of graduated people by the population with the "theorical age of graduation" (of 24 years old in Switzerland and 25 years old in Italy).

Finally, it is relevant to know that while in Italy the rate of the unemployed is generally higher than in Switzerland (for instance, 8,1% in January 2004 according to Istat; 3,7% in October 2004 according to seco), in the "border region" Canton Ticino has the highest unemployment rate (Table 15). Considering the number of Italian commuters coming to Ticino each day, one can conclude that the cantonal labour market suffer from a structural problem (the demand does not correspond to the supply). The progressively permeability of the frontiers to foreign workers will therefore be an opportunity for cantonal firms and a challenge for Canton Ticino workers[22].

Table 15: Unemployment in the border region[23]

	Unemployed in 2003	Unemployed rate (%)
Canton Ticino	8129	5,1
Verbano-Cusio-Ossola	3454	4,5
Varese	13230	3,4
Como	6761	2,7
Sondrio	2847	3,5
Lecco	1951	1,3
Border Region	**36372**	**3,3**

Source: dati armonizzati su base USTAT, Rilevazione sulle forze lavoro in Svizzera (RIFOS) (Svizzera); ISTAT, Indagine sulle forze di lavoro (Italia)

1.4.3 Foreign and Italian capital in Ticino

The financial services of Canton Ticino has a privileged relationship with the Italian market. On one hand this fact implies an advantage because of the Italian economic strength and the high density of capitals. On the other hand Ticino financial sector depends on the Italian business cycles. The structure of this sector is similar to the national one, but some peculiarity could be identified: an important presence of small financial societies that entertain direct links with the customers and exploits some local banks services in outsourcing; a monoculture of private banking and an important presence of Italian banks (Table 16).

Table 16: The Ticino's bank sector in numbers

	Institutes	%	Desks	%	Employees	%
National Bank	1	1,3	1	0,5	12	0,2
Cantonal banks	3	4,0	25	11,9	586	7,4
Big banks	2	2,7	43	20,5	2341	29,6
Raiffeisen banks	1	1,3	47	22,4	463	5,9
Trade banks	6	8,0	20	9,5	1058	13,4
Stock-exchange banks	15	20,0	19	9,0	1494	18,9
Other institutions	1	1,3	1	0,5	3	0
Foreign banks	40	53,3	50	23,8	1914	24,2
Foreign plants	4	5,3	4	1,9	13	0,2
Private banks	2	2,7	1	0,5	16	0,2
Total	**75**	**100**	210	100	7905	100

Sources: Swiss National Bank, Associazione Bancaria Ticinese

[22] Because of that, an observatory of the labour market has been istitutionalised by the Centro per l'osservazione delle dinamiche economiche (CODE). For further informations see website http://www.code.ire.eco.unisi.ch/

[23] In the publication of Istat and Ustat 2004 the border region includes the three provinces of Varese, Como, VCO, Sondrio and Lecco. However, at the moment no commuters come from the last two provinces.

The amount of capital administered by Ticino's financial institutes are estimated to be around 300 and 350 milliards of Swiss francs (about 10-15% of the national administered patrimony) and foreign capitals are thought to be about the 70-80% of them (mainly from Italy).

1.4.4 The flows of goods across the frontier

The most important trade partners of Switzerland are located in Europe (Table 17). In particular, a relevant quantity of goods are exported/imported to/from Italy.

Table 17: The 10 major trade partners of Switzerland in 2003

Share	In millions of CHF	Importations	Rank	Exportations	In millions of CHF	Share
33.30	41'219.7	Germany	1	Germany	27'708.8	21.21
11.13	13'779.2	Italy	2	U.S.A	13'843.6	10.60
11.09	13'731.0	France	3	France	11'457.2	8.77
5.17	6'398.9	The Netherlands	4	Italy	10'971.1	8.40
4.38	5'418.2	U.S.A	5	United Kingdom	6'223.7	4.76
4.34	5'377.7	Austria	6	Japan	5'138.7	3.93
4.00	4'947.7	United Kingdom	7	Spain	4'700.0	3.60
3.79	4'695.5	Ireland	8	Austria	4'445.8	3.40
2.93	3'629.2	Belgium	9	The Netherlands	4'373.8	3.35
2.45	3'031.9	Spain	10	Hongkong	2'751.6	2.11
100.00	123'777.8	TOTAL		TOTAL	130'661.5	100.00

Source: http://www.zoll.admin.ch/f/aussen/entwicklung/wirtschaftsraeume/ein_ausfuhranteil_regionen.php

Thus, because of its geographical position, the goods cross or involve Ticino as trade's origin or destination (according to customs statistics, in 1999 242'679 vehicles circulated in Ticino for those reasons). In terms of monetary value, Ticino's importations and exportations represent about 4% of the Swiss total in 2003 (Table 18).

Table 18: Switzerland and Ticino importations/exportations in the period 1995-2003 (in 1'000 of CHF)

	1995	2000	2001	2002	2003	+/- %	in % 2003
Switzerland's importations	94'483'260	139'402'170	141'889'281	130'193'314	129'742'808	-0.4	100.0
Ticino's importations	2'994'055	4'743'005	5'085'187	5'207'951	5'514'242	5.9	4.3
Switzerland's exportations	96'236'382	136'014'912	138'491'670	136'522'950	135'404'981	-0.8	100.0
Ticino's exportations	3'149'219	4'709'149	5'036'358	4'650'285	5'247'143	12.8	3.9

Source: http://www.zoll.admin.ch/f/aussen/zahlen/kantone/kantonen_einfuhr.php

However, the part of goods crossing the Italian frontier is higher (6,9% vs. 4,3% for importations and 5,6% vs. 3,9% for exportations in 2003) as part of the national trade transit is across Ticino (Table 19). The national trade between Ticino and Italy in 2003 is therefore of 3'390,9 mio CHF for imports (8'905,1 – 5'514,2) and 1'375,2 mio CHF for exports (6'622,3 – 5'247,1).

Table 19: Import and Exports across the Italian frontier in Ticino

Zones	Importation			Exportation		
	2002	2003	+/- %	2002	2003	+/- %
Across Italian frontier in Ticino (in millions of CHF)	8'477.5	8'905.1	5.0	6'170.2	6'622.3	7.3
Across Italian frontier in Ticino (in 1000 tons)	3'369	3'483	3.4	1'417	1'479	4.4

Source: http://www.zoll.admin.ch/f/aussen/zahlen/kantone/uebertrittszonen.php

Finally, it should be considered that being Canton Ticino on the major European transport axis North-South, on its roads and rails circulate goods traded by other European countries: in 1999, 654'791 vehicles transited across Ticino and Gotthard Tunnel (306'158 Nord-Sud and 348'633 Sud-Nord). The trade activities are therefore a source of an intensive use of Canton Ticino's transport infrastructures. In particular, the constant increase of road transport lead times to times to a collapse of the viability, to relevant environmental and economic problems that for several years have been challenging politicians in charged of finding solutions.

CONCLUSIONS

The territorial and socioeconomic characteristics of Canton Ticino presented in this first part, highlights its relatively light socioeconomic weight, its dependency from external resources and its low density of firms and inhabitants if compared to the other Swiss Cantons and Italian closest Provinces. From our point of view, it is therefore misleading to consider Ticino as a metropolis because of its strong relationship with Milan metropolis as suggested by the SFSO. Indeed, on one hand the socioeconomic weight of Ticino's resources does not allow to fulfil the criteria to be considered as a metropolis. On the other hand, the relationships with the Italian Provinces in the suburbs of Milan metropolis, considered in this chapter, seem to highlight a position of dependency of Ticino from the labour and capital market of these foreign regions.

The same conclusion is achieved considering the political positioning of citizens living in this Canton. According to the recent work of Hermann and Leuthold (2003), Ticino has a different mental structure than the rest of Switzerland. The ideological division in Ticino is mainly between richer (right-liberal) and poorer (left-conservative) municipalities, whereas the opposition between City and Rural areas does not exist. Our interpretation of this result is that these City-Rural areas contention does not exist inside the Canton, as the relevant urban agglomerations (Cities) of Ticino are outside its frontiers: one on the north (Zürich) and one on the south (Milan).

The actions of Ticino's economic agents are therefore similar to those operated by citizens located in the periphery of a big city, that typically try to take advantage of urbanisation economies generated by it (see section 4.1.1). In this context, the increase of trade and workers mobility freeness (favoured by the bilateral agreements signed by Switzerland and the member of the European Union, and more in general by an increasing mobility of goods and people) favours the accessibility of Lombardia's resources (in terms of skilled workers, capitals, and other production inputs) and market (in terms of suppliers and consumers), but at the same time it increases competition (either for local firms or local workers). In the short term, the effects are an increase of the selective effects of market, which highly challenge the less competitive Ticino's firms and workers. However, in the long term one expects that the development opportunities represented by the access to a wider labour, capital and input markets will increase the innovativeness and competitiveness of the cantonal economy.

CHAPTER 2: THREE PERIPHERAL REGIONS OF TICINO

The territorial, socioeconomic and political positioning of Canton Ticino presented in the previous Chapter highlighted the relative "weight" of this Canton in the national and international context, as well as some specific characteristics that reveals the influences of external metropolis on the cantonal economy. At this level of observation, Canton Ticino can therefore be considered a peripheral area.

It is now time to know more about the internal characteristics of this peripheral Canton. In fact, the spatial distribution of resources and the functional and socioeconomic dynamics allow to distinguish several regions inside the cantonal frontiers. As already explained at the beginning of Chapter 1, Ticino knows an economic (Lugano) and a political centre (Bellinzona), while the rest of the territory can be considered peripheral to these two centres.

Of course, in Ticino some additional urban concentrations are present, but the relative dimension of the periphery concept imposes to choose a level of observation to avoid confusions. In this Chapter the chosen level refers to the Ticino regions. At this level, RLVM, RMVM, RTV can be considered three regions peripheral to those of Lugano and Bellinzona.

Since the empirical part of this dissertation will be focused on these three regions, in this chapter we will firstly present a descriptive macro-analysis of their territorial and socioeconomic environment and subsequently an overview of the main firms characteristics and the innovation's spatial diffusion obtained through three dedicated surveys[24].

2.1 The population and the territory

A. The Locarnese and Vallemaggia Region (RLVM)

In RLVM live the 20,3% (Appendix 12) of the 2000 cantonal population. Only the region of Lugano hosts more inhabitants (40,7%). After a relatively low rate of growth between 1980 and 1990 (+ 3,4%), in the 90s 5'340 new residents populated the RLVM, which correspond to an increase of 9,4%. The highest rate after the Lugano Region ones.

However, being the region more territorially extended of Canton Ticino (it represents the 40% of the total surface), the population's density is relatively low (56,4 inhabitants per Km2; Appendix 13). RLVM and RTV are in fact the more mountainous regions of the Canton. The main urban agglomeration has developed close to the lake, while the rest of the region residential areas present an higher degree of population's dispersion.

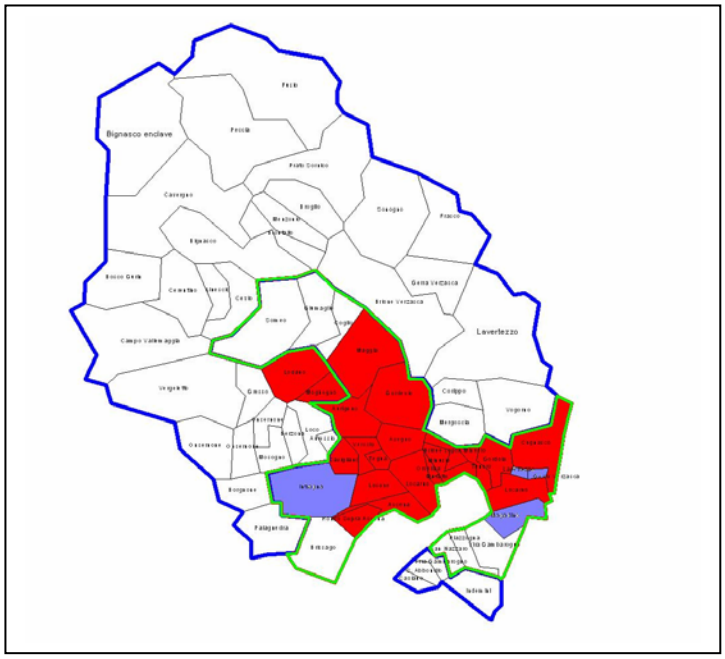
According to the SFSO definition (see Appendix 2), in RLVM rural municipalities in 2000 (white areas in Figure 5) are still more than urban ones (in red is represented the situation of 1990; in blue the municipalities that have been additionally considered urban in 2000). This duality is not only geological, but even socioeconomic.

According to this spatial distribution, in Monitoreg project the authors (Alberton and Bossi 2001) named the more dense and dynamic area Pegaso (bordered by a green line in Figure 5) and the peripherical area Corona (bordered in blue in Figure 5). This distinction was used to define two different development strategies that will not be reported in this work.

[24] See details in Chapter 6.

On average, the RLVM has the oldest population in 2000 (43,3 years old). In fact, as shown in Appendix 14, the 54% of the population is more than 40 years old. The presence of inhabitants with an high schooling degree shifted from 3,3% to 4,4% between 1990 and 2000. However, the major increases of graduates in this period were observed in Lugano and RMVM, where the University of Lugano and the Accademia of architecture were recently created.

Figure 5: Urban and rural areas in RLVM



Source: Alberton and Bossi 2001

B. The Mendrisiotto and Valle di Muggio Region (RMVM)

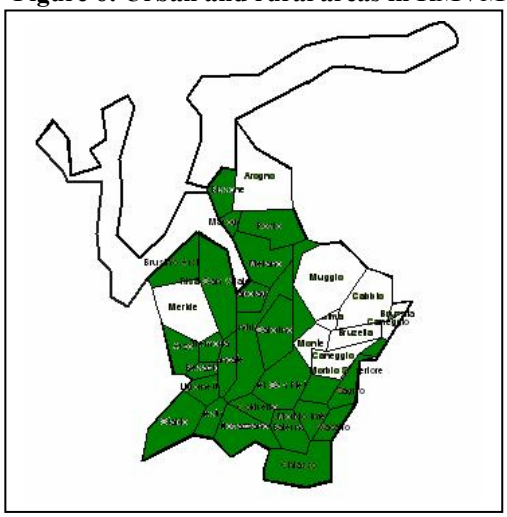
RMVM is the smallest Ticino's region in terms of surface (Appendix 13). Located in the south of the Canton, it is densely populated (407 inhabitants per Km2). Its population represent the 16% of the cantonal population (more than Bellinzonese and RTV which are bigger in terms of surface) and it slightly increased between 1980 and 2000 (Appendix 12).

Except for the Muggio Valley, the territory of the region is generally flat, densely urbanised and crossed by the main european free- and rail-way along the axis North-South. Geographically speaking, it could be considered part of the Pianura Padana which is a wide areas on the south of the Alps on which is located almost the totality of Lombardia Region.

Considering the high population density, it is not surprising that in 2000 urban municipalities cover almost the totality of the regional territory (green areas in Figure 6).

The age of RMVM's inhabitants is on average higher than the cantonal mean (42,3) and more than 50% of the population is over 40 years old (Appendix 14). However, thanks to the presence of the new Accademia of architecture born in 1996, in 1990-2000 the number of graduates increased more than in the other regions except for Lugano (Appendix 15).

Figure 6: Urban and rural areas in RMVM

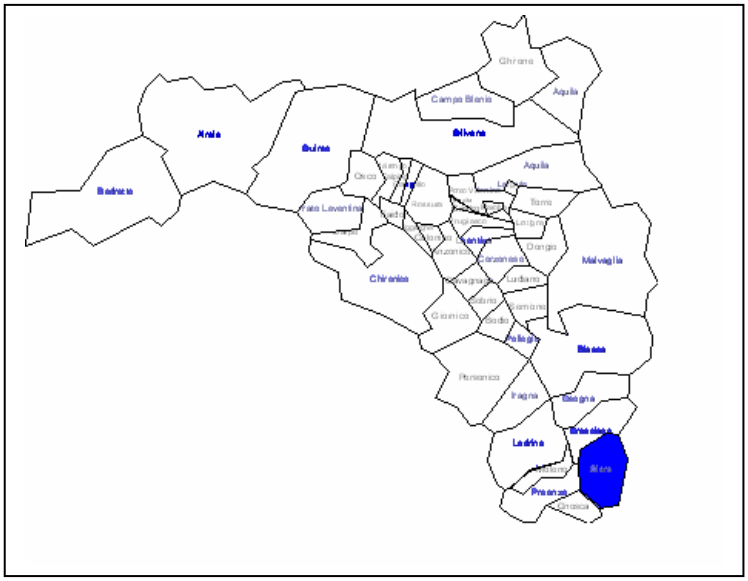


Source: SFSO data and personal elaboration

C. The Tre Valli Region (RTV)

The RTV is the smallest Ticino region in terms of population (Appendix 12). In fact, it hosts the 9% of the total inhabitants and during the last two decades of the past century it recorded the lowest increasing rates (even negative in the period '80 – '90). However, in terms of surface only the RLVM has a more extended territory (Appendix 13). Thus, as a result of this two factors, the population density is the lowest of Canton Ticino (27,2 inhabitants each Km2). Located in the north and close to the Alps, RTV has therefore the typical characteristics of a rural area: small villages and mountainous areas.

Figure 7: Urban and rural areas in RTV



Source: SFSO data and personal elaboration

According to the SFSO definition (Appendix 2), in Ticino there are four conurbations around the four main urban municipalities (Lugano, Locarno, Bellinzona and Mendrisio-Chiasso). Thus, none of them is located in RTV which is completely rural (except for the municipality of Claro which is in the periphery of Bellinzona conurbation; Figure 7).

The age structure of RTV present the highest share of inhabitants under 19 years old and an important presence of residents over 60 years old (Appendix 14). Thus, in this region the population is mainly "non professionally active". In fact, the number of people between 20 and 59 years old is the lower than the cantonal average. Moreover, the percentage of population with an high degree (Appendix 15) is the lowest among the Ticino regions (2,3% in 2000).

2.2 The socioeconomic characteristics

A. The Locarnese and Vallemaggia Region (RLVM)

The 24,4% of working inhabitants are employed by the secondary sector (Appendix 16). Thus, an higher percentage than in the whole Canton (20,5%). Being partially rural, even the share of the primary sector (2,7%) is higher than in Ticino (2%). By contrast, the tertiary sector, which is the most present in each region, is relatively small (72,9%).
The RLVM business density (firms each 100 inhabitants) is identical to the cantonal average: it was of 6,1 in 2001 and it decreased of 0,1 between 1998 and 2001 (Appendix 17). However, the share of firms present in RLVM (Appendix 18) decreased between 1985 and 2001: in 1985 the RLVM's firms represented the 22,3% of Ticino's firms (only the share of Lugano was superior), while in 2001 this value decreased to 20%. This is mainly due to the evolution of firms in Lugano region, where there was a shift from 41,5% to 44,2% that increased the gap between Lugano the other regions.

In terms of employees (Appendix 19), the trend is similar. While in absolute terms there was a slight increase of workers (+ 577) between 1985 and 2001, the relative share decreased of 0,8% because of a consistent increase in Lugano (+4,1%) which is the only region increasing its share in this period. Not surprisingly, the Shift and Share analysis (Appendix 20), which is based on employees data of 1985, 1998 and 2001, shows negative evolutions for all the Ticino regions except for Lugano.

RLVM had the highest MIX[25] value in the period 1985-2001 (because of the presence of high-growth activities), but between 1998 and 2001 it lost the first position now occupied by Lugano (Appendix 20). This is partly due to a decrease of employees in the "mechatronic" industry[26],

[25] *Industry Mix* (MIX) identifies fast growing or slow growing economic sectors in a local area based on the cantonal growth rates for individual sectors. Thus, a local area with an above-average share of the cantonal's high-growth industries would have grown faster than a local area with a high share of low-growth economic activities.
[26] It includes the branches number 29, 30, 31, 32 and 33 of the NOGA classification. A Swiss national version of the European NACE classification (see Appendix 22).

which was a regional specialised[27] sector in 1998, but no more in 2001 (Appendix 21). In fact, loosing the specialisation in 29 and 33 branches, in 2001 the mechatronic industry became a specialisation of Luganese Region. The competitive effect (SHIFT[28]) of the RLVM was already negative in the period 1985-1998, and it decreased in the years 1998-2001 (Appendix 20). On the whole, the pace of growth of the RLVM' sectors is therefore lower than the pace of cantonal sectors.

B. The Mendrisiotto and Valle di Muggio Region (RMVM)

In 1990 RMVM was the region with the lowest share of working inhabitants in the secondary sector (20%) and the highest share in the tertiary sector (78,6%; Alberton and Bossi 2002). However, between 1990 and 2000 firms of the tertiary sector progressively left RMVM to concentrate in the main economic centre of Canton Ticino (Lugano), which in 2000 had the highest share of active population in the tertiary sector (Appendix 16).

The business density (firms each 100 inhabitants) was slightly inferior to the cantonal average (respectively of 6.0 and 6.1; Appendix 17), but it increased between 1998 and 2001. However, in 2001 the firms located in the region represented a lower cantonal share than in 1985 (-0,5% in the period 1985-2001; Appendix 18). More than 1500 employments were therefore lost (Appendix 19).

The Shift and Share analysis (Appendix 20) shows that the decreasing number of employments in the period 1998-2001 were just due to the abandon of cantonal high growth sectors (MIX), which probably shifted from RMVM to the Luganese (as for instance activities of the financial sector).

Finally, the most specific characteristic of this region is that more than 1/3 of the regional employees are commuters (Table 13) with medium-low qualifications. After Lugano, the RMVM is in fact the region in Ticino with the highest share of commuters moving from Italy.

C. The Tre Valli Region (RTV)

Similarly to the cantonal level, between 1980 and 2000 the RTV's economy became more tertiary. However, this evolution is more stressed in RTV. In fact, the secondary sector lost 19% of the share in this period (-11% in Ticino), while the tertiary sector increased 21% (in Ticino +13%). The primary sector in RTV had still the highest share in 2000 (5,3%; Appendix 16), but its share decreased of 2 percentage points between 1980 and 2000. Moreover, although this strong increase of the tertiary sector, its share in 2000 was still the lowest in Ticino (61,5%).

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[27] Taking into account the number of workers (x) of each sector, the i-sector is a regional specialisation sector of the j-region if and only if the value of this ratio is superior of the value to the same i-sector in the other j-1 regions (Rj):

$$\frac{\frac{X_{ij}}{\sum_{i=1}^{n} X_{ij}}}{\frac{\sum_{j=1}^{k} X_{ij}}{\sum_{i=1}^{n}\sum_{j=1}^{k} X_{ij}}}$$

Thus, considering the five regions of Canton Ticino, was looked for the regional specialisation sectors of them.

[28] The *Regional Shift* (SHIFT) or competitive effect is perhaps the most important component. It highlights a local area's leading and lagging sectors. Specifically, the competitive effect compares a local area's growth rate in an economic sector with the growth rate for that same sector at the cantonal level. A leading sector is one where that sectors' local area growth rate is greater than its cantonal growth rate. A lagging sector is one where the industry's local area growth rate is less than its growth rate.

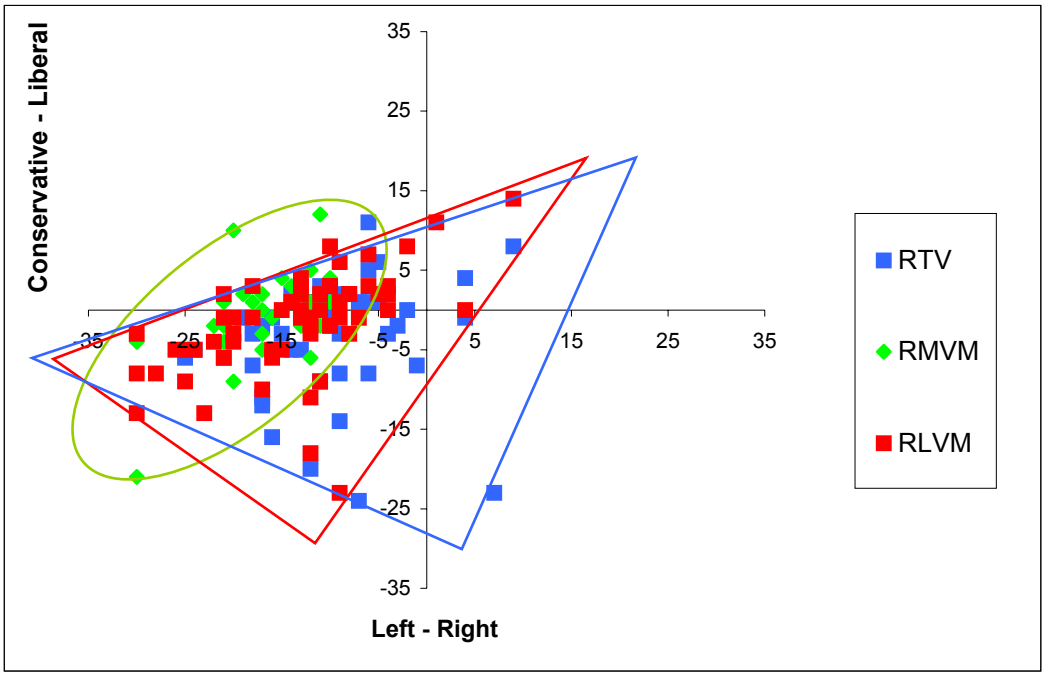
Another "negative" supremacy is the lowest business density, which between 1998 and 2001 decreased of 0,2 (Appendix 17). The number of firms in 2001 is exactly the same of 1985 (+1 to be precise), but because of the increase of firms in the rest of the Canton, the share decreased of 1,2% in this period (Appendix 18). In terms of employees the RTV represents the 5,4% of the cantonal work force (Appendix 19), which is the smallest regional share in 2001. Between 1985 and 2001 in RTV were lost 1029 employments: the second worse regional performance.

The increase of tertiary sector (which is the highest growing sector in Ticino) and the lost of employments lead to a better industrial MIX, but a worse regional SHIFT (Appendix 20). The switch recorded between 1998 and 2001 stresses the difficulties that this region is knowing in terms of socioeconomic development. Finally, several sectoral specialisations (Appendix 21) of RTV are based on few firms that operate in economic branches not present in the rest of the Canton.

2.3 Political positioning of the three Ticino regions

The political positioning of Canton Ticino presented in section 1.3 highlighted the different mental structure of Ticino if compared to those of the other linguistic regions of Switzerland. However, in Figure 3 it is quite hard to distinguish the political positioning of the three Ticino regions. For this reason, in Figure 8 we decided to draw a scatter plot of their political positioning using the data of Hermann's and Leuthold's study (2003).

Figure 8: Political positioning of the three Ticino regions



Source: Hermann and Leuthold (2003), personal elaboration

To give a shape to the regional political positioning we used three geometrical figures: a green ellipse for the RMVM, a red triangle for the RLVM and a blue triangle for RTV. From this graphical representations it is possible to distinguish the more left and liberal positioning of

RMVM, which is the more urban region (as seen in Figure 6). This result is consistent with Hermann and Leuthold findings. Indeed, they also highlighted a left and liberal attitude of Swiss cities and a more right and conservative positioning of more rural areas.

Compared to the cantonal positioning (Figure 3), which include Lugano and Bellinzona regions, those of the three peripheral regions appears more "right and conservative".

2.4 Firms' characteristics, judgments of local context and innovations

Thanks to the three IRE's surveys conducted in Ticino in the period 2001-2003 (Alberton and Bossi 2002, 2003a, 2004a) by 2076 firms of the three regions (RLVM, RMVM and RTV), were collected information on the characteristics of their firms, the owners judgements on the quality of the local context (economic, social, infrastructural and institutional) and the innovation's activities[29]. In addition, we dispose of the results of a national triennial survey on innovation activities conducted by KOF in 2002 (Arvanitis et al. 2004) that allows us to compare the attitude to innovation of Ticino's firms to that of Swiss' firms.

Table 20: Main characteristics of firms located in RLVM, RMVM and RTV

Firms' main characteristics	
Firm size	10,6 employees
Human capital skills and origins	5-6% of employees have an academic title
	More than 50% of employees lives in the region. However, in RMVM commuters represent the 46,5%
Turnover	The median turnover per employee is of 135'714 CHF
Markets	70% of sales are on final markets
	23% of firm's turnover is achieved in foreign markets
ITC's	95% of firms with at least one Personal Computer
	0,4 Personal Computers per employees
R&D	The majority of firms invests less than 50'000 CHF per year in R&D
Delocalisation	18,3% of firms is looking for a delocalisation of its activities

Source: Personal elaboration using IRE' surveys data

Firms' main characteristics (Table 20)[30] computed merging data of the three IRE's surveys and weighting the answers to obtain representative statistics of the regional socioeconomic reality[31], reveal some typical features of these firms. In particular, firms are quite small, they employ a small

[29] See Appendix 1

[30] A more detailed presentation of these results could be found in Appendix 23 (available in Italian only), where data exposed are the average values or the answers obtained with the highest frequency by the surveys, joined by information on the variable distribution.

[31] The weight of each observation was changed so as to obtain the same sectoral shares (measured in terms of employees) of the real economy in 1998 (for RLVM and RMVM) and in 2001 (for RTV). For further information see Alberton and Bossi 2002, 2003a, 2004a

number of high qualified workers, their market is mainly local and they do not invest important sums of money in R&D. However, without referring these characteristics to a specific strategic aim (as for instance the capacity to innovate) the attempt to comment these results is merely a subjective exercise without any scientific validity. Since the aim of this first part is mainly descriptive, we skip deeper analysis of possible implication on firms attitude to innovation that will be discussed in Part III.

We were able to collect additional information through questionnaires sent to each firm of the three regions concerning the firms' owners' judgments on the quality of the local context. Classifying the elements from the most appreciated to the less one (Table 21), three elements do not reach a satisfactory level (defined as a mean of the scores: "very bad", "bad", "good", "very good"): Quality of public incentives to innovation and tourist activities, Quality of territorial planning, Quality of public support to economic activities.

The most interesting aspect of these results is that even without explicitly asking entrepreneurs to judge the local context referring to implication for their innovative capacity, two of the lower scored elements (14^{th} and 15^{th}) are linked to innovation activities: public (financial) incentives to innovation and the territorial planning, which as revealed by the last KOF analysis on innovation activities of Swiss firms is considered one of the most important obstacle to innovation (Arvanitis et al. 2004).

Table 21: Judgments on the local context quality

Rank according to firms judgment	Local context elements
1	Quality of customers
2	Availability of financial resources
3	Quality of infrastructures
4	Quality of high schools
5	Quality of human capital
6	Quality of primary and secondary schools
7	Quality of knowledge in the region
8	Quality of fiscal system
9	Quality of natural resources
10	Quality of sectoral associations (lobbies)
11	Presence of downstream partners
12	Quality of laws
13	Presence of upstream partners
14	Quality of public incentives to innovation and tourist activities
15	Quality of territorial planning
16	Quality of public support to economic activities

Source: Personal elaboration using IRE' surveys data

However, even if it could be expected a negative effect of these two elements on innovation capacity of firms, other elements of local context could offset it. In fact, as we will see in Chapter

3, the quality of customers, the quality of human capital, the availability of financial resources, and other elements highly scored are innovation determinants as well.

To investigate the diffusion of innovative activities of firms in the three regions, entrepreneurs were finally asked to say if they had innovated in the previous three years and what kind of innovation they had done. More precisely, questions about innovation present in the three surveys[32] were:

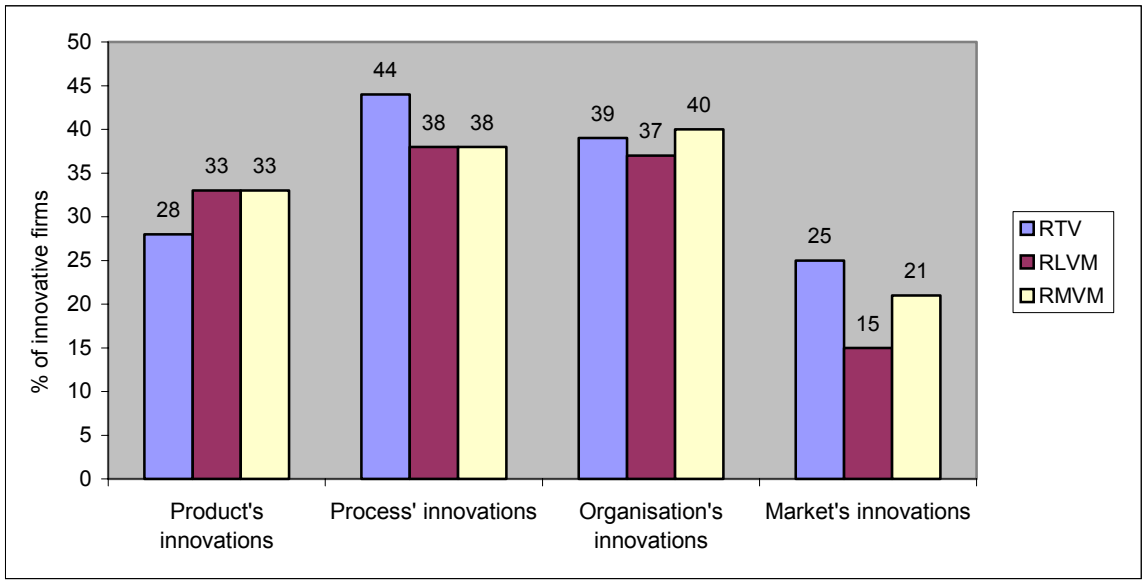
- *Have you launched completely new products or services into the market in the last three years? (Yes/No) How many?*
- *Have you introduced important newness in yours production processes in the last three years? (Yes/No)*

- *Have you introduced important newness in yours firm's organisation in the last three years? (Yes/No)*

- *Have you operated into new market in the last three years? (Yes/No)*

The results of the above four Yes or No questions are reported in Graphic 2.

Graphic 2: Share of innovative firms in the three regions



Source: Alberton and Bossi 2002, 2003a, 2004a

On the whole, process' and organisation's innovations result to be the more frequent innovation in the three regions. Considering that the local competition is generally low[33], this result is not surprising. In fact, "when firms have to choose between the two types of innovation [product and process innovation], it is demonstrated that both firms undertake the product innovation when the competition is intense, they choose different investment projects in intermediate competition, and they pursue cost-reducing innovations when competition is less intense. If firms may pursue both

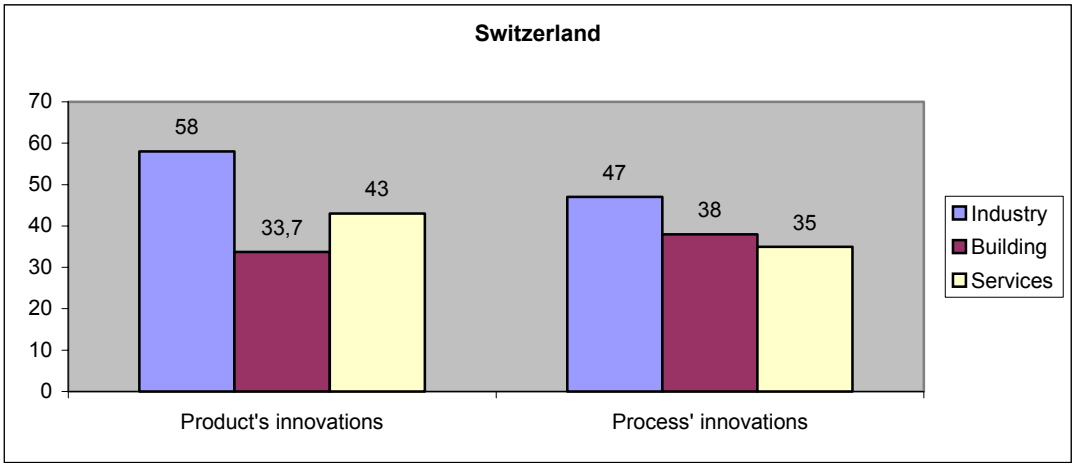
[32] Because the use of this questionnaire was a newness for the institute, there was a learning by doing that led to include new questions in the subsequent versions. However, only the identical questions included in the three "regional" versions could be considered for a inter-regional comparison of the results.
[33] For more details see Monitoreg projects (Alberton and Bossi 2001, 2003, 2004).

innovations, they mix the types depending on the innovation cost structure. Again, firms incur higher costs into product innovations, when the competition is initially intense" (Weiss 2001).

RLVM' shares of firms producing innovation in products and processes are identical to RMVM' shares (33% innovate in products and 28% in processes). However, its shares of innovative firms adopting new organisations or operating on new markets are the lowest among the three regions. RMVM has the highest share of firms introducing organisation's innovations (40%), while in RTV the shares of innovative firms are the highest for processes and market.

As said before, the sectoral structure of the economy plays an important role in firm's innovation strategies. Thus, distinguishing three sectors (industry, building and services[34]) it is possible to observe the different sectoral behaviours. In Switzerland the KOF survey 2002 allowed to compute the shares of the innovative firms by sectors[35] (Graphic 3).

Graphic 3: Innovations in Switzerland by sectors



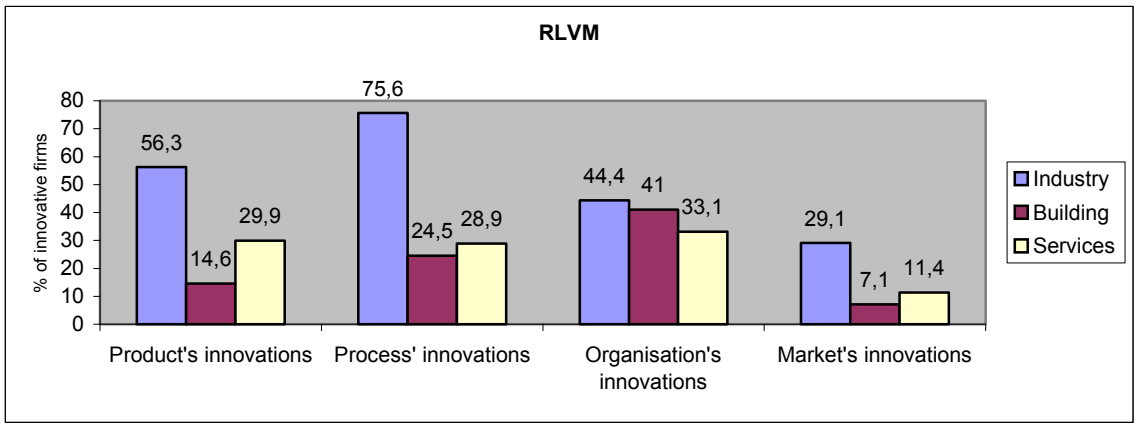
Source: Arvanitis et al. 2004 and personal elaboration

In Industry the products' innovations are more frequent than process' innovations (58% vs. 47%). The same aptitude is verified by the service sector (43% vs. 35%), while in buildings process' innovations are more than products' one (38% vs. 33,7%). Let us see if this proportion are similar at the regional level.

In RMVM (Graphic 4), 56,6% of firms operating in the industry sector innovated in products at least once during the period 1999-2001. Thus, about the same share was observed at the national level (58%). By contrast, the share of firms that adopted an innovation in production processes (75,6%) is higher than the one of firms that innovated in products (47%). Thus, differently from the national results, in RLVM process' innovations are more present than products' innovations. In building sector the situation is similar to the national level: innovation in processes are more frequent than in products. While in services are both inferior, product's innovations are more than process' innovations as at the national level.

[34] Industry include NOGA branches (a Swiss national version of the European NACE classification) from 1-37; Building include branches 40-45 and Services 50-85.
[35] No information are available about organisation's and market's innovations.

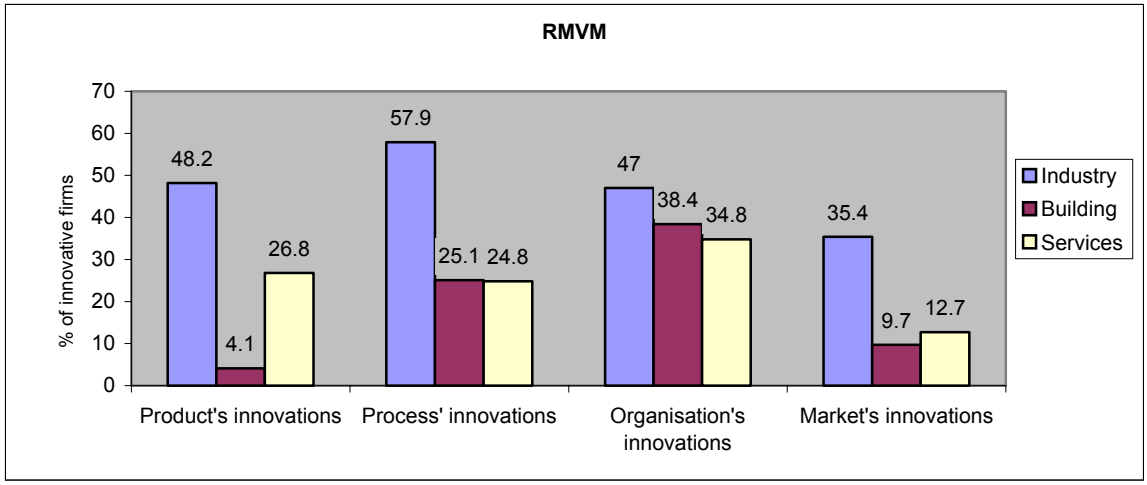
Graphic 4: Innovations in RLVM by sectors



Source: Alberton and Bossi 2002

Organisation's and market's innovations could not be compared to national data because the latter is not available. However, the data reveals an higher innovative activities of services if measured by newness in the organisation (33,1) instead of product's or process' innovations. Moreover, it is observable the constant superiority of the innovative share by Industry. Finally, the "local dimension" of the building sector is confirmed by the low share of firms that started operate into new markets.

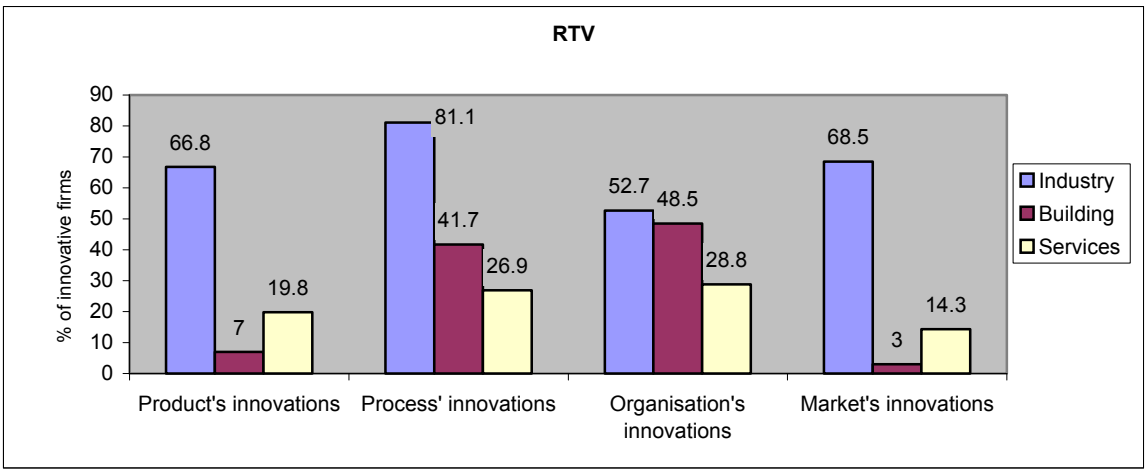
Graphic 5: RMVM and innovations by sectors



Source: Alberton and Bossi 2003a

In RMVM (Graphic 5) firms of industry sector innovate in products less than at the national level (48,5% vs. 58%), but more in terms of process' innovations (57,9% vs. 47%). In building sector process' innovations are more present, but the product's innovations are very few if compared to the Swiss results (4,1% vs. 33,7%). Moreover, as in RLVM, the service sector shows lower share than at the national level. Once again, observing the results of organisation's and market's innovations one notices the superiority of industry, the law number of building sector's firms looking for new markets, and a an high performance of services when organisational innovations are considered (34,8%).

Graphic 6: RTV and innovations by sectors

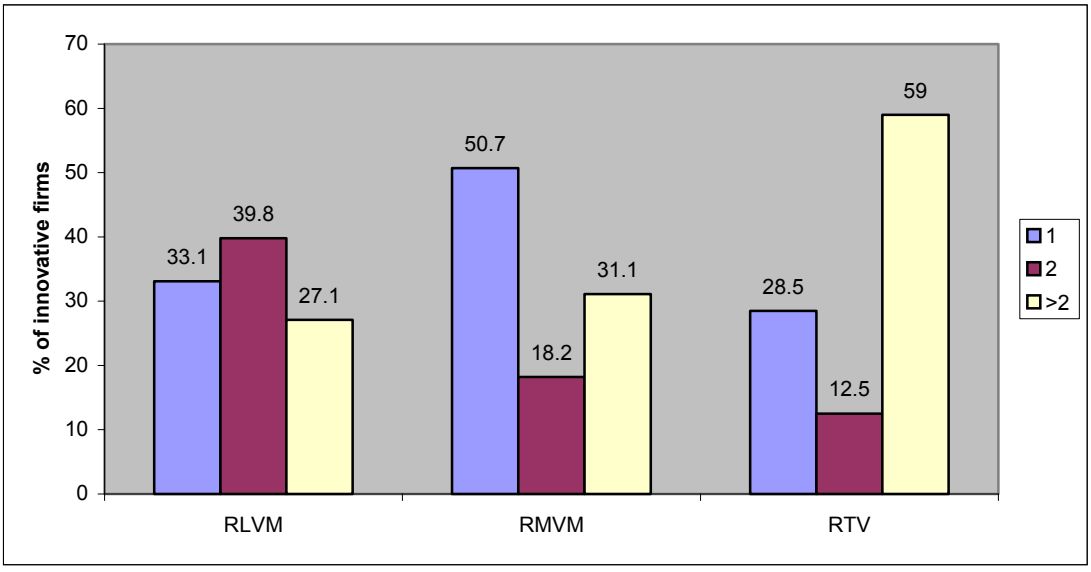


Source: Alberton and Bossi 2004a

The innovations' activities in the RTV (Graphic 6) shows that the presence of innovative firms in industry and building sector is higher than in the other regions. Besides, in process' and market's innovations the merit of the high innovativeness is overall of the industry sector.
Moreover, the RTV's industrial firms that innovate in products and processes are more than at the national level (respectively 66,8% vs. 58% and 81,1% vs. 47%). By contrast in both building and service sector there is a lower share of firms innovating in products and processes.

However, it is important to take into account that in the period 1980 – 2000, in terms of employees, the secondary sector lost 19% of the share (-11% in Ticino), while the tertiary sector increased of 21% (in Ticino +13%). At first sight it could appear a paradox that the less innovative sector is growing while the more innovative one is losing importance in the local economy, but an explanation is directly given by the data themselves: the industrial firms surviving to the negative evolution of the sector are usually innovative.

Graphic 7: Number of products' innovations



Source: Alberton and Bossi 2002, 2003a, 2004a

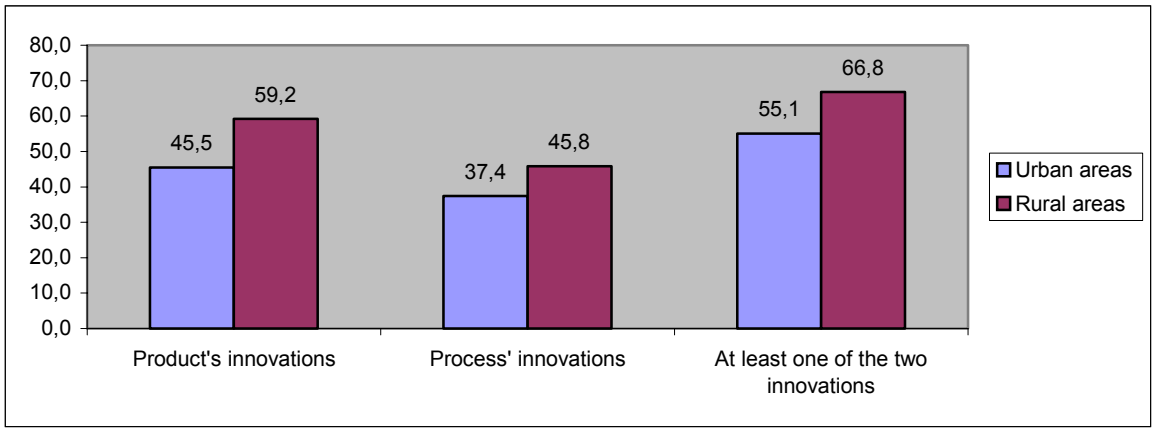
On the whole, in the industry sector the share of firms that innovate in products is similar or superior to the share observed at the national level, while in the case of process' innovations the share is always superior in Ticino regions. In the building sector the rule "more new products than new process" (valid at the national level) is respected in each region but with lower shares. By contrast, Ticino's firms active in the service sector result less innovative than national firms.

To conclude this section, in Graphic 7 is reported the number of product's innovations realised by firms in the three years that preceded the survey. Even in this case the RTV shows an high number of firms which declared to have introduced more than two new products (59% of the total). Thus, not only RTV's innovative firms are numerous, but they are dynamic producers of newness. In RLVM the share of firms producing one, two or more than two new products is about of 30%, while in RMVM more than 50% create just one new product and about 30% more than two.

2.5 Innovations in urban and rural areas of Switzerland and three Ticino regions

Another way to distinguish spatial distribution of firms, is to leave the regional subdivision of results and to present them by urban and rural areas (as defined by SFSO[36]). This spatial distinction was not adopted by the KOF for its study of innovation activities in 2002 (Arvanitis et al. 2004) because the analysis' aim was to supply a national picture of the innovation phenomenon and not a regional or spatial one.

Graphic 8: Innovation in Swiss rural and urban areas in 2002



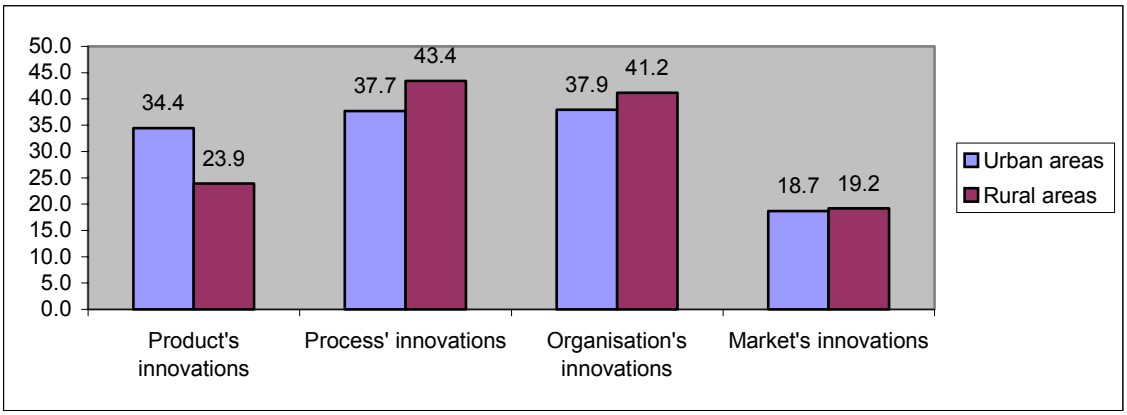
Source: KOF data and personal elaboration

However, having obtained the access to the data collected in 2002, it has been possible to compute (using the same KOF method of weighting observations in the sample), the share of firms adopting product's or process' innovations (or at least one of them) in urban and rural areas.

The most evident result of Graphic 8 is the higher share of innovative firms in rural areas (66,8% vs. 55,1%). Moreover, firms located in rural areas result to be more innovative in products than in processes as urban firms do but with lower shares.

[36] See definition in Appendix 2.

Graphic 9: Innovation in Ticino's rural and urban areas



Source: IRE data and personal elaboration

In Ticino regions (RLVM, RMVM and RTV), except for product's innovations, the results confirm a general higher presence of innovative firms in rural areas[37] (Graphic 9). However, Ticino's rural and urban firms are generally less innovative than national firms. The only exception is the urban firms innovating in processes (37,7% vs. 37,4%).

CONCLUSIONS

The secondary statistics and the main results of IRE's dedicated surveys presented in this first part highlighted the main characteristics of RLVM, RMVM and RTV either at a macro or micro level. The spatial distribution of the socioeconomic resources, their evolutionary trends and the firms characteristics revealed differences and similarities of the three regions. Differences are mainly due to the different territorial situation (more or less mountainous and more or less close to the frontier) of these regions, which lead to different socioeconomic realities. By contrast, the main similarity aspect is the absence of important agglomerations and a general increasing socioeconomic weakening with respect to the main Ticino's economic region of Lugano.

From our point of view, the Lugano development could be seen as a reaction to the increasing "globalisation" of Ticino's local economy. Even if the reasons could not be easily identified, the dynamics of spatial concentration around the city of Lugano seems to be simultaneous to the increase of the international competition, the financial difficulties known by the local economy and in turns by the local public institutions.

This evolution appears very similar to the dynamics explained by the core-periphery model (see section 4.2): a sort of catastrophical evolution that according to the initial situation leads the strongest region to know an increasing level of economic agents concentration and the others a flight of their resources. However, we will not argue that this model perfectly fit the Ticino socioeconomic evolution. Indeed, the Swiss federalist system, regional policies instruments and other factors act as centrifugal forces that prevent this phenomenon to be catastrophical and irreversible (see section 4.1.2). Nonetheless, the concentration of resources in the more urbanised region (Lugano) seems to be the answer of a peripheral Canton to produce a level of

[37] To get significant results that could represent the real situation in the three different regions, the weight of each observation in the sample was changed so as to obtain the same sectoral shares (measured in terms of employees) of the real economy in 1998 (for RLVM and RMVM) and in 2001 (for RTV).

agglomerations externalities (see section 4.1.1) sufficient to contrast the centripetal forces exerted by external big agglomerations as Zürich (for instance in the financial sector) and Milan (whose firms could even benefit of lower production costs).

The numerous indirect effects that the territorial and socioeconomic characteristics could have on the innovation activities and strategies of the firms justify the choice of spending this first Part in describing the characteristics of Canton Ticino and its regions.

Moreover, the results of the innovation diffusion are apparently in contrast with the idea that innovations are usually favourite by agglomeration of firms (Chapter 4). In fact, on one hand statistical socioeconomic descriptions about the three Ticino regions allow to conclude that in three areas are no important agglomerations. On the other hand, we showed that innovations activities are well present in these three regions and even more present in rural areas (as defined by the SFSO) than in their conurbations (except for product's innovation). Thus, even if conurbations as defined by SFSO could be useful to distinguish the diffusion of innovation in two different typology of space (urban and rural), they should not be assumed (a priori) as similar to agglomerations to which innovation theories usually refer (see Chapter 4): industrial districts, innovative milieu, industrial growth poles, etc.

Before starting the investigation of the innovation determinants of firms located in these peripheral regions, an overview of the innovation's scientific literature (Chapter 3) and the core-periphery model (Chapter 4) is required.

PART II
INNOVATION IN ABSENCE OF AGGLOMERATIONS: ATTITUDE TO INNOVATION OF FIRMS SETTLED IN PERIPHERAL REGIONS

INTRODUCTION

The key role of innovation in economic growth and regional development is no more a controversial issue among scientists: on one hand, technological change is considered the engine of economic growth, since it allows economy to overcome the constraint of a steady state priming a new technological path. On the other hand, to maintain an absolute advantage and sustain regional development, competitiveness should continuously be fed by innovations.

According to innovation theories, the innovative behaviour of a firm can differ according to its internal characteristics but also to the specific characteristics of other firms, actors and institutions which are interactions or can potentially interact with it. The institutional environment and the socioeconomic characteristics of the area where a firm is located can therefore play an important role in its innovation capacity. However, while many innovation and regional development theories have focused their attention on successful dynamics occurred in areas where the degree of socioeconomic agents' agglomeration is high (industrial districts, innovative milieu, industrial growth poles, clusters, technological parks, etc.), few of them have investigated the innovations dynamics in areas without agglomeration. Moreover, either the reasons for agglomerate in one place rather than another, or the territorial micro-foundations of innovation have been ignored for a long time.

To introduce the first main multi-disciplinary phenomenon of this work (innovation), in Chapter 3 we will present an overview of the main indicators used to measure innovation, the main innovation's determinants considered by the classical and modern literature, and the strategic reasons to launch innovation. Moreover, reporting recent scientific contributions of regionalists, we will discuss the role of territorial competitiveness and proximity in favouring or discouraging innovation.

The description of peripheral areas as "areas where agglomerations are absent" implies the possibilities to define the geographical borders of an agglomeration. Or, since peripheral areas and agglomerations are conceptually and geographically complementary (one is the rest of the other), the relative and absolute sides of periphery considered in the introduction of Part I are dimensions of the agglomeration concept as well. The relative side of these concepts will therefore prevent from distinguishing a level of concentration sufficient to recognise an agglomeration without recurring to a subjective (or absolute) criterion: minimal number or density level of firms in the agglomerations, etc.

The complementarity of agglomerations and periphery is evident in the core-periphery model (Chapter 4), which models the main dynamics of spatial dispersion and concentration of firms. However, assuming the existence of catastrophical mechanism, this model deals only with two extreme situations: the concentration of the firms in only one region and a perfect fifty-fifty share of the firms between the two regions considered in the model. Since in the real world the situations are never so extreme, a non subjective way to distinguish peripheries and agglomerations is not supplied by this model. Nonetheless, it will give us the opportunity to discuss the reasons of firms' agglomerations (centrifugal and centripetal forces), and to consider the possible implications on the innovation activities and the strategies of the firms.

Since not only the geographical dimension of periphery can have effects on the innovation activities, other territorial and socioeconomic elements that characterise peripheral areas will be considered in Chapter 5. The aim is to characterise peripheries in terms of dimensions that can affect the innovation attitude of firms. However, innovation being a territorial dependent phenomenon, the specific characteristics of each regions prevent a generalisation of the results. This last aspect is certainly one of the main reasons that explains why regional scientists looking for "territorial" innovation determinants have favoured descriptive approaches rather than models. In fact, the wish to introduce spatial dimension in a model of innovation activities is partly in contrast with the wish to apply it to a wide range of regions of the world: the more the explanatory power of the model would depend on specific territory characteristics, the less it will be possible to obtain a model fitting a large number of regions.
However, distinguishing which characteristic of peripheral areas are specific of the region analysed and which not (as we will do), it will be easier for other researchers to evaluate if our results fit the regional reality they are studying. At first sight our scientific contribution could therefore appear as a drop in the see, but since no other ways to overcome this trap seems to be available, it could also pragmatically be considered as a necessary small step to improve the scientific knowledge in this field.

CHAPTER 3: INNOVATION DEFINITION, MEASURES, DETERMINANTS, STRATEGIES AND SPACE

According to several growth theory authors (e.g. Solow 1956, Romer 1990, Aghion and Howit 1992), the innovative capacity and the ability to imitate new technologies adopted across regions are key factors in determining the rate of growth of an economic system. Thus, since many years, economists have been trying to understand and formalise mechanisms related to the generation and diffusion of innovation. The first stimulus to investigate in this scientific field was given by Joseph Schumpeter's writings (1939, 1942), which are still the major theoretical references for present economic researches. According to Schumpeter, technological change consists of the introduction of new products (product innovation), production processes (process innovation) and management methods (organisational innovation) in an economic system.

Two additional important distinctions are made between *radical* and *incremental* innovation and between *global* and *local* innovation. Radical innovations represent a breakpoint with the existing products and production processes, while an incremental one implies an improvement of them. On the other hand, a global innovation implies a particular event, for instance the introduction of a new machinery in a production process, that occurs for the first time at a global level, whether a local innovation refers to a similar event that happens in a defined environment and that is already occurred somewhere else[38]. This second distinction is not very common in literature, but it will be especially useful and recurrent in explaining innovation strategies of firms located in peripheral areas.

Furthermore, three different phases of technological change are usually distinguished: *invention* that relates to the generation of new ideas (scientific or technological); *innovation* that implies the development of marketable newness; and the *diffusion* phase, whose focus is on the distribution of innovations over time and space. However, these phases should not lead to believe that technological change is a linear process. In fact, the interrelations between the various stages of the technological change suggest that a chain model which considers information feedbacks is more appropriate (see Klein and Rosenberg 1986).

Although the existence of several terms to describe the main phases or types of innovation, the complexity of the phenomenon hamper the adoption of a universal definition of innovation. Thus, the theoretical and empirical works on innovation are dealing with an high degree of subjectivity. Some of the most popular definitions and measures of innovation will be therefore presented in this Chapter.

Another important factor that increases the difficulty of modelling the innovative attitude of firms is the uncertainty about future rents (or pay-off to use the game theory terminology). Indeed, through R&D and other scientific and technical services, firms attempts to reduce asymmetric information and uncertainty, but despite their effort a certain degree of uncertainty will remain (Freeman and Soete 1997, pp. 242-264). Thus, entrepreneurs will strategically act in a context of no perfect competition, because two of the assumptions of the model (perfect information and equal technology) are not fulfilled. After a comprehensive overview of the major innovation's determinants, we will therefore present several strategies adopted by innovative firms.

Later on we will introduce the main arguments that have led regional economists to consider space as a fundamental determinant of innovation activities and regional development. As we will see,

[38] This distinction is proposed in Crespi 2004

the concept of proximity is recurrent and not only geographical but also cognitive, organisational, social and institutional in this literature. Said differently, these approaches have the merit to highlight the necessity to enter other territorial dimensions in innovation models, in addition to the spatial distance among economic actors (the geographical proximity).

Since the regional approaches are convincing in showing the impact of space on innovation, the possible spatial dimension of each innovation's determinants will be highlighted and summarised in the conclusions of this chapter.

3.1 Introductory concepts, definitions and measures of innovation

Since a theoretical clear definition of such a complex phenomenon as innovation has not yet been found, its measure always implies a certain degree of subjectivity that researchers should introduce in defining it and choosing indicators to measure it. Indeed, each indicator implies a measurement error and can only partially explain the innovation activities. Moreover, the sectoral, competitive and production structure plays an important role in firms' innovation strategies. Thus, to keep into account this heterogeneity of factors, researchers generally appeal to a set of indicators and generate an index.

One of the most referred definitions of innovation in Europe is the one proposed in 1997 by the Oslo Manual. A joint publication of Eurostat[39] and the OECD currently under revision in order to account for new orientations of European innovation policy. According to OECD technological innovation is defined as follow:

> *"**Technological product and process (TPP) innovations** comprise implemented technologically new products and processes and significant technological improvements in products and processes. A TPP innovation has been implemented if it has been introduced on the market (production innovation) or used within a production process (process innovation). TPP innovations involve a series of scientific, technological, organisational, financial and commercial activities. **The TPP innovating firm** is one that has implemented technologically new or significantly technologically improved products or processes during the period under review"* (OECD, 1997, pp. 31-32).

TPP innovation can therefore be composed of:

- *"A **technologically new product** is a product whose technological characteristics or intended uses differ significantly from those of previously produced products. Such innovations can involve radically new technologies, can be based on combining existing technologies in new uses, or can be derived from the use of new knowledge".*
- *"A **technologically improved product** is an existing product whose performance has been significantly enhanced or upgraded. A simple product may be improved (in terms of better performance or lower cost) through use of higher-performance components or materials, or a complex product which consists of a number of integrated technical sub-systems may be improved by partial change to one of the sub-systems".*
- *"A **technological process innovation** is the adoption of technologically new or significantly improved production methods, including methods of product*

[39] http://epp.eurostat.cec.eu.int/

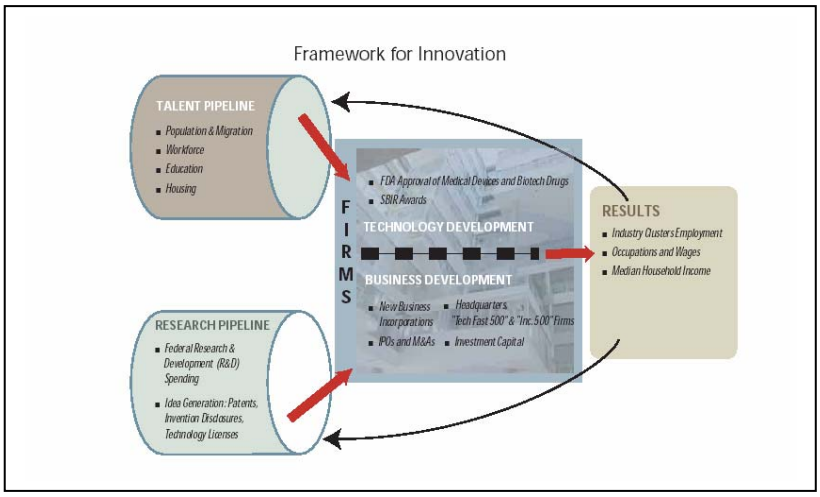
delivery. These methods may involve changes in equipment, or production organisation, or a combination of these changes, and may be derived from the use of new knowledge. The methods may be intended to produce or deliver technologically new or improved products, which cannot be produced or delivered using conventional production methods, or essentially to increase the production or delivery efficiency of existing products" (OECD, 1997, pp. 31-32).

Among the more famous Index and statistical innovation's monitoring instruments in USA and Europe could be mentioned: The Index of the Massachusetts Innovation Economy; The European Scoreboard of Innovation; The Community Innovation Survey.

i) The Index of the Massachusetts Innovation Economy (IMIC)

"The Index measures the progress of 17 indicators related to the Massachusetts Innovation Economy[40]*. Innovation is a complex process. No economic model can do full justice to the interplay of talent, finance, and new ideas that determines first whether an innovation will occur, and then if it succeeds in generating real economic growth. The objective of the Index is to create a broad outline of the innovation process in the economy so one can benchmark the Innovation Economy in Massachusetts with other competitor states and to identify trends in the leading indicators over time. The 2004 Index disaggregates the state's innovation process into four parts* [Figure 9]*: three resource pipelines (Technology & Business Development, Talent, and Research) and the Results that appear and impact the pipelines. These four components are delineated by a set of indicators that track the performance of the Innovation Economy."* (Massachusetts Technology Collaborative 2004)

Figure 9: Framework for innovation



Source: Massachusetts Technology Collaborative 2004

[40] "Indicators are quantitative measures that tell how well the state is doing: whether the state is going forward or backward; getting better, worse, or staying the same. A rigorous set of criteria was applied to all potential indicators. All of the selected indicators: are derived from objective and reliable data sources; are statistically measurable on an ongoing basis; are bellwethers that reflect the fundamentals of economic vitality; can be understood and accepted by the community; measure conditions in which there is an active public interest". (Massachusetts Technology Collaborative 2004)

ii) The European Scoreboard of Innovation

"The European Innovation Scoreboard (EIS) was developed at the request of the Lisbon European Council in 2000 . It focuses on high-tech innovation and provides indicators for tracking the EU's progress towards the Lisbon goal of becoming the most competitive and dynamic knowledge-based economy in the world within the next decade.
The EIS contains 17 main indicators, selected to summarize the main drivers and outputs of innovations. These indicators are divided into four groups: Human resources for innovation (5 indicators); the creation of new knowledge (3 indicators of which one is divided into EPO and USPTO patents); the transmission and application of knowledge (3 indicators); and Innovation finance, outputs and markets (6 indicators)."
(http://trendchart.cordis.lu/scoreboards/scoreboard2002/index.cfm)

Being not in the European Union, Switzerland (together with Iceland and Norway) figures in the EIS as an Associate country. The results of recent analysis revealed that *"both Switzerland and Iceland are above the EU mean for 10 and 11 indicators respectively, which would place them among the innovative leaders. Switzerland's performance is particularly strong for life-long learning, business R&D expenditures, USPTO high-tech patent applications, new capital raised on stock markets and the value-added share of high-tech manufacturing, with levels more than 20% above the EU mean (see Country page). Switzerland is lagging for two of the human resources indicators: new S&E graduates and working-age population with tertiary education. The trend results for Switzerland are behind the EU average for six of eight indicators, suggesting that Switzerland is loosing its innovative advantage*"
(http://trendchart.cordis.lu/scoreboards/scoreboard2002/associate_countries.cfm).

iii) The Community Innovation Survey

"The Community Innovation Survey (CIS) provides this basis. It is the main statistical instrument of the Union that allows the monitoring of Europe's progress in the area of innovation. The CIS creates a better understanding of the innovation process and analyzes the effects of innovation on the economy (on competitiveness, employment, economic growth, trade patterns, etc.).
The CIS has been carried out for the first time in 1992. CIS2 took place in 1996 and CIS3 in 2001. Data gathering and analysis has been supported under the various Community RTD Framework Programmes. Since 2000, the CIS has become a major data source of the "European Innovation Scoreboard". To ensure the timely updating of the scoreboard, the Commission has asked the Member States to carry out the CIS more frequently.
The methodological basis of the CIS is provided by the "Oslo manual" [OECD 1997]*, a joint publication of Eurostat and the OECD […] The Oslo manual is currently under revision in order to account for new orientations of European innovation policy. Among other aspects, the next CIS should contribute to a better understanding of the "non-technical" aspects of innovation, such as management techniques, organisational change, design and marketing issues" (http://www.cordis.lu/innovation-smes/src/cis.htm).*

In Switzerland the SFSO does not supply an Index on innovation activities of firms, but several indicators (e.g. R&D expenditure by the private sector, the universities and the government, new firms, patents, and so on) that could be used by researchers and policy makers to compose their own index or to give prominence to some punctual policy results.

Two research institutes that carry out analyses on the innovation activities in Switzerland are the BAK Basel Economics and the KOF. However, while the former (as IMIC and EIS) adopts a "macro" approach (referring to the regional and national level) and obtains data by secondary statistics, the latter acquires information directly by firms through a triennial survey.

BAK established in 1998 the «IBC BAK International Benchmark Club», which "*advises governments, administrations, trade associations, foundations and companies at the national and regional level on matters of business location quality and economic policy. The Clubs' unique database currently covers 260 regions and up to 64 business sectors and is regularly extended and updated. This database allows the Clubs' members to assess in detail strengths and weaknesses of their region and to benefit from the experiences of other regions*" (http://www.bakbasel.ch/wEnglisch/benchmarking/ibc_club/).

The IBC Development Module Innovation focuses its studies on "*innovation resources, innovation processes and innovation results. The following indicators are currently available:*

- *hourly productivity growth*
- *size of labour pool broken down by qualifications*
- *public and private R & D expenditure*
- *number of students of universities and technical universities*
- *bibliometric indicators*
- *availability of venture capital*
- *quality of knowledge and technology transfer*
- *number of newly founded companies*

In order to enhance the comprehension of the rather complex notion of regional and national innovation capacity, new indicators are constantly developed and added. Currently the focus is on national and regional penetration of the ICT infrastructure and its contribution to productivity growth. The IBC location factor module „Innovation" is developed in collaboration with the ISI/Fraunhofer Institut, Munich and D & B (Dun & Bradstreet International)".
(http://www.bakbasel.ch/wEnglisch/benchmarking/modules/innovationW3DnavidW2678.shtml)

The KOF classifies the innovation's indicators by the three phases of the innovation process (Table 22) according to an Arvanitis and Hollenstein work (1999).

Table 22: Measures of innovation by the phases of the innovation process

Input	Output	Market results
Innovation expenditures (qualitative) o Research o Development o Realisation and design o Further investments o Informatics equipments **Innovation expenditures (share of turnover)** o R&D activities o Total innovation's expenditures	**Meaning of product and process innovation** o From a technical point of view o From an economic point of view **Patents filed** o Yes/No o Number of patents	**Degree of novelty (product innovation)** Share of turnover by: o Improved products o New or substantially improved products World's newness: o Yes/No o Share of turnover **Innovations' consequences in terms of cost reduction (process innovation)** o Yes/No o Percentage

Source: Arvanitis et al. 2004, personal translation

The main results of KOF' survey (Arvanitis et al. 2004) show that in Switzerland, between 1991/93 and 1997/99, the innovative efforts of the manufacturing firms decreased. The same trend was recorded by the service sector, but the shorter period of observation (data on services are collected only since 1994/96) impose prudent conclusions. This global evaluation was computed combining the trend of firms that have done specific innovation activities (innovative firms that did R&S, filed patents or introduced a world new products) and the intensity of innovation.

Table 23: Innovation indicators in an international comparison

	(1) Share innovators (%)	(2) Share product's innovators (%)	(3) Share process' innovators (%)	(4) Expenditures for innovation as % of turnover	(5) Firms doing R&D activities (%)	(6) R&D expenditures as % of turnover	(7) Product's innovations as % of turnover	(8) Product's innovations as % of turnover	(9) Average of ranks[41]
Based on:	All firms	Innovative firms	Innovative firms	All firms	Innovative firms	Innovative firms	All firms	Innovative firms	
Switzerland 2000-02	67,6	87,8	69,5	4,2	65,4	2,4	23,5	34,2	3,4
Switzerland 1997-99	70,5	78,4	72,4	4,3	62,8	2	not available	not available	
Germany	62,1	85,7	75,7	2,9	51,6	1,4	29,7	34,5	4,6
France	40,8	90,4	76,7	2,5	77	2,1	18,3	24,7	6,8
Italy	36,3	67,7	72,4	2	35,3	0,8	25,6	40,1	11
Sweden	46,8	69,3	43,1	12,1	59,9	3,6	25,9	32,9	3,8
Dänemark	44,3	82,5	58,4	0,5	70,2	0,4	20,1	30,4	10,6
Finnland	44,8	78,2	52,5	2,5	70,9	2,2	32	47	4,4
Norway	36,4	81,7	61,2	1,2	55,1	1	8,9	13,2	12,4
The Netherlands	45,3	83,1	56,4	1,5	54,3	1,1	12,1	17,1	10,4
Belgium	50,1	80,4	61,6	2,7	60,2	1,3	19	26,2	6
Austria	48,8	70,9	52,1	1,7	50,3	1,1	17,8	24,1	9,4
Luxemburg	48,3	72,6	57,2	1,3	38,6	0,7	9,5	12,5	11,8
Island	55,1	83	61,6	1,7	70,6	1,3	4	5,6	7,6
Spain	32,6	66,4	67	1,2	37,9	0,6	25,3	37,5	12,6
Greece	28,1	67,8	63,7	2,1	56,4	not available	11,7	29,4	11,3
Portugal	46,4	60,2	67,1	2,6	39,2	0,4	25,9	34,2	9

Source: Arvanitis et al. 2004 ; Eurostat, NewCronos ; http://europa.eu.int/newcronos/. Period of observations: 1998-00 (except for Switzerland 2000-02)

International comparisons could be done only at the European level (Arvanitis et al. 2004), because only at this level the available data are similar. In Table 23 are reported indicators of *Community Innovation Survey* III (1998-00) for 15 European countries and Switzerland (based on KOF data). The table shows that the share of innovative firms in Switzerland detected by the 1997/99 and 2000/02 KOF' surveys (column 1) are the highest in Europe (70,5% and 67,7%) and different to the other countries there is not an important gap between products' (column 2) and process' innovators (column 3). In the lower part of the classification are Mediterranean countries (Italy, Spain, Greece and France), and two Scandinavian countries (Sweden and Finland). Moreover, in Switzerland R&D activities are well diffused, with shares similar to those in Scandinavian countries.

[41] Arithmetic average of five indicators: (1); (4); (5); (6); (7)

In terms of product's innovations as % of turnover among innovative firms (column 8), at the top of the rank list are Finland and Italy (with more than 40%), while Switzerland follow in a group of countries that reach about 34-37% of the turnover selling innovative products. The average of five indicators (column 9) shows that, even if there has been a worsening in the last years, Switzerland is still an innovation's leader in Europe.

Table 24: Advantages and disadvantages of innovation indicators

Input	Output	Market results
Advantage: They allow to do forecasts about future innovation capacity ***Disadvantages:*** The effects on innovation capacity are mainly indirect and difficult to be measured Only few of them are reported by secondary statistics	**Meaning of product and process innovation** ***Advantage:*** It can be obtained by asking to the firm if it has introduced newness form a technical and economic point of view in the last three years ***Disadvantages:*** It is a subjective measure **Patents filed** ***Advantage:*** It is an objective measure. Data are easily obtained by the answerable institutions. Available in each country. ***Disadvantages:*** The administrative costs (6'000 euro at the European level + 800 euro each years; 50'000 -100'000 euro at the world level + different cost according to the country of origin) can lead innovators not to patent some innovations.	***Advantage:*** It is an economic measure (share of turnover) ***Disadvantages:*** These data are not reported by secondary statistics Very often are not known or computable by the firm as well.

Source: Capuano 2004, Arvanitis and Hollenstein 1999, personal elaboration

As said in this section, the explanatory power of each indicators is only partial. Thus, advantages and disadvantages of each of them should be known by the researcher in charge of measuring innovation capacity. In Table 24 are summarized the main merits and lacks of them. To compute a significant index of innovation at a micro level is therefore a challenge for researchers: it implies a well knowledge of the topic (from a theoretical and empirical point of view) and the availability of detailed and costly data on firms activities.

3.2 Determinants of innovation

In a now famous book, Schumpeter (1942) was the first to discuss the relationship between innovation activities and company characteristics. In particular, he put forward a fundamental hypothesis: innovation activity increases more than proportionally with company size and with market concentration.

Provoked by Schumpeter's claims, industrial organisation economists focused their efforts on the effects of firm size and market concentration on innovation, neglecting other fundamental determinants (appropriability, financial structure, geographical proximity, market demand, technological opportunity, etc.).

In fact, there can be a number of different reasons for firm's heterogeneity in innovation activity. On one hand, this diversity could be due to firm own characteristics: the company's size, the relationship with other economic agents, the opportunities for technological alliances, the strategic objectives, the means used to protect the innovation and the innovation activity itself. On the other hand, the sector of activity, the institutional environment and the socioeconomic characteristics of the area in which firms are located could also play an important role in its innovation capacity.

This latter factor (the location of the firm) is considered crucial in the present work. Indeed, our fundamental assumption is about ***a specific innovative attitude of firm located in peripheral areas*** (or outside agglomeration). However, the complexity of innovation phenomena and the multitude of elements directly and indirectly linked to the spatial dimension (see Chapter 4), do not allow to assume a priori neither that the influence of the spatial location of the firm has a dominant explanatory power nor that it is completely independent from the other determinants.

In the following paragraphs we will present an overview of the factors that the scientific literature usually considers as innovation's determinants and their possile spatial dependency. An essential step of the further implemention of a model explaining the attitude to innovation of firms settled in peripheral areas.

Firm size

Even if the Schumpeter's (1942) classic discussion highlighted qualitative differences between innovative activities of small and large firms, the empirical literature (with only few exceptions[42]) has usually interpreted his claim in quantitative terms: as a continuous relationship between R&D and firm size. Thus, the Schumpeterian hypothesis about firms size has been tested by regressing some measure of innovative activity (input or output) on a measure of size (Cohen 1995, p.184).

Over the years, several justifications for a positive effect of firm size on inventive activity have been offered (Cohen 1995, p. 184): capital market imperfections confer an advantage on large firms in securing finance for risky R&D projects because size is correlated with the availability and stability of internally-generated funds; there are scale economies in the R&D function itself; the returns from R&D are higher where the innovator has a larger volume of sales over which to spread the fixed costs of innovation, particularly process innovation; R&D is thought to be more productive in large firms as a result of complementarities between R&D and other non manufacturing activities (e.g. marketing and financial planning) that may be better developed within large firms; finally, it is sometimes suggested that large, diversified firms provide economies of scope or reduce the risk associated with the prospective returns to innovation.

As counter-arguments were suggested that as a firm grow large, efficiency in R&D is undermined by a loss of managerial control or, alternatively, by an excessive bureaucratic control. In other words, the incentives of individual scientists and entrepreneurs may decrease with firm' size because their ability to capture the benefits from their individual efforts diminishes or their creative impulses are frustrated by the conservatism characteristic of hierarchies of large corporations[43] (Scherer and Ross 1990, pp. 652-3).

Other studies focused on the relationship between firm size and the composition of firms' R&D within industries suggested that larger firms tend to favour incremental R&D[44] and relatively more

[42] E.g. Scherer 1965, Nelson et al. 1967, Gellman Research Associates 1976, Pavitt et al. 1987

[43] For an interesting investigation about "how can economic agents with given endowment of new knowledge best appropriate the returns from that knowledge", see Audretsch 1995.

[44] Mansfield 1981, Wilson, Ashton and Eagan 1980

process R&D[45] than smaller firms (Cohen 1995, p. 206). Subsequent studies precised that larger firms are not innately more capable at process or incremental R&D. Rather their attitude reflect a different strategy: larger firms favour those types of innovation (such as process and incremental) that confer more appropriability advantage because the innovation are less saleable in disembodied form and are less likely to generate rapid growth (Cohen and Keppler 1996).

By an empirical analysis, Acs and Audretsch (1990) revealed that small firms performs more innovation per employee. However, few years later Cohen and Keppler (1992a) criticised this last result arguing that is not sufficient to count the number of innovations as they can deeply differ in quality. In a more recent literature, the major conclusions are that, apart from the question whether the relationship is linear or not (see, for example, Mohnen and Dagenais 2002; Martínez-Ros and Labeaga 2002), the probability of being innovative increases with firm size. However, given that a small firm innovates, the number of innovations introduced and/or the speed of diffusion (measured in share of innovative products in total sales) is not lower than in larger firms (Kleinknecht and Mohnen 2002, p. xxiii).

Since this innovation's determinant is essentially internal to the firm, neither theorical nor empirical studies distinguish the impact of this determinant in different spatial contexts. However, comparing the average firm' size across several countries or regions (e.g. peripheral and urban) and historical periods (e.g. after a local demand expansion or the development of a new local specialisation), differences can be observed. Thus, even without reporting scientific investigation on the determinant of firms' size, it appears naive to exclude a priori a link between the space and this innovation's determinant. Nontheless, ceteris paribus, being an internal characteristic of the firm, the marginal contribution of firm' size is independent from space.

Monopoly power vs. competition

The second Schumpeter hypothesis deals with the question whether an economic system characterised by the presence of a big company and a certain level of market concentration performs better (in terms of dynamic efficiency) than a context of perfect competition. The debate about this aspect is based on two famous contributions of Schumpeter and Arrow. Indeed, in contrast with Schumpeter's ideas, Arrow (1962) argued that perfect competition gives the major incentives to innovation. His argument is that a monopolist gains less than a new entrant from innovation, because by its introduction the monopolist will replace part of his existing profits, while in perfect competition it is actually the introduction of an innovation that produces all rents. Incentives to invest in R&D are therefore greater in perfect competition.

On the other hand, Schumpeter stressed the positive effects of market power on innovation through two arguments (Cohen 1995, pp.191-192):

- firms require the expectation of some form of transient market power to have the incentive to invest in R&D (usually obtained by patent law and conceptualise in literature by the term "*appropriability*"[46]). Thus, the incentives to invent are associated with the expectation of *ex-post* market power.
- An *ex-ante* oligopolistic market structure and the possession of *ex-ante* market power also favours innovation. The reason is that an oligopolistic market structure reduces uncertainty associated with excessive rivalry that tends to undermine the incentive to invent. Moreover, the profits derived from the possession of ex-ante market power provides firms with the

[45] Link 1982, Pavitt et al. 1987, Scherer 1991
[46] This concept will be explained in section 5.2

internal financial resources necessary to invest in innovative activity. Finally, ex-ante market power would tend to confer ex-post market power.

The extensive empirical literature has mainly focused analyses on the effects of market concentration on innovative behaviour (thus, on ex-ante market structure), while the effects of expected ex-post market power on innovation have not been investigated by traditional measures of market structure but rather characterised under the general heading of appropriability.

Results on market structure effects on innovation are not really conclusive, and an array of theoretical arguments yielding ambiguous predictions have been offered (Cohen 1995, p.192): "some have supported Schumpeter's position that firms in concentrated markets can more easily appropriate the returns from inventive activity. Others have demonstrated, under the assumption of perfect ex-post appropriability, that a firm's gains from innovation at the margin are larger in an industry that is competitive ex-ante than under monopoly conditions (Fellner 1951, Arrow 1962). Still others have argued that insulation form competitive pressures breeds bureaucratic inertia and discourages innovation (e.g. Scherer 1980)". Finally, Kamien and Schwartz (1972, 1976) argued that intermediate market environments between perfect competition and monopoly are more likely to produce the best conditions to perform innovative activities.

Other works on this topic confirmed the ambiguity of market structure effects on innovation. Gerosky (1990) found an inverse relation between concentration and the rate of investments in innovative activities. More recently Blundell et al. (1999) confirmed Gerosky results, while Aghion et al. (2002) provided evidence of a U-shaped relationship between competition and innovation. At the same time, someone argued that innovation seems to be most favoured by intermediate levels of competition (Baldwin et al. 2002), others confirm the Schumpeter hypothesis (monopoly stimulates innovation) but finding that the probability of innovating decreases with the degree of vertical integration (Martínez-Ros and Labeaga 2002), and someone else (Leiponen 2002) that competition stimulates innovation, but that the Schumpeter effect[47] is never significant.

Controversial arguments about the role of market concentration are present even in the literature focused on knowledge spillovers (which are an important innovation's determinant as we will see later): according to Marshall-Arrow-Romer model (see section 4.1.1), the presence of a single industry (regional specialisation) in a given area favours knowledge spillovers and innovation in turns. By contrast M. Porter (1990) stresses the importance of strong competition between local firms within the same industry in determining the pace of innovation.

Furthermore, some authors investigate the different impact of competition on ***product and process innovation*** finding that: a stronger competition induces more process innovations, whereas technological competition stimulates more product innovations (Le Bas and Cabagnoles 2002); an high degree of competition supports the introduction of new products and, as the degree of competition decreases, firms will favour process innovations (Weiss 2002). Even if there is some evidence that market power is conductive to innovation, there is no consistent evidence about the nature of this relationship because they are generally different and of opposite sign for product and process innovations.

The existence of a local monopoly or a competitive market depend not only on the charactarestics of a single firm, but even on the characteristics of the other local firms and the regional

[47] Measured by the proportion of small firms in the industry.

specialisation. Thus, market concentration is not independent from the spatial level one chooses for the analyses of innovation activities.

Appropriability

Innovation activity has the characteristics of a medium-long term investments. Thus, it implies a certain degree of risk due to the impossibility of an exact rent forecast. This uncertitude is induced by the no guarantee that the innovation will result in a marketable product, and the risk that competitors may copy the innovation and benefit from it avoiding development costs.

The first type of risk could not completely be avoided because it depends on the future tastes and financial availability of consumers that could be influenced by several unpredictable factors, such as radical technological changes introduced by competitors, catastrophical natural events, and so on. In sectors where the product life cycle is short (for example because of vertical innovations), this risk is therefore higher and it requires a production process structure with an high degree of flexibility.

The second type of incertitude is due to the positive externalities produced by the creation of new knowledge. Having the characteristics of a public good (or at least of a club good), the knowledge created by an agent affects positively the welfare of other agents (which could benefit from the R&D effort without being charged of its costs)[48]. For such reasons patent protection is the main way through which the firm would be able to internalise the external effect mentioned above. In other words, this means that protection (implying an ex-post market power) represents the firm's capability for appropriability, which in turn is essential to encourage the firm in launching innovations.

However, while some firms use patents, others consider it as an ineffective measure of protection. In 1986 Mansfield argued that the effectiveness of patents differs across industries. Later on Levin et al. (1987) reinforced Mansfield's finding by a survey distinguishing 130 more narrowly-defined lines of business. Levin et al. analysis revealed that firms in many industries consider other mechanisms as quite effective in appropriating the returns from innovation: investments, in complementary sales and service efforts, the advantage of a head start, the ability to move quickly down the learning curve and secrecy[49].

Appropriability is therefore considered an important incentive to innovate. However, there is only little experimental evidence that it promotes innovation (Baldwin et al. 2002). In fact, on one hand protection allows the inventor to internalise positive externalities and it gives him incentives to innovate, on the other hand, protection generate a monopoly power that not only keep competitors out of the market niche but also deter any activities of research in this field. Hence, protection can become an argument against innovation (Morck and Yeung 2001).

The R&D activities are the main source of new inventions and innovations. With only few exceptions, their contribute to innovation is considered positive. Nonetheless, partially depending on knowledge spillovers, the level of the local competition and the strategies adopted (see section 3.3), one should expect a different intensity of R&D activities and innovation's protection according to the characteristics of the area in which firms are located.

[48] For instance, Mansfield et al. (1977) proved that there is a positive difference between social and private internal rate of return of R&D investments.
[49] For more literature see Cohen 1995.

Organisational capability and Technological opportunity

In standard neo-classical theory of production, technological opportunity could be defined as "the set of production possibilities for translating research resources into new techniques of production that employ conventional inputs" (Cohen 1995, p. 214). In other words, it measures how well connected a firm is to scientific research and the extent to which knowledge flows can be transferred from one firm to another (Baldwin et al. 2002).

However, while some authors[50] focused on differences due to a substantive technological or related expertise which leads them to pursue different innovative activities, others[51] emphasized the role of oganisational capabilities in conditioning the R&D productivity of the firms (Cohen 1995, pp. 210-207).

Organisational approach suggests that a brilliant idea is not enough to account for innovation and that it is not the effort of fitting demand needed that accounts for its diffusion. In fact, the institutional environment in which ideas take place plays an important role. This factor was introduced into the innovation literature by the national innovation system[52] (NSI) which captures the interactions of different institutions and organisations that create and adopt innovations in a country. In particular, it is argued that national institutions, such as the financial system, the educational system and government support for research, influence the innovative activities of firms and sectors. According to this literature, the increasing interactivity within and among several aggregation levels relates to the growing knowledge intensity of industrialised economies highlighting the importance of ***networks*** and should encourage scientists to improve their understanding of the dynamics of knowledge creation and utilisation (Küppers and Pyka 2002).

At the same time, the literature on business systems suggested that even organizational variables are relevant for firms to be innovative (Whitley 1999): ***cooperation between firms, research institutes and clients***. Thanks to the organisational structure, information flows between economic actors in formal and informal networks that can improve or hamper (in case of an inefficient structure) the innovative outcome.

The diffusion of this literature on organisational aspects of innovation, is certainly not independent from the most expanding sector of services. In fact, approaches considering the external technological progress (i.e. technological innovations) as a factor that could change the otherwise fixed relation between inputs and maximal output, are appropriate for process innovation in manufacturing, but less in the service sector, where inputs and outputs often cannot be separated neatly. Moreover, in the last years product innovations have gained importance in both sectors. The need of a new approach to deal with emergent phenomena could therefore explain this new discipline (see Rosa 2002). In particular, in the last years the knowledge-based theories[53] are used as reference to show the key role of knowledge management in developing a competitive advantage and a successful launching of new products (Li and Calantone 1998).

On the side of technological approaches, two complementary views of the ***technological diversity's effect*** on an industry's rate of advance are distinguished (Cohen 1995, p. 204):

[50] See for instance Jewkes, Sawers and Stillerman 1958, Cohen and Klepper 1992a and 1992b, Lerner 1991

[51] See for instance Clark, Chew and Fujimoto 1987, Clark and Fujimoto 1991, Henderson 1993, Mansfield 1968, Mowery and Rosenberg 1989, Nelson 1991

[52] See for instance Dosi, Pavitt and Soete 1990, Lundvall 1992, Edquist 1997

[53] Knowledge-based theories explain determined firms' behaviours such as: strategica alliances (Inkpen and Crossan 1996; Kogut 1988), mergers and acquisitions (Bresman *et al*. 1999), firms' internationalisation (Johanson and Vahlne 1977), diversification (Pennings *et al*. 1994) and production plants' competitiveness (Leonard-Barton, 1992).

- The first approach deals with the topic from an evolutionary perspective suggesting a *selection effect*: "the more approaches there are to a given technological objective, the greater will be the contribution to technical advance of the apporach that the market ultimately selects".
- The other approach suggests that diversity may affect technical advance through a *breadth effect*: "the greater the number of non-competing and possibly complementary technological objectives that are pursued, the greater the rate of technical advance".

However, there is little systematic evidence of technological diversity's effects or how they act[54].

Within industries, two additional reasons could explain differences in the nature of innovative efforts across firms (Cohen 1995, p. 204):

- R&D activities are *not qualitatively homogeneous*: some variables may influence process innovation but not process innovation. For instance, the availability of patent protection would be expected to have a stronger effect on product R&D than on process R&D[55], and a firm's degree of diversification would be expected to have a stronger effect on basic research than on applied research and development[56].
- The influence of *the innovative effort's composition on the rate of technical advance*. In other words, the allocation of the efforts on the different types of innovation activity influences the capacity of firms in exploiting and adapting new technological developments.

Nonetheless, due to the absence of data that distinguishes types of R&D activities, little research has been conducted on this topic.

National institutions being the cradle of innovation systems, the spatial dimension of this factor is evident. By contrast the technological opportunity is more an issue linked to the sectoral activities' diversity. However, since the regional economic specialisation is a spatial phenonmenon, even this innovation's determinant is indirectly dependent on space.

Sources of knowledge

The observation of firms' differences in their innovative activities pushed some economists to argue that technical advance within an industry requires interactions of firms. In other words, it is argued that is not an optimal size of firm but merely an optimal pattern for any industry that guarantees the most effective gathering and a commercial optimisation of the flow of new ideas (Jewkes, Sawers and Stillerman 1958).

The interaction of firms allow them to choose between internal and external sourcing for generating innovation. The availability of external technology may substitute or complement internal research investment of a firm. In fact, while the literature based on transaction costs considers the choice between internal and external sourcing for individual transactions as a substitute mode to innovate (e.g. Williamson 1985, Pisano 1990), other authors argued that also complementarities between internal and external R&D activities and knowledge could help the generation and commercialisation of new product and processes (e.g. Arora and Gambardella 1994, Cockburn and Henderson 1998, Granstrand et al. 1992).

Furthermore, firms investing in ***internal R&D*** activities are able to better scan the environment for existing technology and evaluate the profitability of the integration of external knowledge into its

[54] One exception is Cohen and Malerba (1994) who observed a significant and positive relationship between technological diversity and a subjective measure fo industry rate of technical advance.
[55] Levin et al. 1987
[56] Nelson 1959

own firm's innovation process. The importance of a stock of prior knowledge to effectively absorb external know-how lead Cohen and Levinthal (1989, 1990, 1994) and later on other authors as Kamien and Zang (2000), to develop researches on the "absorptive capacity" of firms. Moreover, the internal R&D can contribute to increase the appropriation capacity of the firm (for example: increasing complexity of own new product and processes), while the access and the exploitation of ***external knowledge*** may leverage the productivity of the internal R&D activities (Veugelers 1997).

However, there is also some features of knowledge associated with innovation that could make it more or less *costly to be transmitted*: cumulative character, codifiability or tacitness, complexity and its relationship to the expertise of the receiving firm[57]. Another aspect considered by researches on the division of innovative labour across firms within industries is the ***formal and informal quality of ties and linkages*** (see Cohen 1995, pp. 209-210).

In a recent work. Leiponen 2002 argued that the propensity to engage in R&D activities, the tendency to collaborate on R&D with outside partners and the innovation output are depressed in technological regimes where ***competitors and suppliers*** are important sources of knowledge. By contrast, innovation is prosperous in regimes where ***customers and universities*** are important sources of information. Moreover, ***personnel with technical skills*** are more sought after than those holding a ***post-graduate degree***. Furthermore, his analyses allowed to obtain complementarities between internal R&D, R&D outsourcing, outside collaboration and product innovation.

Various forms of complementarities were found also by other authors: Favre et al. (2002) reported that internal R&D, external R&D and inward ***foreign direct investment*** are complementary; Diederen et al. (2002) observed significant complementarities ***among more organisational activities of the firm*** (marketing, organisational changes, integration and horizontal cooperation); Cassiman and Veugelers (2002) provided evidence on complementarity between ***own R&D and external technology sourcing activities***, showing that firms that are only engaged in a single innovation strategy, either internal R&D activities or sourcing technology externally, introduced fewer new or substantially improved products than to firms combining internal and external sources.

A related literature focused on the role of the different sources of knowledge in innovation processes, is the one dealing with the human capital concept. Seminal contribution in the study of the interaction between ***human capital*** and technological change was given by Nelson and Phelps (1966). Their intuition was that different levels of human capital determines differences across countries in the technology adopted and affects the way in which those technologies are used. Later on, several authors confirmed this relationship between human capital and technological change. For example: Acemoglu and Zilibotti (2001) showed that countries with less skilled workers would have greater difficulties in implementing effectively technologies because of the derived lack of absorptive capacity.

From a more institutional prospective, some authors (Asheim 1996, Simmie 1997, Morgan 1997) have stressed the importance of collective learning processes through the concept of *learning regions*, others through the concept of *regional innovation system* (Cooke et al. 1997; Cooke and Morgan 1998), still others (e.g. Nelson and Winter 1982, Dosi et al. 1988) through the *national*

[57] Nelson and Winter 1982, Winter 1987, Pavitt 1987, Cohen and Levinthal 1989, Morwery and Rosenberg 1989, Malerba and Torrisi 1992, von Hipple 1994

system of innovation literature highlighting the differences in the average level of schooling between populations of advanced and those of less developed countries.

At the firm level (or micro-level), the literature about the contribution to innovation of different qualified workers reveal an "organisational" dimension that economists have usually avoided, leaving this research field to strategic management literature. For instance, in a recent article Laursen and Mahnke (2000) stressed the importance of internal complementarity in ***human resource practices*** in the development of a knowledge-based theory of firm differences.

Another pivotal question in order to understand innovation mechanisms and dynamics is the intra- or inter-sectoral origin of knowledge externalities. Although several empirical works have discussed the sectoral origin of technological externalities, they have not reached any consensus. According to Autant-Bernard (2003), "the major explanation derivable from existing empirical works to clarify these divergent observations relies on the ***maturity level of the particular sector***. In their development phases firms would be placed to capture quite general technological spillovers, whereas their mature phases would be characterised by externalities essentially internal to their particular sector[58]". Thus, for example, high-tech activities would gain from externalities emanating from other technological fields while low-tech activities would benefit from intra-sectoral externalities.

Considering the moderns ICTs, in many cases the exchange of knowledge between firms can occur at costs close to zero. However, the cost of knowldege transmission (that could be considered inversely related to the geographical proximity) is not the only obstacle to knowledge diffusion. Indeed, other dimensions of the proximity should be taken into account (institutional, organisational, etc. - see section 3.4.2) as well as the maturity level of the sector. As we will see, these aspects are not independent from the territory (e.g. traditional sectors are more present in peripheral areas). Thus, the space has an important role in explaining the marginal contribution to innovation of external sources.

Market demand

In economic innovation theory, the role of demand factors has been almost neglected. This fact could be due to the importance assumed in the literature by the technology push model, which describes the innovation process as driven by an exogenous advancement in scientific and technological knowledge. The implicit assumption of this model is therefore an unlimited capacity of the market in absorbing all the introduced innovations in a passive way.

However, starting from Schmookler's (1966) classical study, the hypothesis that the flow of innovations is enhanced by (expected) growth of effective demand has been investigated several times. According to Schmookler, technological change is not driven by scientific discoveries but by the existence of a demand for a particular invention. Scientific knowledge determines the "inventive potential", but market forces choose which invention will be actually realised.

Later on, the demand-pull hypothesis was empirically tested by other authors (e.g Giplin 1975, Mowery and Rosenberg 1979, Scherer 1982, Kleinknecht and Verspagen 1990), which confirmed the existence of a positive correlation between demand and innovation even if it turns out to be less strong than Schmookler would have expected.

[58] Audretsch and Feldman 1996; Bottazzi 2001

At a macro level, Gerosky and Walters (1995) found innovations being caused by demand expansion: on one hand, markets have a limited ability to absorb new products in a given period so that, when a demand expansion is registered, this capacity tends to grow making the introduction of innovation more profitable. On the other hand, appropriability problems are associated to innovative activities so that firms often have a limited time to gain profits from the introduction of a novelty. In periods characterised by a growing demand trend, innovations are therefore more likely to appear. Moreover, in a more recent panel analysis, Brouwer and Kleinknecht (1999) report that firm level changes in R&D are sensitive to demand growth.

However, in the context of discussing Kondratieff long waves in long-run growth, Kleinknecht (1990) found evidence that fairly radical innovations ('basic innovations') move in a counter-cyclical pattern. These innovations open up entirely new technological trajectories and initiate new growth industries, while incremental innovations (consistently with Schmookler's observations) occur within established technological trajectories and industries.

The previous authors' studies do not consider any link between market demand and space. However, for M. Porter (1990), it is hard to be innovative if the local market is not demanding. According to him, what makes a nation innovative are customers that are sophisticated and looking for better products and services. From this point of view, even this innovation's determinant is not independent from space.

Corporate governance, financial structure and rent seeking

Using game theory terminology, it could be said that the separation between corporate ownership and control generates conflicts between the interests of the principal (shareholders) and the agent (managers). Indeed, the presence of asymmetric information determines the necessity of some control instruments aimed at reducing the divergence between their different goals. Shareholders are in fact attracted by investments in innovative activities especially for their high potential returns and they can reduce risk spreading it among their portfolio of investments. In contrast, managers' success and rents are closely related to the outcome of a specific project. Thus, they will prefer R&D projects associated with a low risk level. Without an effective corporate governance the pace of innovation could be negatively affected (Munari and Sobrero 2003).

According to Munari and Sobrero (2003), the innovation capacity of a firm is therefore significantly influenced by the nature of control instruments (strategic or financial control), the type of principal (distinguishable by the level of stock concentration), and the characteristics of the board (insider or outsider directors). Being long-term oriented, strategic control results more appropriate in dealing with innovative and fast evolving environments. Stock ownership concentration favours R&D expenditures as owner's knowledge of firms activities and managers' control increase with concentration. For the same reasons, insider directors are more effective than outsider.

According to Cohen (1995) one of the most widely-considered firm innovation's determinant is cash flow. As Schumpeter suggested in 1942, it is usually argued that large firms are favoured by the availability of internal founds in a world of capital market imperfections. Results of many studies confirmed that there is a positive relationship between cash-flow and R&D investments, but some scholars have disagreed over the interpretation of this findings (see Cohen 1995, pp. 198-199). Moreover, the role of cash flow is embedded in the relationship between corporate finance and R&D investments. In particular, a number of empirical studies, verified that innovative firms tend to be more cash constrained (see Hao and Jaffe 1993; Mulkay, Hall and Mairesse 2000; Hall 2002).

In 1991, Muphy et al. developed a model of Schumpeter innovation and dynamic efficiency in which entrepreneurs could choose if to invest in R&D to raise the future productivity of the economy's production process, or in influencing political decisions to increase their future profits. These investments in political connections are called political rent seeking, and from the prospective entrepreneur's viewpoint they are much like investments in innovation since he/she pays up front and receives returns stretched across many subsequent years. Moreover, Murphy et al. results pointed out that if rent seeking is more profitable than investment in real innovation, it acts as a disincentive to innovation.

As firm' size, the corporate governance and the financial structure are stategic elements internal to the firms. However, corporate governance is usually based on local institutions laws and financial resources can depend on the local public intervention (subsidies, fiscal laws, etc.) or the presence of private financial institutions (venture capitalists, etc.). Similarly, the investiments in political connections (rent seeking) could not be considered independent from the institutional context in which the firm is operating. For all these determinants the role of space is therefore relevant.

"Geographical" proximity

This dissertation mainly deals with the impact of no agglomeration on innovation activity. It should be clearly said that the geographical proximity is only one of the several dimensions that could affect the innovative capacity of firms (see section 3.4.2). However, since it explicitly introduces the spatial dimension in innovation dynamics the geographical dimension has been the most discussed determinants of innovation by regional economists.

The idea that (tacit) knowledge spillovers are spatially bounded is still one of the dominant ideas of many regional studies. Nonetheless, already in seminal works, as in more recent studies, the reasons of knowledge spillovers were differentiated: the Marshall-Arrow-Romer model (MAR) suggests that knowledge spillovers are enhanced by the presence of a strong concentration of a single industry (thus: a local monopoly) in a given area; in opposition, Jacobs (1969) believes that the major source of knowledge spillovers comes from the interaction of actors belonging to different industries; finally, more recently, Porter (1990) agrees with the MAR view about the positive effect of industry geographical concentration, but in contrast with MAR he stresses the role of strong competition between local firms within the same industry in determining the pace of innovation.

The analysis of spatial innovation determinants have therefore been concentrated on three major areas: the importance of knowledge spillovers at a local level (e.g. Jaffe 1989, Acs et al. 1992), the advantages of being clustered rather than dispersed (e.g. Audresch and Feldman 1996, Baptista and Swam 1998), and in discovering if industry diversification generates more externalities than industry specialisation or vice versa (e.g. Scherer 1982, Glaeser et al. 1992, Feldman Audretsch 1999).

The spatial dimension is therefore directly or indirectly present across all the innovation determinants. Among them the geographical proximity is a determinant that captures the residual effects of space on innovations that the previous do not explain. For this reason, the innovation models we are going to present in Part III make distinction of the geographical proximity (firms' density) and the role of territorial and socioeconomic characteristics (distinguishing urban and peripheral areas as well as low and high firms' density areas).

3.3 Innovation strategies

Another aspect that has an influence on the innovativeness of a firm is the reason to launch an innovation. Indeed, the strategic aims of firms provide additional information about their attitude to innovate. The uncertainties associated with individual innovation projects does not allow firms to maximize profit using the same strategies it would adopt in a situation of trustable forecasts. Thus, in a context of imperfect competition and imperfect information, the neoclassical short-run theory becomes unhelpful. Because of that other approaches, taking into account the historical context of any industry in a particular country, have been developed to interpret and understand innovative behaviour (e.g. Nelson and Winter 1982, Dosi et. al. 1988).

In the book "The Economics of Industrial Innovation", Freeman and Soete (1997, pp. 265-285) attempt to classify the strategies which firms adopt facing different contexts. They argued that "any firm operates within a spectrum of technological and market possibilities arising from the growth of world science and technology and the world market. These developments are largely independent from the individual firm and would mostly continue even if it ceased to exist. To survive and develop it must take into account these limitations and historical circumstances. To this extent its innovative activity is not free or arbitrary, but historically circumscribed. Its survival and growth depend upon its capacity to adapt to this rapidly changing external environment and to change it. Whereas traditional economic theory largely ignores the complication of world science and technology and looks to the market as the environment, changing technology is a critically important aspect of the environment for firms in most industries in most countries".

Thus, according to Freeman and Soete (1997) there are various alternative strategies that firms may follow, depending on their resources, their history, their management attitudes and their luck. These different attitudes have been classified in six "arbitrary"[59] categories (offensive, defensive, imitative, dependent, traditional and opportunist) whose characteristics will be briefly reported hereafter.

Offensive strategy
Firms which follow an offensive strategy are a very small minority which attempt to achieve technical and market leadership by being ahead of competitors through radical innovations.

Such a strategy must either be based on a special relationship with part of the world science-technology system, on strong independent R&D, on very much quicker exploitation of new possibilities or on some combination of these advantages. Most successful offensive innovations where partly based on in-house fundamental research. However, it was certainly not a completely pure research in the academic sense of knowledge, pursued without any regard to the possible applications. Thus, the firm pursuing an offensive innovation strategy will be those centred on experimental development work. This includes design engineering (a very strong problem-solving capacity in designing, building and testing prototypes and pilot plants) on the one hand, and applied research on the other.
Furthermore, firm will probably seek patent protection not only for its original breakthrough inventions but also for a variety of secondary and follow-up inventions. Finally, the generation and processing of information would occupy a high proportion of the labour force, but whereas for the traditional firm this would represent a top heavy and wasteful deployment of resources, these activities would be the life-blood of the offensive innovating firm.

[59] As Freeman and Soete (1997) explain, any classification of strategies is somewhat arbitrary and does violence to the infinite variety of circumstances in the real world. However, such classification may be useful for purposes of conceptualisation.

Defensive strategies
A larger number of firms follow defensive strategies, responding fairly quick to the innovative efforts of others with new products and processes of their own. This is sometimes described as a "fast second" strategy or involutionary in the sense that a would-be offensive innovator may be outpaced by a more successful offensive competitor.

A defensive policy may be just as research intensive as an offensive policy. The difference lies in the nature and timing of innovations. The defensive innovators do not wish to be the first in the world, but neither do they wish to be left behind by the tide of technical change. They may not wish to incur the heavy risks of being the first to innovate and may imagine that they can profit from the mistakes of early innovators and from their opening up to the market. Defensive R&D is probably typical of most oligopolistic markets and is closely linked to product differentiation: if firms wish to obtain or retain a significant share of the market they must design models at least as good as the early innovators and preferably incorporating some technical advances which differentiate their products, but at a lower cost. Then, like the offensive innovator, it will be a knowledge intensive firm, employing a high proportion of scientific and technical personnel.

Patents may be extremely important for the defensive innovator but they assume a slightly different role. Whereas the pioneer patents are often a critical method of protecting a technical lead and retaining a monopolistic position, for the defensive innovator they are a bargaining counter to weaken this monopoly.

Imitative strategy
Much larger numbers of firms follow a simpler imitative strategy, sometimes on the basis of licensing, franchising or subcontracting from more innovative firms. The imitative firm does not aspire to "leap-frogging" or even to keeping up with the game. It is content to follow some way behind the leaders in established technologies, often a long way behind. If the lag is long then it may be unnecessary to take a licence, but it still may be useful to buy know-how. If the lag is short, formal and deliberate licensing and know-how acquisition will often be necessary.

The imitative firm may take out a few secondary patents but these will be a by-product of its activity rather than a central part of its strategy. Moreover, the imitative firm may devote some resources to technical services and training but these will be far less important than for innovating firms, as the imitators will rely on the pioneering work of others or on the socialization of these activities, through the national education system.

The imitator must enjoy certain advantages to enter the market in competition with the established innovating firms. These may vary from a captive market to decisive cost advantage. This market may be in a geographical area where the firm enjoys special advantages, varying from a politically privileged position to tariff protection. Alternatively or additionally, the imitator may enjoy advantages in lower labour costs, plant investment costs, energy suppliers or material costs. Finally, imitators may enjoy advantages in managerial efficiency and in much lower overhead costs, arising from the fact that they do not need to spend much on R&D, patents, training, and technical services, which loom so large for the innovating firms.

Unless the imitators enjoy significant protection or privilege, they must rely on lower unit costs of production to make headway. This will usually mean that, in addition to lower overheads, they will also strive to be more efficient in the basic production process. Consequently, production engineering and design are two technical functions in which the imitators must be strong.

They will also wish to be well-informed about changes in production techniques and in the market, so that scientific and technical information services are another function which is essential for the imitator. Thus, the information function is very important for the selection of products to imitate and for the acquisition of know-how.

Finally, imitators may become completely dependent or may start out in a dependent role, as it is often the case with firms in developing countries importing technology.

Dependent strategy
A dependent strategy involves the acceptance of an essentially satellite or subordinate role in relation to other stronger firms. The dependent firm does not attempt to initial or even imitate technical changes in its product, except as a result of specific requests from its customers or its parent company.

Most large firms in industrialized countries have a number of such satellite firms around them supplying components, doing contract fabrication and machining, or supplying a variety of services. The dependent firm is often a subcontractor or even a sub-subcontractor. Typically, it has lost all initiative in product design and has no R&D facilities.

The small firms in capital intensive industries are often in this category and hence account for rather few innovations. However, small subcontract firms may also move from a dependent status to the category of innovative firms by the upgrading of their specialized knowledge in a narrow field. Thus, in spite of their apparently weak bargaining position, they may enjoy good profits for considerable periods, because of low overheads, entrepreneurial skill, specialized craft knowledge or other peculiar local advantages. Moreover, even if they are squeezed pretty hard by their customers, they may prefer to endure long periods of low profitability rather than be taken over completely. Although bankruptcies and take-overs may be common, there is also a stream of new entries.

Traditional strategy
The "dependent" firm differs from the "traditional" in the nature of its product. While the dependent firm products change quite a lot in response to an initiative and a specification coming from outside, the product supplied by the "traditional" firm changes little, if at all. The traditional firms sees no reason to change its product because the market does not demand a change, and the competition does not compel it to do so. Both lack the scientific and technical capacity to initiate product changes of a far-reaching character, but the traditional firm may be able to cope with design changes which are essentially about fashion rather than technique. Sometimes indeed, this is its greatest strength.

Traditional firms may operate under severely competitive conditions approximating to the perfect competition model of economists. Or they may operate under conditions of fragmented local monopoly based on poor communications or a lack of a development market economy. Their technology is often based on craft skills and their scientific inputs are minimal or non-existent. Moreover, demand for the products of such firms may often be very strong, to some extent just because of their traditional craft skills (handicrafts, restaurants and decorators). Such firms may have good survival power even in highly industrialized capitalist economies. But in many branches of industry they have proved vulnerable to exogenous technical change.

Opportunist strategy
Finally, the variety of changing circumstances is so great, both, markets and technology, will always have possibilities of identifying product niches (providing a product or service which consumers need, but nobody else has thought to provide) and moving into them on a purely opportunist, entrepreneurial basis. Imaginative entrepreneurship is still such a scarce resource that it will constantly find new opportunities, which may bear little relation to R&D, even in research intensive industries.

No innovation
A "strategy" not considered in the previous overview is the choice of no innovating at all. In a competitive and changeable world to renounce to innovate is equivalent to the choice to die. Nonetheless, some firms could actually choose to die. In a no more recent study of the adoption process of numerically controlled machine tools in the American tool-and-die industry, Mansfield et al. (1971) showed that many firms did not intend to adopt it, "even when firm owners granted that the lack of numerical control would soon be a major competitive disadvantage". Mansfield estimated the median payback period in this case as five years and suggested that in many firms in this category the owners were close to retirement. In particular circumstances (for example when the perspective of rents imply a delay that does not coincide with entrepreneur short-term needs), the choice to not innovate can be rational. In general, being possible to benefit from innovation rents only in a medium-long term, firms that for any reasons (cash flow shortage, lock-in effect, high risk aversion, etc.) have an higher preference for the present (and therefore a low discount rate of future profits), are very likely less innovative than other firms.

3.4 Space in innovation's dynamics

Our empirical analysis of firms' attitude to innovate will be carry out at the microeconomic, but considering the impact of space (implying macro-socioeconomic conditions) as well. In this section we will therefore highlight: on one hand the reasons to consider innovation as a key factor of the regional economic competitiveness and growth, and on the other hand, the role played by space in innovative dynamics.

3.4.1 The key role of innovation in territorial competition among regions

The territorial competitiveness is a crucial concept to understand the role played by the territory in the regional development process and the inter-regional relationships. In a recent paper, Camagni (2002) deals with the questions of the soundness of the concept itself in terms of economic theory and the question of the new foundations on which this competitiveness is based, using a cognitive-evolutionary approach.

One of his main conclusions is that "the concept of territorial competitveness is theorically sound, considering not only the role that the territory plays in providing competitive 'environment' tools to individual companies, but especially the role that it plays in the processes of knowledge accumulation and in the development of interpretative codes, models of co-operation and decisions on which the innovative progress of local companies is based" (Camagni 2002, pp. 3-4). This conclusion is supported by different concepts of proximity that will be deeply considered later (see section 3.4.2): a system of localised technological externalities (related to the geographical proximity); a system of economic and social relations (related to the organisational proximity); and a system of local governance (related to the institutional proximity).

A second relevant argument proposed by Camagni concerns the understanding of the inter-relational mechanisms and the possible long-run outcomes of a peripheral region in a "core-periphery" game (see section 4.2). In fact, he argues that "some laws that govern the economics of inter-national trade do not operate at the sub-national level, and this once again make the concept of territorial competitiveness relevant" (Camagni 2002, p. 4).

Moreover, Camagni suggests that the the law of comparative advantage does not hold in inter-regional trade, and consequently the ricardian conclusion (more recently sustained by Krugman 1998; p. 91) that for each region will always be granted some specialisation and role in the interregional division of labour is not valid. Thus, the principle that governs production, specialisation and trade is the absolute advantage. So that, if a certain level or rate of growth in competitiveness is not assured, "the fate of that economy may be crisis, depopulation and desertification".

The reasons are related to three characteristics of the intra-national context, which distinguish from the assumptions of the international trade model (Camagni 2002, p. 14):

- it is not possible to assume an initial condition of autarchy as a logical starting point, since trade between territories is the rule – between regions, between cities, between city and countryside;
- there are movements of production factors between territories (commuting workers, labour and capital movements, purchases of estate and property assets from outside), and
- a specific regional currency and exchange rate for each individual territory do not exist.

According to Camagni, the theoretical effects of these three characteristics are important because they imply:

a) a real wages "rigidity"
b) the absence of trade balance constraint
c) the absence of monetary policy.

A. Real wages "rigidity"

At a macroeconomic level, close linkages between real wages and average productivity recorded in an isolated country in conditions of autarchy are lost because any excess demand is addressed to the purchase of external goods. By contrast, a*t a microeconomic level*, wages contractually defined by companies are influenced by local productivity but not to the extend required by the international trade model, since (Camagni 2002, p. 14):

- "monetary wages are largely defined through collective national contracts, and relate to a level (and a growth) of average national productivity (if not those of the most advanced regions) and not those of weak regions;
- when the lower average productivity of a region is due to factors externals to companies (poor accessibility, low quality of public services), in order to keep local products competitive workers should accept monetary wages lower than their "factory" productivity, and this is unrealistic in a context where migration is logically and practically permitted, and where the level of prices of most goods consumed locally is at the "international" or "inter-regional" level (monetary wages lower than the national average would therefore also result in lower real wages). Wages in weak regions would

therefore not fall to the levels required to assure external competitiveness in at least some products".

B. No trade balance constraint: causes and consequences

Because of real wages "rigidity" it is possible that a region possesses an absolute disadvantage in all goods, and therefore suffers from a rising unemployment[60] and deficit in its trade balance that could not be re-equilibrated by automatic mechanisms. An extreme case could be a territory that does not produce or export anything and lives on imports, where income and internal purchasing power are assured by various alternative possibilities:

- by the income of commuting workers;
- by the sale of wealth or capital assets to foreign residents (houses, land, properties);
- by public transfers (pensions, unemployment benefits) or private transfers (remittances from emigrants).

However, since in the long term this situation is not sustainable, adjustments will occur more rapidly and more likely through emigration and depopulation rather than through a fall in real wages. In fact, whenever labour and capital will cease to be supported by external territories or by national government loans, income transfers or subsides, they would promptly emigrate in search for better employment conditions.

Talking about this argument, it should be stressed that Krugman himself, reflecting about the likely consequences of increased European integration, became conscious of the theoretical implications of the factors' mobility. In fact, he recently affirmed that "in international economics, we [international trade authors] take as our base case a world in which resources are completely immobile but in which goods can be costlessly traded. What I found myself gravitating towards was a style of models in which factors of production were perfectly mobile but in which there were costs to transporting goods. In other words, I found myself doing something closer to classical location theory than to international trade theory" (Fujita M. and Krugman P. 2004, p. 151). Thus, "[…] there is no particular reasons to expect a region whose traditional industries are faring badly to attract new industries. It can simply shed people instead. […] The story is one in which the point is not the existence of a strong force for divergence, but the absence of a force for convergence of output and employment" (Krugman 1993, p.248).

C. To export or import without monetary policy

The national exchange rate is defined as a weighted average of the regional trade balances, which include the influences of "strong" regions, usually net exporters, and "weak" regions, usually net importers. Thus, while the former are in a situation of a relatively undervalued exchange rate, the latter are in the opposite situation: a relatively overvalued exchange rate that does not favour their exports.
Moreover, if a specialised region sees its productivity (and competitiveness of export sectors) increase at a lower rate than that of other regions, given similar wage dynamics (defined at national level), it would see its competitive advantage decline and disappear and it would not be able to use the obvious instrument available to countries, devaluing the exchange rate, or to count on a spontaneous re-establishing mechanism through wages.

[60] In the short-run and a flight of workers in the long-run.

Thus, according to Camagni, the regional dimension requires different model's assumptions. In particular, the intrinsic openness both to the movement of goods and movement of factors implies:

- a context of inter-regional trade within a regime of "absolute advantage";
- inexistent or inadequate spontaneous adjustment mechanisms;
- the possible emergence of mass unemployment, emigration and abandonment of weak regions.

In terms of strategies these assumptions significantly influence the policies of development or survival for underdeveloped territories. Camagni (2002, p. 16) suggests three domains of interventions:

- to carry out political lobbying aiming to secure public transfers (a strategy that is merely defensive, costly and to be rejected);
- to improve the competitiveness of the local system;
- to attract investments from other regions and abroad.

Moreover, the way towards territorial competitiveness does not mean at all a wasteful zero-sum game as the one considered in the core-periphery model (Camagni 2002, p.21): "competitiveness reached through territorial quality and public service efficiency brings benefits to all local activities, both originating from inside and from outside; competitiveness reached through spatial specialisation means widening roles for complementary specialisations, developed in complementary contexts; competitiveness reached creating local synergies among actors, or integrating external firms into the local relational web, exploits technological and organisational spillovers and generates increasing returns that are at the very base of economic development, in its 'generative' sense".

The improvement of competitiveness and the attraction of foreign investments is a long-term objective whose driving force is focused on the supply side factors and dynamic elements allowing the continuous recreation of the local advantage through a flow of radical and incremental innovation[61] (Camagni 1996).

Thus, on one hand, the particular characteristics of the regional dimension lead to consider territorial competitiveness development as the only strategic attitude to be adopted by ambitious underdeveloped territories (among them peripheral regions could be included by common sense). On the other hand, innovation is the key element on which should be focused policies aiming to maintain an absolute competitive advantage (and therefore its level of territorial competitiveness) in the long-term.

3.4.2 Proximity and Innovation

Even if regionalists generally agree on the reasons to consider innovation as a crucial element of territorial competitiveness and regional development, there is still a limited understanding on the sources of technical progress and the reasons that innovation varies over time and across space.

In 90s, the emergence and diffusion of New Economic Geography theories (see Chapter 4) allowed to introduce imperfect competition in a general-equilibrium model of an entire spatial economy and placed the persistence of agglomeration economies at the heart of the analysis. More

[61] These are typical characteristics of the offensive strategy seen in section 3.3.

recently regional economists and geographer react to this approach redefining locational context as "a geographic unit over which interaction and communication is eased". Thus, "knowledge is not easily contained, and geography provides one means to define knowledge spillovers. For these reasons, the generation of innovation may be enhanced in certain locations, and, as a result, these areas benefit from higher rates of technological advance and economic growth" (Feldman and Massard 2002, p.1). However, it is not generally accepted that locational and geographical components are innovation's determinant. Indeed, innovation processes are more complex than the researchers previously imagined. The early studies done in the 90s mainly focused on the American system of innovation and they are not easily comparable to more recent inquiries conducted in Europe. Therefore, the analyses in the field of geography of innovation require an enlargement of prospective in order to allow a precise interpretation of space as innovation's determinant.

Knowledge spillovers are considered to be at the heart of understanding the role of proximity in the innovation process. However, this relationship is not obvious or easily identifiable. Moreover, without making distinction of the different kind of proximity (geographical, organisational and institutional), the analyses hardly lead to significant conclusions.

The geographical dimension of external scale economies is known since Marshall works (see section 4.1), but only in the 60s the existence of a relationship between space and innovation was suggested by Thompson (1962). In the 90s, while Krugman works allowed economists to explicitly consider the spatial dimension in a general equilibrium model, economic geographers made several scientific efforts to demonstrate that geography still matter in interactive learning knowledge creation and innovation.

At the beginning, works put emphasis on the productivity effects that stem from co-location of industrial and university research and development. Jaffe (1989) wrote what is generally considered to be the first important study shifting the knowledge production function from the unit of observation of a firm to that of a spatial unit by linking the patent activity within technologies located within states to knowledge inputs located within the same spatial jurisdiction. Acs, Audretsch and Feldaman (1992) confirmed Jaffe's results substituting patents with a direct measure of innovation activity of the introduction of new products into the market. Later on, Feldman (1994) extended the model to consider other knowledge inputs for the commercialization of new products. Results confirmed that the output of innovation is a function of the innovative inputs in that location.

However, all these studies have not allowed to open the black-box of proximity relations and to understand knowledge interactions among socioeconomic actors located one close to the other. To pursue this objective, the French school of Proximity Dynamics suggested to make distinction between organizational and geographical proximity (Torre and Gilly 2000). Furthermore, since institutional environment influences, shapes and constrains players' interactions, a third form of proximity is often considered: the institutional proximity (Kirat and Lung 1999). All these aspects are recurrent in works that are focused on the "proximity economies" (Bellet et al. 1993) and located at mid way between industrial and regional economics.

Nevertheless, the dimensions of proximity are a multitude (physical, technical, cultural, geographical, historical, temporal, relational, institutional, social, organisational, functional, technological, etc.) and among researchers a general consensus about the way they can be joined has not been found yet. A recent work on this subject (Ratti F. 2002) shows a trend in literature to limit the distinction to the three main categories of proximity (geographical, organisational and

institutional), but other authors still consider other categories. For instance, (Boschma 2004) defines five forms of proximity (cognitive, organisational, social, institutional and geographical); he stresses how other forms of proximity may function as substitutes for geographical proximity in enhancing interactive learning and innovation; and he describes the advantages and disadvantages of each of them in terms of innovation capacity development.

A. Geographical proximity substitutes and complements

Due to advanced ICT's networks through which learning takes place, interactions are not spatially limited. In a recent study Rallet and Torre (1999) showed that tacit knowledge may be transmitted across large distances through several forms of proximity. In particular this occurs when there is a clear division of precise tasks that are coordinated by a strong central authority (organizational proximity) and the partners share the same cognitive experience (cognitive proximity). In a study on patent citations, Breschi and Lissoni (2003) found that social connectedness (measured as the degree of social closeness between inventors involved in citing and cited patents) rather than geographical proximity played a significant role in knowledge spillovers. Furthermore, their results tend to support the view that tacit knowledge is a club good, which is shared between members of so-called "epistemic communities" or "communities of practice", wherever they are located. Thus, even at a local level, because of the exclusivity of the club (a social network for instance), geographical proximity could not be considered a sufficient condition for the exchange of tacit knowledge. In other words, it turns hard to become a member of tight networks of personal relationships through which local knowledge circulates.

Geographical proximity may however play a complementary role in building and strengthening social, organisational, cognitive and institutional proximity. For instance, spatial proximity facilitates informal relationships (Audretsch and Stephan 1996), more frequent face-to-face contacts between firms are leading to a more personal and embedded relationship (Harrison 1992), and human actions and social relations (such as norms and habits) that shape and reinforce institutions (Gertler 2003).

B. Proximity's effects on innovation processes

Since all types of proximity reduce uncertainty between actors, they facilitate interactions and the allocation of resources to learning. Proximity is generally believed to contribute positively to innovation, which is seen as the result of interaction and cooperation between actors within the firm (e.g. between marketing and R&D departments), between firms (e.g. buyer-supplier relationships) and between firms and other organisations, such as universities. In this body of literature, innovative milieu and regional innovation systems are only two of the several notions that reflect this interactive and institutional base of learning and innovation having an explicit spatial dimension. In particular, the interplay between the different forms of proximity in a territory is thought to be source of competitive advantages of the local production systems.

According to these approaches, *geographical proximity* enhances learning because short distances facilitate knowledge sharing and institutionalise more easily behavioural rules (Camagni 1991); *cognitive proximity* is a particular input (knowledge accumulates in time through usage, due to learning from experience, trial-and-error, etc.) which plays a role when the competitive strength of clusters and their capacity to learn is determined by place-specific capabilities in terms of cognitive and uncodifiable assets (Maskell and Malmberg 1999); *organizational proximity* could be associated with the network type of economic co-ordination, characterised by trust-based relations among local organisations, which tends to lower transaction costs, to facilitates transfer

of (tacit) knowledge, of collective learning, innovation and co-operation between firms (Torre and Gilly 2000); *social proximity* is considered important when the organisational network is strongly rooted in a specific social and cultural context, because a common culture of trust and norms encourage coordination and facilitates transfer and feedback of information via networks of local actors and facilitate the exchange of knowledge (Storper 1997). However, "proximity in its different forms may also have negative impacts on innovation" (Boschma 2004). In particular, negative effects could arise if the proximity degree is too high or too low.

In Table 25 Boschma (2004) summarises the main characteristics of the five forms of proximity.

Table 25: Five forms of proximity: some features

	Key dimension	Too little proximity	Too much proximity	Possible solutions
Cognitive	Knowledge gap	Misunderstanding	Lack of resources of novelty	Clusters built on shared knowledge base with diverse, complementary capabilities
Organisational	Control	Opportunism	Bureaucracy	Loosely coupled system
Social	Trust (based on social relations)	Opportunism	No economic rationale	Mixture of embedded and market relations
Institutional	Trust (based on common institutions)	Opportunism	Lock-in and inertia	Institutional checks and balances
Geographical	Distance	No spatial externalities	Spatial lock-in	Mix of local 'buzz' and extra-local linkages

Source: Boschma 2004, p. 16

Cognitive proximity

There are at least three reasons why some cognitive distance should be maintained in order to enhance interactive learning (Boschma 2004, pp. 4-5):

- knowledge building (novelty) often requires dissimilar, complementary bodies of knowledge;
- too much cognitive proximity easily lead to cognitive lock-in, in the sense that routines within an organisation can obscure the view on new technologies or new market possibilities;
- when the cognitive distance between agents is rather small, it increases the risk of involuntary spillovers across organisations (since knowledge cannot always be totally appropriated). Thus, in such circumstances, competitors are very reluctant to share knowledge.

On the other hand, if the knowledge gap between actors is too high, the absorptive capacity of the firm could lead to misunderstanding or completely prevent a transfer of knowledge. To find a balanced level of cognitive proximity, Maskell (2001) suggested the creation of knowledge clusters that are taking place through variation and deepened labour division[62].

[62] At the horizontal dimension, variation between local competitors with similar capabilities stimulates new experiments, which are taken up (againts low costs) in the transparent cluster. At the vertical dimension, inter-firm learning (between buyers-suppliers) is stimulated because low co-ordination costs in clusters allow for increasing specialisation and in turn diversification.

Organisational proximity
New knowledge creation goes along with uncertainty and opportunism. Thus, strong control mechanisms are required in order to ensure ownership rights (intellectual property rights) and sufficient rewards for own investments in new technology. In principle, a hierarchical organisation or tight relationships between different organisational units can provide a solution to these problems.
However, too much organisational proximity may also be unfavourable to learning and innovation (Boschma 2004, p.7). In fact, there is the risk of:

- being locked-in in specific exchange relations (dependency on relation-specific investments in communication and understanding; evolution in a closed and inward-looking system);
- a lack of feedback mechanisms that are common to more symmetrical relations, so that new ideas are not rewarded in a bureaucratic system and interactive learning hardly takes place;
- a lack of flexibility, so that less initiatives are undertaken and rewarded;
- vested interests in organisations opposing change that undermine their positions.

As possible solution it is argued that loosely coupled systems, as opposed to tightly coupled systems, can avoid these inconveniences. In fact, loose coupling safeguards organisational autonomy within and between organisations and it guarantees a certain degree of flexibility[63].

Social proximity
Social proximity is defined in terms of socially embedded relations between agents at a micro-level. Relations between actors are socially embedded when they involve trust that is based on friendship, kinship and experience. It does not include situations in which people share sets of values, such as ethnic and religious values, because this aspect of cultural proximity at a more macro-level will be associated with the notion of institutional proximity (Boschma 2004, p.9).

Social proximity implies trust-based relationships that facilitate the exchange of tacit knowledge which is an important source of innovation. As suggested by Lundvall (1993), social proximity encourages a social and open attitude of 'communicative rationality', rather than a pure, calculative and narrow market orientation towards minimising costs. Moreover, compared to pure market relationships, social proximity, which is based on durable relationships, allow to reduce, but not to eliminate, the risk of opportunistic behaviour.

By contrast, too much social proximity may have negative effects on learning and innovation (Boschma 2004, p.9).:

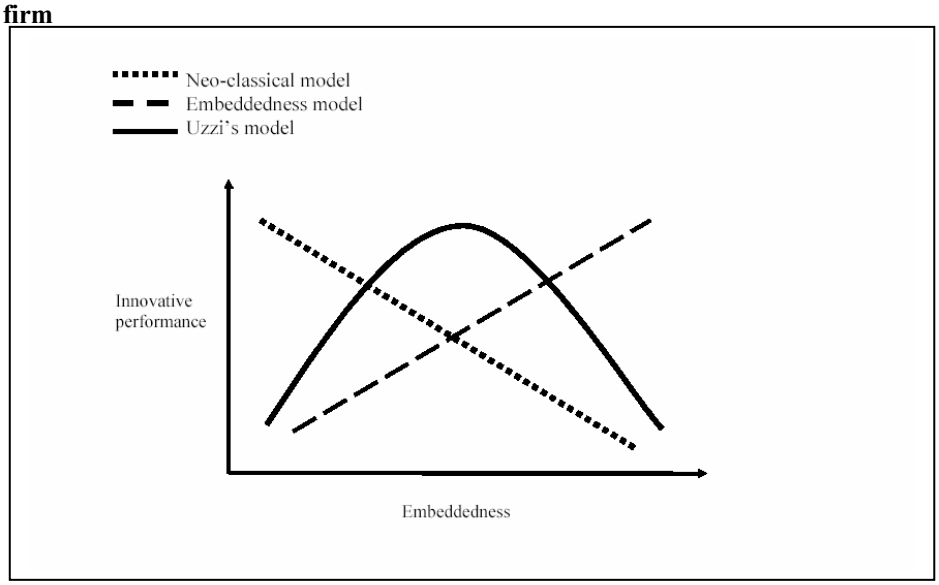
- embedded relationships, in which much loyalty is involved, may lead to an underestimation of opportunism when relations are based on emotional bonds of friendship and kinship (Uzzi 1997);
- long-term relationships, or too much commitment may lock buyers and suppliers into established ways of doing things, at the expense of their own innovative and learning capacity.

Thus, the more embedded economic relationships are, the better is the economic performance of a firm up to a certain threshold, after which adverse impacts arise because of lock-in. Uzzi (1997)

[63] For instance, it is less likely that bureaucracy and formal obligations are involved, it guarantees network connections whithin and between organisations and, thus, access to complementary sources of information.

proposed an inverted-U relationship between embeddedness and innovative performance at the firm level (see Figure 10). According to him, the social dimension of economic relationships has a positive influence on the performance of a firm up to a certain threshold (contrary to neo-classical thinking), after which these positive effects can turn negative when embedded relationships become too closely tied (contrary to the embeddedness model).

Figure 10: The relationship between the degree of embeddedness and the innovative performance of a firm



Source: Uzzi 1997, in Boschma 2004

To avoid detrimental effects, Uzzi (1997) suggested a mixture of both embedded and market relationships at the network level to secure social proximity and distance respectively, so that the adaptative capacity of actors may increase considerably. A similar strategy is adopted by flagship firms in the IT, which combine 'first tier' networks (formed by alliances laid down in official contracts) and 'second tier' networks (based on informal and trust-based relationships with local partners).

Institutional proximity

Differently from social proximity, which is based on relations between agents at the micro-level, institutional proximity will be associated with the institutional framework at the macro-level (such as norms and values of conduct). Thus, even institutional arrangements at the micro-level, in which norms and values are embodied in specific exchange relations, are covered by the notions of organisational and social proximity (North 1990).

Institutions reduce uncertainty and lower transaction costs: formal institutions (such as laws and rules) and informal institutions (like cultural norms and habits) influence the extent and the way actors or organizations coordinate their actions. Thus, they are enabling or constraining mechanisms that affect the level of knowledge transfer, interactive learning and innovation.

However, institutional proximity may also become a constraining factor, hampering collective learning and innovation. An institutional environment consists of an interdependent set of institutions, the effectiveness of one institution (e.g. the way the labour market is organised) increases the returns from other complementary institutions (e.g. the way the financial market operates). Thus, this mutual interdependence of the various parts of the institutional system may

cause local inertia (Boschma 2004, p.11) because change brings instability between the elements of the system. So that either no change takes place, or only localised change which does not upset the functioning of the whole system does (Hannan and Freeman 1977). In other words, institutional rigidity leaves no room for experiments with new institutions that are required for the successful implementation of new ideas and innovations.

Therefore, the political system should fulfil several requirements that guarantee checks and a kind of balance between institutional stability (reducing uncertainty and opportunism), openness (providing opportunities for newcomers) and flexibility (experimenting with new institutions).

Geographical proximity

As already discussed at the beginning of this section, geographical proximity may facilitate inter-organizational learning, but it is often difficult to disentangle geographical proximity from the other forms of proximity. Thus, interactive learning could be enhanced by geographical proximity, but not only through it. Moreover, it may contribute to a regional lock-in. However, this latter effect could be circumvented by a mixture of local and non-local relationships or access to diverse but complementary capabilities, loosely coupled networks and/or a mixture of embedded and market relations (Boschma 2004, p. 15).

The contribution of micro-relationships between local actors to interactive learning and innovation could not be simplified as a positive geographical proximity effect. Either because it is not just positive, or is not only geographical. Thus, if the black-box of "proximity" is not open, the analyses of production and innovation local systems (which developed concepts as "technological clusters", "industrial districts", "technopoles", "innovative milieu", etc.) risk to stay a merely descriptive exercise.

C. Proximity and innovative firms' localisation: the role of firm's size and R&D production phases

An additional reason to not consider geographical proximity as a-priori favourable or indispensable condition for innovation, are the different needs of innovative firms according to their size, production phases and innovation strategy.

As recently stressed in a contribution of Massard and Torre (2004), the size of firms plays an important role in localisation decisions: while large firms could avoid geographical proximity "constraint" by a partial delocalisation of their employees (temporarily or definitively), small firms should consider geographical implication of their localisation even if the need of proximity will be only temporary.

Indeed, the need of external knowledge could be different according to the production phases (Gallaud and Torre 2001). Lets consider the case of R&D processes:

- **exploration activities**, which are aimed to explore sustainable technological change possibilities through the search of new knowledge and their integration in innovative processes, implies a geographical proximity between the suppliers of knowledge;
- **exploitation of a known technology** is more a routine activity of innovation production and the need of cooperation could be confined to temporarily face-to-face meetings;
- **imitation of competitors' innovative processes or imitative R&D activities** need rapidity and flexibility. Thus, activities of innovation production are generally

internalised and they do not need geographical proximity between organisations (firms).

Geographical proximity and firms' localisation should not be confused. In fact, a durable geographical proximity during the exploration activity does not mean that the necessity of localisation proximity for large firms could delocalise part of their research departments. This is the reason why innovation networks are usually more localised when composed by small firms and more dispersed in the case of large firms (Massard and Torre 2004).

3.4.3 Microeconomic dimension of space

As seen in a previous section, the innovation activities are the heart of a firm's competitve strategy as well as the regional development. The microeconomic nature of innovation is therefore evident as well as the role of space in influencing the main innovation determinants. Because of that, the space should enter innovation models even if the level of observation and investigation will stay microeconomic.

The effects of space on innovation are indirect and hardly identifiable, because for each innovation's determinant a model including spatial characteristics should be defined. Such a procedure will require a deep theoretical knowledge of several topics, each of them can be the object of a single dissertation. Thus, the ambition of our empirical study can not be a clear identification of these linkages, but rather to test if the impact of space on innovation exists, observing the contribution of several innovation's determinants in different areas: urban and peripheral. In the next Chapter we will therefore start to investigate the nature and the origins of these two areas.

CONCLUSIONS

This chapter presented an overview of the main instruments, index, which are currently used to measure innovation in Europe and USA. Moreover, we afforded a description of the main determinants considered by the scientific literature and a subjective classification of the innovation' strategies of firms. Finally, the role of space in innovation dynamics has been introduced as well as the main traits of the microeconomic approach we will adopt to empirically investigate innovation in peripheral areas.

In Table 26 we summarised the main innovation's determinants, their theoretical and empirical origins, their spatial dimensions and their expected contribution to innovation (positive or negative) according to the literature reported in this chapter. The list should not be considered exhaustive, but at least as including the major explanatory factors that leads to innovations.

Furthermore, the strategies classified in this chapter are a good reference to understand the "instrumental" role of innovation in firms activities. Innovation is not an end but a means to pursue different strategic objectives that the firm consider having the right of priority according to their (internal and external) socioeconomic and historical context. For these reasons, a product (or a process) innovation launched by a firm located in peripheral region could have a different objective from the same innovation introduced by a firm in an urban area. On the other hand, firms located in a particular area (peripheral for instance) could tend to adopt a similar strategy to face the same challenges triggered by the same context.

Another interesting aspect is the different need of geographical proximity required by firms of different size and the several R&D production phases. Geographical proximity is therefore not a sine qua non condition to innovate. As we will see, firms in peripheral areas are generally small and at a "maturity level", these aspects can help to explain the attitude to innovation of these firms.

Table 26: Determinants of innovation

General agreements		*Role of Space*	*Determinant (impact on innovation)*
Theories	*Empirical studies*		
Dimension of the firm			
Innovation activity increases more than proportionally with company' size.	Several empirical proofs of the positive effect of firms' size on innovation. Counter-argument: the conservatism of large firms.	The national or regional socioeconomic context (local sectoral specialisation, demand evolution, etc.) as well as the historical moment can influence firms dimension and in turn their attitude to innovation.	Firm size (positive)
Market competition			
Innovation activity increases more than proportionally with market concentration (Schumpeter). Vs. Perfect competition gives the major incentives to innovation (Arrow). Local competition increase innovative dynamism of firms (Porter).	Empirical results on market structure effects on innovation are not conclusive. Besides, an opposite impact on product and process innovation could be expected: positive for products, negative for processes.	According to the characteristics of the other local firms and the regional specialisation there can be a local monopoly or a competitive market. The local characteristics can therefore influence innovation activities.	Competition (ambiguous)
Appropriability			
The appropriability opportunities of the firms influence their innovation activities: the public goods characteristics of innovation and the impossibility to exactly forecasting rents lead firms to patent innovations and to adopt different attitudes to innovation according to their strategic aims, investments capacity and propensity to risk.	Even if appropriability is considered an important incentive to innovate, there is only little experimental evidence that it promotes innovation. Moreover, the means of protection can be more or less efficient.	Local knowledge spillovers (public goods) and competition have an important impact on the level of firms' appropriability (strategy) and in turn on their innovative activities.	Patent (the impact can differ across industries) Internal R&D (positive) Investments in complementary sales and service efforts (positive) Advantage of a head start (positive) Ability to move quickly down the learning curve (positive) Secrecy (positive)
Organisation capability and networks			
Business theories stress the importance of the firm's organisation for innovative activities. National innovation systems and other institutional approaches stress the importance of interactions between firms to acquire knowledge and to innovate.	Emergent discipline. Mainly studied by a descriptive approach (best practices).	The importance of the local service sector (launching organisational innovations) and the institutional system influence firms' attitude to innovation.	Internal organisation of firms activities (depend on the efficiency of the organisational structure) Cooperation between firms, research institutes and clients (positive)

(…)

General agreements		*Role of Space*	*Determinant (impact on innovation)*
Theories	*Empirical studies*		
Technological opportunity			
The availability of different technological opportunities lead sectors to have different paces of innovation.	Little empirical researches and evidence on this topic.	Regional sectoral specialisation influence firms' attitude to innovation.	Technological diversity (generally positive; differences between product and process innovation). Sector of activity (absence of a general sectoral "hierarchy")
Sources of knowledge			
Interactions allow firms to acquire external sources of knowledge that can substitute or complement internal skills, optimise R&D activities and increase innovation. The cost of transmission can vary according to the type of knowledge and linkages. Hiring new employees the firm increase its knowledge and it influences its future capacity to absorb new knowledge.	Internal R&D increases the absorptive capacity of the firm. External knowledge may leverage the productivity of the internal R&D activities. Competitors and suppliers as important sources of knowledge decrease the tendency to collaborate on R&D with outside partners and innovation output. By contrast, innovation is well present when customers and universities are important sources of information. According to different studies, complementarities can exist between internal, external R&D, outside collaboration and product innovation; internal, external R&D and inward foreign direct investment; and among more organisational activities of the firm. Personnel with technical skills increases the innovation capacity. It exists a relationship between human capital and technological change.	Cognitive, organisational, social institutional and geographical proximity can favour or hamper innovation. The concepts of learning regions, regional innovation system, national innovation system and other similar concepts are scientific efforts to explain the role of space in innovation activities.	External technology and knowledge (generally positive) Internal R&D (positive) Competitors and suppliers as important sources of knowledge (negative) Customers and universities as important sources of information (positive) Complementarities (positive) Skilled human capital availability (positive)
Market demand			
A classical hypothesis is that the flow of innovation is enhanced by the (expected) growth of effective demand. Porter argues that what makes a nation innovative is customers that are sophisticated and looking for better products and services.	The hypothesis was tested and confirmed. However, different results was obtained distinguishing the impact of demand expansion on incremental (positive impact) and radical innovation (negative effect).	Since it is hard to be innovative if the local market is not demanding, the impact on innovation of market demand is not independent from the spatial dimension.	Demand expansion (generally positive; but positive on incremental innovations and negative on radical innovations).

(…)

General agreements		*Role of Space*	*Determinant (impact on innovation)*
Theories	*Empirical studies*		
Corporate governance and financial structure			
Without an effective corporate governance the pace of innovation could be negatively affected. The most widely-considered firms' innovation's determinant is cash flow. The investments in political connections are much like investments in innovation. However, if rent seeking is more profitable than real innovation's investments, it can act as a disincentive to innovation.	The positive impact of cash flow on innovation has been confirmed by numerous studies.	The institutional dimension of corporate governance laws, the financial system and politics reveal the role of space on innovation.	If managers decisional force is dominant on shareholders decisions (probably negative). Strategic control (positive if fast evolving environments). Stock ownership concentration (positive). Insider directors rather than outsider (positive). Cash flow (positive).
Geographical proximity			
In regional sciences, Marshall-Arrow-Romer externalities, knowledge spillovers, clusters and local economic specialisations are considered the major arguments to explain successful innovative activities and regional development. Geographical proximity has substitutes and complements, and the need of it could be different according to the R&D production phases and firms' dimension.	Empirical finding are mainly based on descriptive approaches, but in the last years there is an increasing number of empirical studies adopting more quantitative methods to investigate the role of geographical proximity on innovation.	Geographical proximity is a concept that refers to physical space.	Geographical proximity (positive or negative depending on the balance between positive externalities and lock-in effect).

CHAPTER 4: CORE AND PERIPHERAL REGIONS

As we will see in this chapter, the New Economic Geography (NEG) approach focuses its studies on the spatial distribution of economic agents. The core-periphery model is fundamental in this modern approach, as it illustrates the conditions in which agglomerations take place and the catastrophical character of the event. Agents' location (firms, workers, inhabitants, politicians, institutions, etc.) is explained as the result of centrifugal and centripetal forces: agglomerations appear if centripetal forces won, periphery otherwise.

In this context, the agglomeration (the core) is the area where there is an high physical proximity of the agents. By contrast, the peripheral areas are places where agents are dispersed or completely absent. Thus, in these areas there is no physical proximity between agents and the positive effects of interactions do not arise. However, this distinction of agglomeration and periphery is too simplistic. In fact, even if the physical proximity could be absent, in peripheral areas there are specific proximities that could influence the behaviour of the agents[64].

Since our aim is to detect the innovation attitude of firms siutated in peripheral areas, in this chapter we will expose why sometimes ressources and firms would gegographically concentrate and sometimes they would not, referring to the NEG approach.

4.1 The economic reasons that lead peripheral regions to emerge

The phenomenon of people, resources and firm concentration could be easily observed in reality and it is commonly defined as an urbanization process leading to the creation of cities. However, either the phenomenon or the sources of it have not been completely understood by scientists yet.

Indeed, this subject could be treated by many points of view: social, economic, geographical, urbanistic, etc. Moreover, the concept of proximity has often generated misunderstanding and confusion among scientists, which consciously or unconsciously have developed theories without defining appropriately the key concepts. Thus far that someone even defined this attitude as "fuzzy concepts": "is one which possesses two or more alternative meanings and thus cannot be reliably identified or applied by different readers or scholars" (Markusen 2003).

The interest of economists for the sources of concentration and dispersions arise in the 90s thanks to Porter works (1990) and the birth of the New Economic Geography after the appearance of Paul Krugman's now classic two works: "Increasing Returns and Economic Geography" (1991a) and "Geography and Trade" (1991b). As Krugman recently wrote (Fujita M. and Krugman P. 2004), in this field the aim of economists should be to explain both concentration and dispersion by a general-equilibrium story: "why so many people work in Manhattan and also why so many other people do not".

However, many other economists could be considered precursors of this topic. As one will see in section 4.1.1, the source of centripetal and centrifugal forces were treated by several economists in the past (von Thünen 1826, Mashall 1920, Hoover and Vernon 1959, Weber 1909, and others) and they are still investigated nowadays. In fact, as Krugman argued, these forces should be explained by "more fundamental motivations; it should not leave us open to jibes like that of the physicists who said, 'So economists believe that companies agglomerate because of agglomeration economies' " (Fujita M. and Krugman P. 2004).

[64] See for instance Goffette-Nagot and Schmitt (1998) describing rural areas.

The risk to be tautological in this topic is high. A step-by-step research process and clear definitions are therefore required. In fact, the complexity of reality imposes the researcher to be modest and cautious in modelling concepts as agglomerations and periphery. In dealing with these concepts, even the Nobel price Robert Lucas was not ashamed to write: "what can people be paying Manhattan or downtown Chicago rents for, if not for being near other people?" (Lucas 1988). That sounds as: "people agglomerations exists, because people agglomerates". But, is this tautological or the description of a cumulative process in which history and expectations matter?

As one will see (section 4.1.4), the core-periphery model interpretation could lead to significant conclusions in this field. According to it, agglomeration of resources or geographical concentration of particular industries are processes that imply dynamic mechanisms. The observation of an agglomeration is therefore a static picture of a dynamic process that could lead to a stable or instable equilibrium. Said differently, centripetal and centrifugal forces are constantly active and dependently on the prominent one, they can favour concentration or dispersion. Assumptions and results of this New Economic Geography model have been sources of several criticisms by regional economists, which for a long time have been looking for the regional development determinants.

4.1.1 Agglomeration economies

Introducing the argument about the reasons for agglomeration economies, it has been a custom to go back as far as to Alfred Marshall (1890, 1920 Chapter X), and other authors as Weber (1909), Hoover (1937), Christaller (1933) and Lösch (1940, 1954). However, as recently reviled by Fujita (2000), von Thünen himself provided a very systematic account of most factors explaining economic agglomeration (in Sect. 2.6 of Part II of von Thünen 1826, 1966)[65], so as of the

[65] According to von Thünen (1966, pp. 287-290), industrial agglomerations could be explained by the following reasons:

1) "*Only in large-scale industrial plants is it profitable to install labour-saving machinery and equipment, which economise on manual labour and make for cheaper and more efficient production.*
2) *The scale of an industrial plant depends on the demand for its products.*
3) *The number of buyers depends, in provincial towns, on the number of countrymen coming in to sell their products, or passing through on their way to the capital.*
   For instance, a countryman may visit the capital to sell his products, and decide to buy some liquor. It will be cheaper for him to buy this in the capital, even if it costs him half a thaler more than he would pay in the provincial town two miles from his farm, because he would have to make a special journey to fetch the local alcohol.
4) *For all these reasons, large scale plants are viable only in the capital in many branches of industry. But the division of labour (and Adam Smith has shown the immense in‡uence this has on the size of the labour product and on economies of production) is closely connected with the scale of an industrial plant. This explains why, quite regardless of economies of machine-production, the labour product per head is far higher in large than in small factories.*
5) *People aware of possessing an exceptional skill or talent will not wish to waste their time on other work, where they can achieve nothing outstanding, but will move to the capital, to devote all their energy to their particular skill; in return they will reap ample reward. Thus the capital attracts outstanding talents—among business men, artisans and labourers as well as among scholars and civil servants–and in this way is able to obtain a signi…cant advantage over the provinces.*
6) *The large town offers buyers and sellers far more guarantee of being able to buy and sell at current prices. The great merchant has not the time to consider the special situation of his customer and fix the price of the article he wants to sell accourding to the buyer's needs or knowledge. He has an established price; which protects the customer from sharp practice. Besides, in the presence of so many competitors the attempt to cheat the customer would be scarcely worth the trouble.*
7) *Where factories and workshops employ machinery and equipment that has been produced in the large town and is incapable of being locally repaired, each repair will cost much in transport, and will give rise to considerable and harmful delays in production*

   Since it takes machines to produce machines, and these are themselves the product of many different factories and workshops, machinery is produced efficiently only in a place where factories and workshops are close enough together to help each other work in unison, i.e. in large towns. Economic theory has failed to adequately appreciate this factor. Yet it is this which explains why factories are generally found communally, why, even when in all other respects

centrifugal forces (explaining in particular the impact of the high land rents and high food prices on monetary wages in large cities). Even if he wrote this text before the Industrial Revolution and many scholars ignored it, von Thünen's explanation of centripetal forces is so comprehensive that it is still useful to introduce agglomeration economies in modern works: as Fujita stressed (Fujita M. and Krugman P. 2004), "the combination of von Thünen's agglomeration factors 1), 2) and 4) closely resembles the 'basic story' in Krugman (1991b) on the emergence of a core-periphery structure" (see Section 4.1.4).

Although the appreciable precursor effort of von Thünen, the majority of modern authors which discuss about agglomeration economies, refer to the seminal work by A. Marshall, further restated by Arrow (1962) and Romer (1986, 1990): also known as Marshall-Arrow-Romer externalities (MAR). All these three authors claimed that geographical agglomeration of a particular industry produces knowledge externalities which can have positive effects on the rate of innovation and economic growth. According to Marshall, industrial concentrations arise because (1920, p.271):

"*When an industry has thus chosen a locality for itself, it is likely to stay there long: so great are the advantages which people following the same skilled trade get from neighbourhood to one another. The mysteries of the trade become no mysteries; but are as it were in the air, and children learn many of them unconsciously [...]Employers are apt to resort to any place where they are likely to find a good choice of workers with the special skill which they require...The advantages of variety of employment are combined with those of localized industries in some of our manufacturing towns, and this is a chief cause of their continued economic growth*".

Referring to Marshall writings, in modern handbooks one speaks about (a) knowledge spillovers, (b) non-traded local inputs, or/and (c) local skilled-labour pooling.

A. Knowledge spillovers

If many firms are clustered in the same location, the employees' knowledge of one firm can easily diffuse to employees of other local firms. This easy access could be either through frequent face-to-face contacts in business meetings, or more informal occasions as business lunches, sport activities and other social events. Thus, geographical proximity allows workers to learn from each other and diffuse tacit information. As McCann explains (2001, p. 56), "tacit information is information which is incomplete and which is shared on a non-market basis, and can relate to issues such as new products, personnel, technology, and market trends". Combining the partial information collected in several occasions, participants to these meetings can build up a coherent vision of the economic environment and improve their competitive skills. Thus, the more they are, the more the picture will be complete. Moreover, being part of such a spatial cluster allows participants to face more efficiently the increasing pace of technological change. The rapid information circulation among agglomerated firms and workers give them an advantage relative to other (excluded) economic actors.

Even if this type of agglomeration forces has been most widely discussed by geographers, regional and urban economists and more management authors as M. Porter (1998), the empirical analyses are far from explaining the mechanisms of differentiated diffusion knowledge among economic actors. A simple explanation of this shortage of empirical works could be find in the following

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conditions appear suitable, those set up by themselves, in isolated places, so often come to grief. Technical innovations are continually increasing the complexity of machinery; and the more complicated the machines, the more the factor of association will enter into operation."

words of Paul Krugman (1991b, p.53): "knowledge flows […] are invisible; they leave no paper trail by which they may be measured and tracked". More recently (Fujita M. and Krugman P. 2004) he also argued that if he has been "rather ascetic on this topic" is because he "could not find any solid micro-model of knowledge spillovers or communications". Thus, in the new economic geography the centripetal forces enter the models as "linkages factors" (the pecuniary externalities through linkage effects among consumers and industries).

Discussing about measures of knowledge flows, one should be aware not to confuse the concept of information and tacit knowledge. As Jacobs (1969) suggested, information has a familiar meaning and interpretation (i.e. information about stock exchange can be easily transmitted by media), while tacit knowledge is difficult to codify and often only serendipitously recognized. In particular, while the revolution in telecommunications has influenced the information flows and has reduced the marginal cost of transmitting it, in order to decrease the marginal cost of transmitting tacit knowledge a frequent social interaction, observation and communication is required (von Hipple 1994).

Finally, it should be stressed that the view expressed by MAR externalities is that knowledge spillovers are enhanced by the presence of a strong concentration of a single industry in a given area. Thus, a local specialisation should be considered a more conductive environment for innovation as companies can internalise spillovers deriving by the production of new knowledge. This point of view is therefore in contrast with Jacobs (1969) ideas, that the major source of knowledge spillovers comes from the interaction of actors belonging to different industries (see above: *urbanisation economies*).

B. Non-traded local inputs

Sharing non-traded inputs, firms located in the same area can benefit from increasing internal return to scale. In fact, "there will be the possibilities for certain specialist inputs to be provided to the group, in a more efficient manner than would be the case if all of the firms were dispersed" (McCann 2001, p.56).
Being clustered, firms have the opportunity to benefit from a specialist service provision (i.e. local tourism marketing) or infrastructure (i.e. fibre-optic system) sharing the costs with all the other beneficiaries located in the agglomeration. Thus, while the variety of inputs available increase, the costs of the non-traded local inputs to each firm within the group will fall as more firms join the cluster.
One important remark concerns the difference between knowledge spillovers (also named "technological externalities") and non-traded local inputs (also named "pecuniary externalities"). In fact, while the former implies interactions non priced at all, with pecuniary externalities the problem lies in the price distortion due to the presence of market power. Thus, knowledge spillovers can be transmitted by pure proximity, while the latter implies market transactions and imperfect competition.

C. Local skilled-labour pool

Another source of agglomeration economies is the local labour pool, which reduces costs and risks for both firms and workers. In fact, clustering allows firms to reduce their labour acquisition costs (search costs and retraining costs) relative to firms in dispersed locations. On one hand, the rapid improvement of market conditions lead firms to expand their labour force quickly and to undertake a search process to acquire workers. On the other hand, being located in an area with a large pool of workers with specialised skills required by the particular industry, the costs to the firm of

retraining the workforce will be relatively low. At the same time, workers could benefit from the firm's geographical concentration since changing jobs (spontaneously or because of a change in firms productivity needs) will not necessarily mean moving out of the region. Besides, they "will be more willing to acquire industry-specific skills if they are more confident about their future job prospects in the same industry" (Armstrong and Taylor 2000).

It is important to stress that these three marshallian agglomeration economies allow to return to scale which are external to any single firm, but internal to the industry. Thus, they refer to the advantages from which a particular industry within a specific geographic area could benefit. However, in many areas, firms of different industries can cluster together and originate agglomeration economies whose nature may differ from a region to another. The first description of the different location forces in a particular region was given in the classic work of Alfred Weber (1909, 1929) who recognised three general sources: the Transport cost differentials; the labour cost differentials; and the agglomeration (de-agglomeration) economies and diseconomies. Later on, Ohlin (1933) and Hoover (1937, 1948) divided agglomeration economies in three different categories: (i) Internal returns to scale; (ii) Localization economies; (iii) Urbanization economies.

i) Internal returns to scale
They exist within *a company* and are based on the scale economies achieved in production simply by the reason of its size. However, these internal production economies of scale are associated with a high spatial concentration. In fact, it is assumed that they arise because a large level of investment takes place at one particular location and it allows firms to grow since they easily find a large quantity of capital and labour force located in the same place.

ii) Localized economies
They result from the scale of a particular industry located at a single place. Each marshallian externality source (knowledge spillovers, labour-market pooling and intermediate inputs) could therefore contribute to localized economies.

iii) Urbanisation economies
They arise from the geographical proximity of a large number of economic activities which jointly serve different industries (Jacobs 1969). These include (Armstrong and Taylor 2000, p. 105):

- Urban transportation and commuting facilities
- Well-organized labour markets and large pools of workers with different types of skills
- The provision of social overheads and government services
- Legal and commercial services such as lawyers, accountants, consultants, freight-forwarding agencies and financial institutions
- Market-oriented activities such as service trades, attracted by the large concentrations of population
- Cultural and recreational activities which attract highly skilled managers and professional workers
- The clustering of organizations which invest heavily in the search of new products and new processes

The urban externalities shift the attention from the supply side (of *marshallian externalities*) to the demand side of spatial economy. In particular, they point out an important assumption that competition models do about consumers tastes: "the preference for variety" (or the convexity of preferences). This aspect was the object of recent empirical works and particularly crucial to distinguish urban and non-urban areas, it will be considered more in details in section 4.1.3.

To conclude, it is important to stress that while internal returns to scale are usually not considered to belong to the agglomeration economies because internal to a single firm, regional economists appeal to localized and urbanization economies to explain clustering phenomena and socioeconomic development processes. The intra- and inter-sectoral origin of knowledge externalities is therefore crucial in order to understand innovation mechanisms and the growth's and localisation's dynamics that derive from them (Duration and Puga 2001). However, either in growth theory (where Marshall's externalities are in opposition to Jacobs' externalities), or in localisation theory (where localized economies are in opposition to urbanization economies) the debate is still in progress. As Autant-Bernard recently suggested (2003), the major explanation derivable from existing empirical works to clarify divergent observations relies on the maturity level of the particular sector.

The choice to focus this dissertation on the innovation attitude of firms located in peripheral regions, where agglomeration is not present, should therefore not lead to the wrong conclusion that the role of agglomeration economies in clustering and innovation processes has already cleared up.

4.1.2 Centrifugal forces

The first author investigating this question was von Thünen, who in 1826 identified the following reasons against the location of industries in the capital city (von Thünen 1826, 1966 pp. 286-7):

- *"Raw materials are more expensive than in the country towns on account of the higher cost of transport.*
- *Manufactured articles incur the cost of haulage to the provincial towns when they are distributed to the rural consumers.*
- *All necessities, especially …rewood, are much more expensive in the large town. So is rent for flats and houses, for two reasons (1) construction costs are higher because raw materials have to be brought from a distance and are consequently more expensive, and (2) sites that may be bought for a few thalers in a small town are very dear. Since food, as well as fuel and housing, cost so much more in the large town, the wage expressed in money, must be much higher than in the small one. This adds appreciably to production costs."*

The term "centrifugal forces" has been adopted more recently by NEG's authors to show a "somewhat comparable trinity of forces opposing agglomeration" (Fujita M. and Krugman P. 2004). These forces are: a) immobile factors; b) land rent / commuting; c) congestion and other pure diseconomies.

Even if all these factors could operate in the real world, the NEG's models simplifies matters taking into account only linkages as a force for concentration and factor immobility as a force against. Without entering into details of the core and periphery model (see section 4.2), it could be said that farmers have been chosen as immobile factors and they generate centrifugal forces because they consume both types of goods: agricultural and manufacturing goods (which are produced by mobile workers).

The land rent contributes to centrifugal forces because the concentration of firms and population in the same place increase the price of land. Thus, it encourages localizations in more peripheral and less populated areas. At the same time, if transport costs are not so high, workers could continue to

be employed in firms located in the agglomerations. In this sense, commuting is considered a phenomena that encourages decentralisation.

Finally, an excess of clustering could lead to congestion of transport infrastructures, of other public and private infrastructures and negative externalities (e.g. pollution), generating centrifugal forces.

4.1.3 Other more recent sources of externalities

In "Evidence on the Nature and sources of Agglomeration Economies", Rosenthal and Strange (2003) highlight many other causes of agglomeration economies that were not discussed by Marshall as: natural advantage, home market effects, urban consumption and rent seeking.

Natural advantage
The main idea is that agglomeration arises because of the benefits of locating in areas endowed with natural advantages and also because of the influence of agglomeration economies. According to Rosenthal and Strange (2003), there is a long history of empirical research on industrial location that has considered the role of natural advantage: Marshall (1920) spoke about the role of physical conditions as the climate, the soil, the existence of mines and quarries, and the easy access by land or water; Fuchs (1962) documented the importance of access to resources for manufacturing industries in North America; more recently Kim (1995, 1999) empirically measured the impact of natural resources in determining agglomeration and later on in determining state employment (assuming all factors of production, including labour, as immobile); finally, in a similar way, Ellison and Glaeser (1999) employed predicted state level employment variables to account for the importance of natural advantage in agglomeration[66].
Thus, "the impact of agglomeration economies can be refined by determining the share of productivity that can be attributed to a location's natural advantage instead of to agglomeration economies" Rosenthal and Strange (2003).

The Home market effects
The idea is, that the interaction between internal scale economies in production and transport costs lead to an home market size expansion through a self-reinforcing process of agglomeration: "[…] when a new firm starts producing in a certain location, it increases local demand for upstream activities ('market expansion effects') and local supply for downstream ones ('market crowding effect'). […] Due to excess demand and supply respectively, wages will go up while intermediate prices will fall. This a bad news for the other intermediate producers ('market crowding effect'). However, it is good news for final suppliers, who feed back into stronger intermediate demand so that also intermediate suppliers will benefit ('market expansion effect')". The net effect of market expansion and market crowding was named "home market effect" by NEG's authors (Krugman 1980, Helpman and Krugman 1985). Details on further studies about home market effects is provided in Head and Mayer (2003).

Consumption
The fundamental idea is to consider consumption possibilities of large cities as sources of agglomeration. As recently reported by Ottaviano and Thisse (2003), in 1926 Haig argued that cities offer a great number of people and a large assortment of consumption goods and services. According to the authors, the advantages of variety are so large that the right question is not "why

[66] However, Rosenthal and Strange (2003) express their criticism about the choice of assuming the labour factor as immobile, because it is precisely the mobility of labour that leads agglomeration in the presence of external increasing returns in production.

to live in the city" but "why not to live in the city". Thus, migration to a large city could be explained purely and simply by a consumption motive.
In Glaeser et al. (2001) are presented different kinds of evidence to indicate the importance of consumption for cities and are distinguished four different ways that large cities enhance consumption :

1) there may be goods and services that are not available elsewhere;
2) they may offer various aesthetic charms;
3) they may allow the provision of public goods that would not be possible in a smaller place;
4) the relatively dense settlement of a large city allows speed of interaction that would not be possible in a smaller city.

In 2003 Waldfogel hypothesised and verified that a larger market may allow goods to be more closely tailored to individual consumers' tastes. Tabuchi and Yoshida (2000) interpreted the positive elasticity of nominal wage with respect to city size as a signal of a corresponding increase in productivity (thus, as a traditional agglomeration economy in production) and the negative elasticity of real wages with respect to city size as an agglomeration economy in consumption: workers acceptance of lower real wages in cities implies a corresponding consumption benefit[67].

Rent-seeking
In 1995 Ades and Glaeser demonstrated a relationship between rent-seeking and the formation of mega-cities: political factors resulted more important than economic ones. In short, they proved that political instability encourage urban concentration. In particular, the ability to engage in rent-seeking seems to be one force that leads to the concentration of population in mega-cities. Other studies focused on the determinants of urban primacy and the impact of urban primacy on growth (Henderson 2003) and on the importance of public policy on location patterns around borders (Holmes 1998). The rent-seeking term could therefore be considered as part of a broader pattern of public policy affecting location.

As exposed in this section, many factors could directly or indirectly contribute to the agglomeration of socioeconomic resources. However, very often the availability of data and a scarce conceptual clarity (due to the complexity of real phenomena) impose researchers to consider only one or two reasons of microfoundations in their models. Thus, on one hand it is useful to be aware of the multitude of agglomeration determinants, but on the other hand this knowledge does not automatically lead to a significant improvement of microfoundated empirical models. In any case, the relatively recent approaches adopted in this scientific field (e.g. the new economic geography) justify caution and a step-by-step attitude in drawing and testing new theoretical and empirical formalisations.

4.2 The core-periphery model and innovative firms

The core-periphery model is a recent attempt to combine centripetal and centrifugal forces in a general equilibrium model. Even if it is often subjected to criticisms for its "intellectual cheap tricks or strategic simplifications" (as Krugman himself recognized; Fujita M. and Krugman P. 2004), it allows to identify some fundamental micro-conditions which could lead or not to a core-periphery situation.

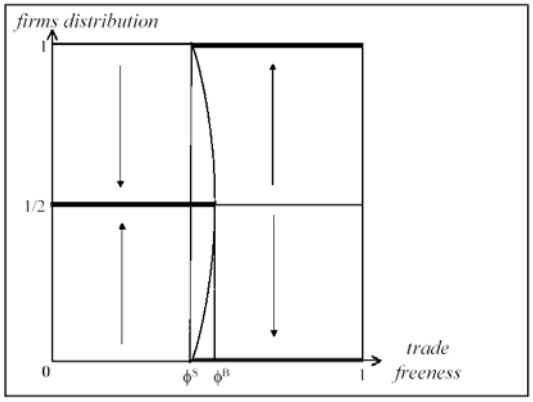
[67] The difference in real wage necessary for the worker to be indifferent between two areas is the main idea of the related literature on urban quality of life (Blomqist et al. 1987).

The core-periphery model was introduced by Krugman in 1991(a). Later on, other variants and improvements of this model were defined by NEG authors: see for instance Krugman and Venable (1995) and Venables (1996) works, in which new assumptions are adopted to explain the geographical concentration of particular industries; or Baldwin (1999), Martin and Ottaviano (1999, 2001) and Baldwin et al. (2001), which focused their attention on the dynamic aspect of the model.

The basic model is a 2x2x2: two regions, two sectors (agriculture and manufacturing) and two types of labour (farmers and workers). The agricultural sector is perfectly competitive, operates under constant returns to scale, farmers are the only input and its output is costlessly traded between regions. The manufacturing sector is monopolistically competitive (since it produces a continuum of varieties of horizontally differentiated products), operates under increasing returns to scale, workers are the only input and interregional shipments of its output are costly because of trade impediments.

To illustrate how centrifugal and centripetal forces dynamics, the graphic depicted in Figure 11 represents the extent of trade freeness $\varnothing$ on the horizontal axis and the share of firms located in one of the two regions on the vertical one (Ottaviano 2003). Trade freeness is an inverse measure of trade costs: $\varnothing = 0$ means autarky; $\varnothing = 1$ means free trade. Horizontal heavy solid lines indicate long-run outcomes in terms of geographical distribution of firms towards which the economic system evolves as pointed out by the vertical arrows.

Figure 11: The basic NEG model



Source: Ottaviano G. I. P. 2003

For low trade freeness (i.e. $\varnothing < \varnothing^S$) the long-run outcome is geographical dispersion of firms, while for high trade of freeness (i.e. $\varnothing > \varnothing^B$) agglomeration in either regions is the only long-run outcome. Moreover, for intermediate values of trade freeness (i.e. $\varnothing^S < \varnothing < \varnothing^B$) both dispersion and agglomeration can emerge in the long run. Thus, as freeness crosses the "sustain point" $\varnothing^S$ from below agglomeration becomes "sustainable" as long-run outcome, while crossing the "break point" $\varnothing^B$ from below symmetric dispersion is "broken" (see Fujita et al. 1999).

Even if extremely useful to understand why agglomeration appears, NEG authors themselves have been extremely cautious about drawing policy implications of this model. Krugman itself recently exposed several reasons of this attitude (Fujita M. and Krugman P. 2004, pp. 156-157). Among them there is a special consideration that makes policy conclusions difficult in the geographic

literature: as shown before, external effects could encourage agglomerations (centripetal forces) or dispersion (centrifugal forces). "So there is a market failure case to be made both that any given agglomeration is too big (look at the congestion and pollution) and too small (think of the linkages and spillovers that would come with more activity). One may have opinions […] but good feelings are not a sound basis for policy".

Nevertheless, Ottaviano (2003) recently wrote a paper with the "incautious" aim to take NEG models literally and as what their exact policy implications are. For instance, he pointed out that the mechanism described above stress an important aspect of NEG model (Ottaviano 2003, p. 670): "once spatial differences take shape they become quite rigid. The reason is circular causality: agglomeration is self-enforcing as it produces rents that tend to hold firms and factors in place".

On one hand, this implies that policy interventions may have no impact whatsoever on the location of firms if the magnitude of intervention does not rises above some "threshold level". On the other hand, if policy makers are able to offer a subsidy that is large enough, they could convince all the firms of the core area to relocate in the periphery. This is due to the "location hysteresis", which arises when the trade freeness level is such that there are multiple long-run outcomes (i.e. for $\varnothing > \varnothing^{S}$): supposing that almost all firms are located in the same region and a trade freeness higher than $\varnothing^{B}$, if a shock is large enough to move a majority of firms to the other region, all firms would eventually cluster there. As Ottaviano explains (2003), "what is crucial is that even a temporary shock would do the job. Indeed, the removal of the initial shock would not lead to a reversal of its effects. This is 'hysteresis' or 'path dependency': transitory shocks have permanent effects" (named *lock-in effect*). Thus, in these mechanisms and dynamics the history matters.

Furthermore, when the trade freeness is high but not too high ($\varnothing^{S} < \varnothing < \varnothing^{B}$), the main concern of firms is the future (which is usually the case of innovative firms) market expansion effect (see *Home market effect* in section 4.1.3). In fact, a jump between the dispersed and agglomerated outcomes can be triggered simply by a shock to expectations (Ottaviano et. al. 2002). Thus, firms' rational choice is to locate where it believes other firms will locate.

Combining the fact that when history matters, even a small transitory subsidy had a large permanent effect on the location of firms, and that when expectations matter, no subsidy is actually required, could be concluded that: "all that a region needs to attract firms is the credible announcement of the subsidy. This will be enough to generate an optimistic view on the future of the region. Firms will move accordingly and the lock-in effect of self-enforcing agglomeration will make the cluster self-rewarding even if the subsidy is no actually delivered" (Ottaviano 2003, p. 671).

Of course circular causality, endogenous asymmetry, multiple long-run outcomes and self-fulfilling expectations phenomena could be found even in models based on technological externalities, but differently from those models, in core-periphery dynamics the emergence of agglomerations depend on the level of trade impediments. Said differently, what distinguishes this model from others is the so called "catastrophic agglomeration" effect. Its name is motivated by the fact that the way in which endogenous asymmetry emerges is highly discontinuous (Ottaviano 2003).

Ottaviano's preliminary effort gave prominence to several other situations in which public policy can influence model dynamics. However, concluding this work, his suggestion for future researchers is to better acknowledge the limits of NEG models. For instance:

1) it will occur to redefine some "too stark" concept as catastrophic agglomeration, introducing elements, as for instance congestion externalities (as Puga did in 1999) or heterogeneity across firms (Tabucchi and Thisse 2002, Murata 2003), that could smooth the transition from dispersion to agglomeration.
2) static NEG models depict the location process as a win-lose situation, but it is not the rule in dynamic models as shown, for instance, by Martin and Ottaviano (1999);
3) welfare analysis is still at an infant stage and this hampers their policy applications (i.e. questions about the optimal size and number of regional clusters should be considered; so as the consequences of a few distortions that are relevant to policy makers).

These suggestions are certainly appropriate and probably useful to overcome the scepticism of regionalists related to this model. In fact, NEG models limits and "tricks or strategic" assumptions have been sources of several criticisms by regional economists, which since a long time have been looking for "territorial increasing returns" and public policy instruments that are able to improve the "territorial competitiveness" of a region. In fact, according to them, even if NEG authors' effort contribute to introduce the space in models of economic nature and to join in a unique model several historical spatial conceptions (physical space, transport costs, polarised growth, etc.), the micro-mechanisms that could explain growth through territorial and local relational elements still remains unexplained.

In a recent publication, Capello (2004, pp. 311-314) argues that NEG explanation of agglomeration origin is economic but not territorial. In particular, proximity advantages (physical, social and relational) do not play a strategic role in the agglomeration processes as described by NEG. Thus, in their models the territory is not considered as an additional determinant of local development. In this approach the space is therefore conceive as a set of points instead of a development's "container".

Secondly, the historical localisation or the initial reallocation's choice of a firm enter exogenously the model and they significantly contribute to define where the agglomeration will take place. A clear example of the exogenous nature of these determinants are firms' profit expectations, which are not explained by the model. In fact, they depend on the beliefs of firms about other firms' behaviours, which could depend on credible policy announcements or other exogenous elements.

The third criticism reported by Capello is about the absence of elements that could smooth or limit the growth and agglomeration process, which is consistent with the first suggestion of Ottaviano reported before.

From our point of view, even if the NEG approach does not consider all the proximity dimensions that are relevant to explain innovation diffusion and regional development (see section 3.4), it has the merit to explain the origin of peripheral areas from an economic point of view. Trade freeness is probably not the only "periphery determinant", but if we observe the Ticino's territorial and socioeconomic evolution of the last years (see Part I), the increase of the free circulation of people, goods and capital across the national frontiers and the five regions of Ticino, it is certainly one of the main reasons explaining the development of urban centres and the abandon of more peripheral areas.

By contrast, the important role of history and the absence of elements that can prevent a catastrophical evolution are restrictive assumptions that prevent the use of this model as a good reference to explain innovation or regional development.

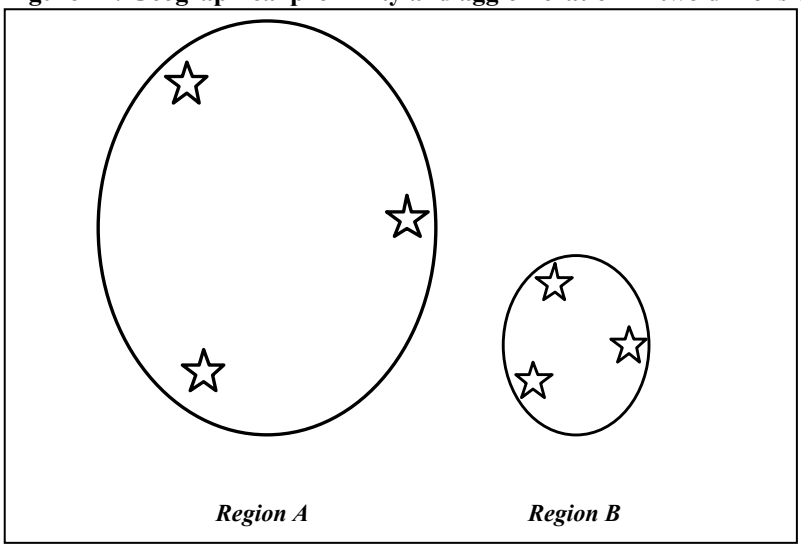
On one hand, innovation is a strategic attitude that firms adopt to improve their competitiveness in the medium-long term. It is therefore meaningful to assume that not only the present territorial situation (or historical moment) in which they are operating can influence innovation' strategies, but also their expectations about the future location of other firms (or R&D partners).

On the other hand, Switzerland is a federalist nation that favours the political autonomy and the financial support of peripheral areas. The public infrastructures are therefore more diffused and dispersed than in other countries and they act as centrifugal forces preventing a catastrophical evolution toward a desertification of peripheries. Moreover, in our opinion the assumption of high trade freeness is not completely realistic because transport costs inside a peripheral region still remain expensive even if the trade barriers at the frontiers fail down. Furthermore, small firms (that usually and mainly populates peripheral regions) could not delocalise their productivity without costs (in opposition to larger and multiplant firms by which these costs could be lower). Finally, since it is meaningful to assume that delocalisation costs could be financially or technically unsustainable by small firms, if the desertification process occurred, the more likely reason would not be the delocalisation of firms from a region to another, but the bankruptcies of firms located in the weaker region.

4.3 Geographical proximity and agglomeration

The spatial aspects considered in the previous sections (Chapter 4) can lead to confuse the term of agglomeration and that of geographical proximity. However, as we will show hereafter, geographical proximity could not be considered a synonymous of agglomeration. In fact, while the latter refers to a ***density*** concept (spatial concentration) of ***a multitude*** of socioeconomic actors at once (at a micro-level only), the former refers to a situation of ***vicinity*** of actors or areas that imply ***at least*** two socioeconomic actors (at a micro-level) or two areas (at a macro-level).

Figure 12: Geographical proximity and agglomeration in two dimensionally different regions



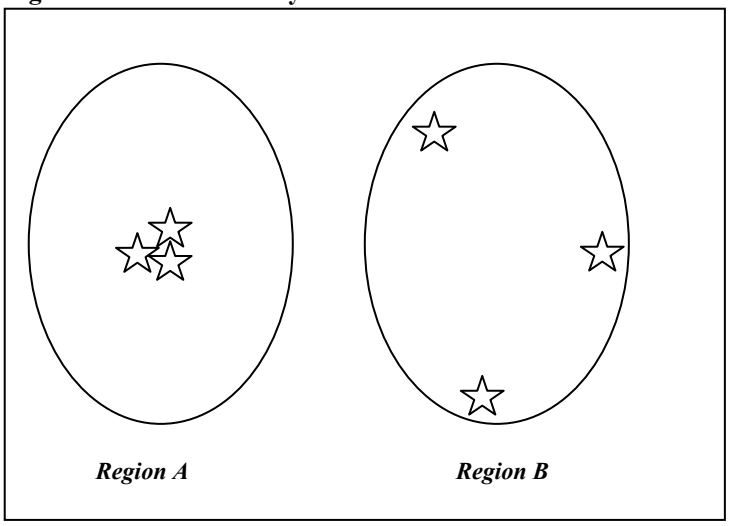
Source: personal elaboration

In Region A (Figure 12) the economic agents (stars) are less distant than in Region B. Thus, in relative terms, geographical proximity is more present in Region B than in Region A. By contrast, neither Region A nor Region B present an agglomeration of actors, which are (homogenously) dispersed. Of course, the more the Region becomes smaller, the more the distinction between

geographical proximity and agglomeration becomes difficult. However, the point here are the different conclusions we reach observing the geographical proximity and the concentration of agents in two different regions.

This is an important distinction even for our empirical works. In fact, comparing for instance the territorial and socioeconomic reality of Ticino and Switzerland, we should be aware of the difference of the two terms. Indeed, the absence of important agglomeration in Ticino does not necessarily mean the absence of geographical proximity (the maximal distance between actors is about 110km). By contrast, an eventual absence of important agglomeration in Switzerland would also mean a very low geographical proximity (because of longer distances between actors). Since innovation is influenced by geographical proximity, this fact is not irrelevant for our analyses. We will therefore choose the density of firms per hectare as measure of "periphery" (see section 7.1), as it takes into account the number of agents and the dimension (hectares) of the region. The results of small and bigger regions will therefore be comparable.

Figure 13: Similar density but different level of concentration

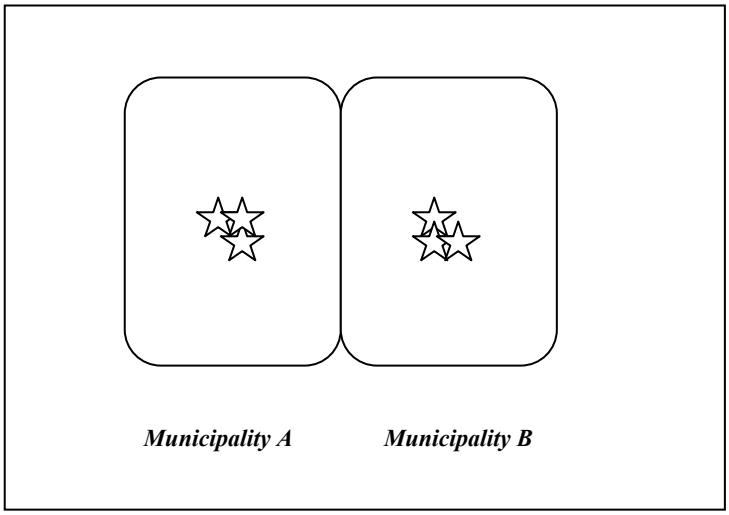


Source: personal elaboration

However, the same level of density in two regions does not say anything about the level of dispersion (or concentration) of the agents. In fact, in Region A and B (Figure 13) the density is the same, but there is concentration in Region A, while in Region B a dispersion of agents can be found.

The use of density can therefore appear as inappropriate. Nonetheless, since no distinction between geographical proximity and agglomeration can be done if the regional dimension is small (as said before). For this reason, in our empirical studies we will share the regions in municipalities and districts (see Chapter 7). Indeed, sharing the territory observed in small areas, the density level will not be misleading because the proximity of agents will be due to the smallness of the region and the concentration will become the main aspect measured by the density.

Figure 14: Agglomeration and dispersion in municipality and district levels



Source: personal elaboration

An additional warning should be considered if the analyses are carried out on several spatial levels (as for instance municipalities and districs). In fact, two municipalities (A and B in Figure 14), both presenting an agglomeration of agents, give origin to a district (the sum of municipality A and B) with dispersed agents. Indeed, there would be agglomeration at the district level if and only if agents were located and agglomerated in just one of the two municipalities. Thus, shifting to an other spatial level the analyses of this phenomena linked to the concept of geographical proximity and agglomeration will lead to different results.

CONCLUSIONS

Factors that could directly or indirectly contribute to the agglomeration of socioeconomic resources are numerous and simultaneously acting as centripetal and centrifugal forces. To combine the multitude of agglomeration determinants in a model that could simulate resources spatial dynamics, is not an easy attempt without appealing to strong assumptions. Thus, the complexity of the phenomena and the scarcity of reliable data have led researchers to favour descriptive to formal approaches. An exception to this attitude is the core-periphery model, that, even if adopting strong assumption to simplify realty, succeeded in modelling spatial dynamics distribution of firms and workers in a general equilibrium model. This model is therefore useful to start defining peripheral regions' and reflecting about possible implications on the innovation attitude of firms.

Indeed, since agglomeration economies improve the innovation capacity of a firm, its expectations about the future spatial distribution of competitors, partners, suppliers and customers could significantly influence their decisions about innovation activities. At the same time, its innovative and production activities could attract other up- and down-stream firms, competitors and workers. Thus, we can conclude that agglomerations and innovation activities are subject to a sort of circular causalty.

An empirical observation of this phenomenon implies the availability of time-series data and a good knowledge of internal firm strategies that are usually not accessible to researchers or public institutions. Nonetheless, even cross-section analyses could try to improve their explanatory power

taking into account the specific characteristics of a region in terms of agent proximity and physical dispersion/concentration.

Regional economists' main criticism to the core-periphery model is that the territory is not considered as a determinant of local development. By contrast, geographers and regional economists consider the territory an active player in the inter-regional competition. Moreover, they argue that some laws that govern inter-national trade are invalid at the inter-regional level. Regional dimension therefore requires different model's assumptions at a theoretical level and different policy instruments at a practical level. In particular, the improvement of competitiveness is a long-term objective whose driving force is focused on the continuous recreation of the local advantage through radical and incremental innovation. Thus, innovation is the crucial element that allow regions to maintain or improve their territorial competitiveness.

According to the regional socioeconomic characteristics and the development ambitions of its actors (or policy makers), innovations strategies or attitude could therefore be different from a region to another. For instance, it could be hypothesised that in a peripheral region, facing scarce financial and human resources and knowing a spatial dispersion of firms (or even a desertification process), the more likely long-term objective is the support to the actual competitive level and not its improvement. Alternatively, consistently with Camagni's statements, a passive attitude of agents (or policy makers) will lead to a desertification of the region or a total dependence from external resources. Innovation strategies of firms located in peripheral regions will therefore be influenced by the institutional system and collective actions.

Territorial characteristics are therefore crucial to understand innovation attitudes of firms. However, the term "territory" includes a multitude of dimensions that often troubles economists because they could not be easily inserted in a model. Nonetheless, it is quite common to hear statements (not far from the "*something in the air*" of A. Marshall) as: "in this region there is not an innovation's culture" or "it is needed a more entrepreneurial attitude", etc. To understand at a theoretical level the role of territoral innovation's determinants, it is therefore inevitable to open the black-box of more social and cultural dynamics. In other words, the analysis of innovation requires an enlargement of prospective in order to allow a precise interpretation of innovation spatial determinants.

The understanding of the role of proximity in innovation process is helpful in seeking this aim. In fact, it allows to introduce the limits to agglomeration processes (which lack in the core-periphery model) and to consider more social and institutional aspects usually avoided by economists but not by regional economists. However, the approach of regionalists and geographer is often descriptive and does not directly supply measurable elements to introduce in more economic models. Nonetheless, it suggests interesting intuitions about micro behaviours of firms and local actors, that could help economists to improve their models.

Finally, the difference between geographical proximity and agglomeration is another fundamental aspect to be taken into account. In fact, this distincion leads us to be cautious in comparing different realities as Ticino and California, to find a measure of periphery able to capture the positive and negative externalities effects of physical proximity and agglomeration, and to be aware of the consequences of a multi-level spatial analyses.

CHAPTER 5: DEFINING PERIPHERAL REGIONS AND THE ATTITUDE TO INNOVATION OF THEIR FIRMS

As emerged in the previous chapter, a region could be considered peripheral only in relative terms: because other regions present more important agglomerations. Since a precise threshold of spatial concentration is not theorically definable, any characterisation of peripheral areas by this criterion is necessarily somewhat arbitrary and does violence to the infinite variety of circumstances in the real world. However, as already explained in Part I introduction, periphery should be defined in absolute terms as well. Indeed, it exists territorial, cultural and socioeconomic characteristics that could be identified as typical of these areas: an economic structure dominated by traditional and mature industries, a deficient training of human resources, a scarcity of companies that undertake R&D activities and a weak entrepreneurial and innovatory tradition[68] etc.

As seen in Chapters 3 and 4, proximities and the expectations about the future territorial evolution (desertification vs. agglomeration) of the area are thought to have an important influence on the definition of firms' innovation strategies and activities. To investigate territorial, cultural and socioeconomic factors intervening in these entrepreneurial processes, it is opportune to have a better knowledge of peripheral areas' characteristics.

5.1 Proximity and agents' interactions in peripheral contexts

Peripheral areas are overall defined by the absence of agglomeration. In opposition to the agglomerations, where the *physical proximity* among agents is high, peripheral areas are usually defined as spaces with low density of population, employments, infrastructures, and settled by agriculture, forests and wild woods. In a peripheral area, inhabitants are spatially discontinuous distributed and the transport networks configuration do not allow an high accessibility. Furthermore, the secular migration from peripheral areas to the cities has decreased the internal physical proximity of peripheral areas and increased the urban one. Because of this characteristics and evolution, the interactions between agents in peripheral areas are usually lower than the interactions of agents located in urban areas (Goffette-Nagot and Schmitt 1998, p.175).

The physical proximity of agents within peripheral areas depends on the number of agents present in the area and its spatial dimension: in a small peripheral region, the distances among agents are shorter than in a bigger peripheral region with the same number of agents (see section 4.3). The density of firms or inhabitants in the area is therefore a good indicator of physical proximity because it takes into account both aspects: the number of agents and the spatial dimension.

However, under the same density degree, the intensity of interactions will depend on other proximity dimensions (see section 3.4.2) which could discourage or encourage interrelationships. Indeed, an high social and cultural proximity (typical of peripheral regions) reduces the variety of knowledge and the potential benefits from exchanging it, while an high variety of knowledge induces firms to interact and to benefit from positive externalities.

Another important aspect to be considered, is the distance of agents settled in peripheral areas from important urban areas. In fact, being not so far from an agglomeration, they can partly exploit the urban economies of it. Furthermore, because of the development of transports, of Information and Communication Technologies (ICTs) and the consequent internationalisation of trade, urban

[68] In this dissertation the scarcity of innovation will not be considered as an indicator of peripheral areas to avoid tautology. In fact, the presence and the attitude of innovative firms in peripheral areas (defined by other indicators and in particular by the firms' density) will be the heart of our empirical investigation in Part III of this dissertation.

agglomerations depend less on closer non-urban areas' natural resources (in particular for nutritional goods) than in the past.

Indeed, at a regional level the *trade between territories is still the rule* (Camagni 2002). Even if peripheral areas tend to be relatively closed and conservative[69], important (vital) interregional relations with more urban areas may exist: many inhabitants are usually commuters working in cities; local infrastructures are often financed by external capitals (for example by public transfers); well-entertained natural resources are often an interesting tourist destination or exploitable inputs of firms located in cities; houses and land properties are sold to foreign residents; etc.

The intra-regional low number of interactions due to agents' dispersion and the relative scarcity of knowledge sources in peripheral areas could therefore be partially but not completely offset by an intensive relationship with more urban areas. The externalities emerging from interactions of firms (networks) located in a peripheral area are therefore usually lower than those of firms located in urban areas.

5.2 Social, cultural, economic and technological homogeneity

Differently from the physical dimension of proximity, social and cultural proximities tend to be higher in peripheral areas than in urban ones. According to Goffette-Nagot and Schmitt (1998, p. 177), this social and cultural homogeneity implies: an important presence of aged people; a low presence of high qualified workers and employments; a low knowledge and skills' diversification of immigrants[70]. Moreover, the activity sectors are less diversified than in a city, employments in the tertiary sector are few, business services are as they were absent and economic activities are generally specialised, traditional and mature (Perrier-Cornet et al. 1996, Coronado et al. 2005). Thus, technological diversity's effects (selection and breadth; see section 3.2) are usually hardly present.

In terms of innovation capacity, the consequences of an excessive homogeneity of social and cultural proximity are similar to those of a cognitive and institutional proximity (see section 3.4.2): lack of resources of novelty, actions no economic rationales, lock-in and inertia. On the other hand, misunderstanding and opportunistic behaviours of agents are few because relationships are based on trust. Thus, at an economic level, the homogeneity allows to build up a specific organisational capital (Jayet 1996) and a collective behaviour (Torre 1993) that favours interrelationships.

Industrial districts, which are usually highly innovative, could be considered as a good example of an economic valorisation of social and cultural proximity: the existence of a common culture and a spatial proximity of the agents, allow an easier know-how transmission, the creation of trustful relationships and implicit contracts (Crevoisier 1998). Moreover, in industries situated in peripheral regions, reciprocal knowledge and a close distance between the private and productive dimension allow a reduction of production costs of the working force (Blanc and Lagriffoul 1996; Aubert 1996).

Nonetheless, the success of industrial districts usually implies a spatial concentration of firms and other economic agents that are not present in peripheral areas. Thus, if not combined with the

[69] Which are usually sources of locked-in effects (see section 3.4.2)
[70] These socioeconomic characteristics are present in the three Ticino region (section 2.2).

spatial concentration of agents and a reached critical mass (which by definition is the case of peripheral areas), the social, cognitive and institutional proximity could be considered more an obstacle to innovation than an incentive.

5.3 Market conditions and entrepreneurial strategies

The small number of firms located in a peripheral region (by definition) can lead to an oligopolistic situation in which firms can choose between cooperation (cartel) and oligopolistic competition. Taking into account the economic, social, cognitive and institutional homogeneity, it seems meaningful to expect local firms could reach common business agreements. An oligopolistic market is therefore highly likely.

Nonetheless, in peripheral regions, there are generally scarce financial resources (preventing particularly the implementation of independent R&D activities), an homogeneous knowledge, a low presence of high qualified workers and employments and the threat of a progressive desertification of the area (see Chapter 4) that can prevent firms to adopt long-term and offensive strategies in the field of innovation. In fact, this strategy implies high investments in R&D and local relationships that risk to disappear in the future (either because of bankruptcies or delocalisation). Entrepreneurs are therefore usually oriented on the short-term and they tend to mainly adopt defensive, imitative, dependent, traditional and opportunistic strategies. Thus, opportunistic (deviation from cooperation agreements) behaviours can appear.

Moreover, since in peripheral regions firms are fundamentally not offensive in their strategies, patent is not the most diffuse means to protect innovations. It is therefore meaningful to expect firms to protect their innovations by other appropriability instruments, as for example secrecy or the first move advantage which are the less costly and easily adoptable strategies to increase the appropriability of innovation's returns. Indeed, complementary sales, service efforts, learning and experience require investments that firms in peripheral areas could not be ready to afford.

Furthermore, non cooperative attitude leads to consider secrecy as a "natural" behaviour and the advantage of a head start as consistent with this latter strategy. Alternatively, the choice of an imitative strategy will imply a "second mover" advantage. As Mitchell et al. (1994) suggested, second movers can learn from the first mover's implementation mistakes, and that's why they can enter the market more cheaply. Monopolies could therefore temporarily appear as a result of "first or second mover advantage" or an opportunistic behaviour (deviation from cooperation agreements) which in absence of a solid R&D and other internal investments do not allow a long-term competitive advantage.

At the same time, even if Ades and Glaeser (1995) demonstrated that the ability to engage in rent-seeking seems to be more present in mega-cities, we would argue that peripheral firms are often supported by intensive regional policies. This leads entrepreneurs to invest time in influencing political decisions and this can even end up to foster and to subsidise inefficient firms and projects (as emerged in Monitoreg studies: Alberton and Bossi, 2001, 2003, 2004). Thus, they do not incentive local firms to adopt a competitive and innovative behaviour.

On the whole, in peripheral region market forces (competition stimulus to innovation) are generally weaker than in urban areas and lead to a situation of scarce cooperation (because opportunistic behaviours and rent seeking are usually preferred to entrepreneurial partnerships) and scarce competition (because firms are few and in a locally and temporarily monopolistic situation). Moreover, because of the low (or even absent) competition and the priority given to

cost reduction, rather than compete through new products, firms located in peripheral regions should be expected to favour process to product innovations.

5.4 Productive immobile factor vicinity and market demand

Among firms located in agglomerations, the use of mobile production's factors is highly diffuse. By contrast, economic activities of peripheral are characterised by an intensive use of immobile factors (see "Natural advantages" in section 4.1.3) whose proximity is sought by some firms (Cavailhès et al. 1994). These immobile factors are (Goffette-Nagot and Schmitt 1998, p. 179):

- ***abundance of territory***: it constitutes an important productive factor extensively used by agriculture and forestall activities. At the same time, residents' and tourists' activities could benefit from positive externalities of these activities: a well entertained territory and low risk of an undesirable urban development.
- ***natural and other resources***: a localisation in peripheral areas allows firms to be active in specific sectors, to be close to natural resources and intermediate products of agriculture and forestall activities.
- ***recreational goods***: these immobile goods are appreciated by workers, retired people and the residential tourism industry.

All these immobile factors are sources of externalities that act as "centrifugal forces" (see section 4.1.2) attracting or maintaining agents in peripheral areas. Without these factors, dispersion of agents in peripheral areas would be higher. Thus, they indirectly contribute to innovation avoiding the flight of innovative firms in agglomerations and attracting firms that wish to exploit these immobile factors introducing innovative production processes and endogenously contributing to the regional growth.

Moreover, in the spirit of the Heckscher-Ohlin theorem, it could be expected that the endowment with specific immobile factors will determine the sectoral specialisation of the region[71]. The impact of the sector' specialisation of the region should therefore be taken into account when innovation performances of a firm are measured.

By definition, peripheral regions are low densely populated of people and firms. The local demand is therefore lower than in urban areas, where the agglomeration of many agents could generate an important demand-pull effect on production and innovation (see section 3.2). Moreover, as a consequence of social, cognitive and institutional homogeneity, demand is quite homogeneous (among agents) and unchangeable in qualitative terms. The incentive to innovate are therefore lower than in urban areas, even if external demand could partly offset the weakness of the local one.

CONCLUSIONS

In this second part we have overviewed the major issues arising from investigating the factors influencing the innovative attitude of firms located in peripheral areas.

Firstly, the overview of innovation's determinants, innovation' strategies and the advantages and disadvantages of various form of proximities on innovation's activities, led us to identify the likely influence of spatial characteristics on the innovation capacity of the firms (Table 26).

[71] As reported in section 2.2, the three Ticino regions have different sectoral specialisations.

Secondly, we tried to overcome the absence of a clear definition of periphery considering the core-periphery model to identify the economical reasons for agglomerate in one place rather than another and to highlight the possible consequences on innovation' strategies of the firms. Moreover, we presented the conceptual differences between the terms "geographical proximity" and "agglomeration", that will be fundamental for the choice of our empirical investigation.

Thirdly, considering the additional and "absolute" territorial and socioeconomic characteristics of peripheral areas, it has been possible to highlight some that could influence innovation activities and strategies:

- lower firms interactions if compared to those of firms located in agglomerations;
- higher knowledge homogeneity;
- opportunistic behaviours and scarce competition;
- rent-seeking;
- specialisation according to the local endowment with specific immobile factors;
- absence of a local demand-pull effect.

An important conclusion of this second part is that agglomeration and geographical proximity are only two of the many factors acting as innovation's determinants. Of course, their importance is crucial to introduce the spatial dimension in the explanation of innovation mechanisms. However, there are additional relevant aspects explaining how territorial, social, organisational and institutional characteristics can influence the innovation capacity of firms.

One of the main aim of this work is to highlight the reasons to distinguish peripheral areas in modelling innovation. Since peripheral regions have specific characteristics that could impact the innovation capacity of firms, being aware of them, the researcher becomes able to implement a model without recurring to the unrealistic assumption of an homogeneous space or the exclusion of significant variables that could explain innovation firms' behaviours, and help policy makers to draw more efficient innovation policies.

PART III
INNOVATION'S DETERMINANTS IN TICINO AND SWISS PERIPHERAL REGIONS

INTRODUCTION

The previous parts of this dissertation had the aim to describe respectively the territorial (Part I) and theoretical context (Part II) in which we are going to develop our investigations on the innovation's determinants. The necessity to stress the territorial characteristics of Ticino regions is due to the main implicit hypothesis of this work: *innovation's determinants of firms settled in peripheral areas are different from those of firms settled in agglomerations*.

After a short description of our data sources (Chapter 6), the first challenging issue that will be considered in this Part III is the choice of a periphery's measure. As emerged in Chapter 4 and 5, a clear definition of periphery does not exist. The literature dealing with this concept is often driven by normative or stereotyped definitions of peripheral areas. Reading it, we can conclude that "Periphery" is either a matter of degree (spatial concentration of socioeconomic resources) as well as a matter of kind (specific characteristics). Because of that, in Chapter 7 we will describe the socioeconomic characteristics of Swiss peripheral areas considering firm's density as indicator of the "peripheral degree".

The aim of this additional descriptive analyses (Chapters 6 and 7) is twofold. On one hand, we would like to identify the territorial and socioeconomic characteristics of high and low firms' density Swiss areas as proxies of agglomerations and peripheral areas. On the other hand, we would like to show the innovation diffusion in these areas.

Later on, in Chapter 8 we will investigate the determinants of innovation in peripheral areas. The descriptive approach as well as the macroeconomic dimension will be abandoned because they do not allow to measure the single marginal contribution to innovation of several factors at the same time.

The analyses will be carried out at the national level using the KOF' sample data and at Ticino's level through the IRE' sample data. Moreover, to capture the (static) effect of socioeconomic dynamics acting at a spatial level wider than the municipalities' one, we will compute the *logit* models at the municipality and the district level. Furthermore, urban and peripheral areas of Switzerland (defined by the SFSO's definition as well as the firms' density) will be distinguished and the innovation's determinants acting in these two kind of territories identified and compared to Ticino's ones.

The aim is to observe the marginal contribution to innovation of several kind of variables (referred to the internal characteristics of the firm, the market structure, the local network and the spatial environment), when the spatial context analysed shifts from a level to another: from the national to the Ticino's level, from the municipality to the district level and, above all, from an urban to a peripheral level.

CHAPTER 6: THE INNOVATION SURVEYS

The empirical analyses of this dissertation are carried out by two independent datasets. One reports the results of three IRE's surveys realised in 2001, 2002 and 2003, while the second refers to the KOF's survey on innovation activities of Switzerland realised in 2002. Both original datasets were completed with recent secondary statistics data of the SFSO (the population national census of 2000 and the firms national census of 2001) and the results of an original work of Hermann and Leuthold (2003) on the political positioning of Swiss municipalities.

The dataset of IRE's surveys will be exclusively used to analyse the innovation activities of firms located in three regions of Canton Ticino, while the KOF's dataset will be used to analyse the attitude to innovation of firms located in all the 26 Cantons of Switzerland. In this Chapter, the two datasets are presented in detail.

6.1 IRE data

The data for this study comes from three dedicated surveys recently conducted in three regions of Canton Ticino:

- Locarnese and Vallemaggia Region (2001 - RLVM);
- Mendrisiotto and Valle di Muggio Region (2002 - RMVM);
- and Tre Valli Region (2003 - RTV).

The data was collected sending questionnaires[72] to all firms located in these three regions (about 8'000 in all). The response rate was of 22% in RLVM, 35% in RMVM and 23% in RTV. Which in terms of employees they represent the 36% in RLVM, the 43% in RMVM and the 31% in RTV. On the whole 2076 respondent firms were finally investigated.

The same questionnaire was sent to firms of the primary (26 firms), secondary (manufacturing and building: 581 firms) and tertiary sector (1469 firms)[73]. However, since in KOF' survey the primary sector was excluded, we will not consider the answers of its 26 firms in our further analyses. The IRE sample will therefore include 2050 firms.

The monitoring of the sectoral appurtenance of respondents allowed to obtain a sample that supplies information on nearly all the economic activities present in the three regions[74]. Questions were either quantitative or qualitative and allowed to complete secondary statistics data available at that time. In particular, information on firms' characteristics (qualifications of employees, supplier locations and number, ICT used, innovation capacity and so on), firms' strategic decisions (localisation, innovations, markets, etc.), and employers judgements on the local socioeconomic resources (availability and quality), the transport infrastructures and the institutional context were obtained.

The results of these three surveys were integrated in three applied research projects named Monitoreg, carried out by the Istituto di Ricerche Economiche and focused on the economic specialisations and regional development potential of the three regions (Alberton and Bossi 2001, 2003, 2004). The aim of this dissertation is however different: while in Monitoreg one gives an

[72] See Appendix 1
[73] See Appendix 24
[74] The lack of respondents in specific 2digit Noga branches was partially avoided by soliciting firms by phone to fill in the questionnaire and return it to our institute.

overview of the elements that contributes to the local territorial competitiveness and the key activities to trigger the local development, in this dissertation the focus is on the innovation capacity of the firms and the positive and negative externalities that the socioeconomic context generates on it.

Differently from the KOF survey (see next section), the focus of IRE's questionaires was not on the innovative activities of the firms, but more generally on characteristics that secondary statistics do not supply. On one hand, this aspect limits the availability of specific data usually collected to analyse innovation phenomena (such as the number of patents, the importance of R&D activities, the aim of innovation activities, the major obstacle to it, etc.). On the other hand, the richness of information collected allows to carry out statistical analyses that objectively identifies the real impact of several variables on innovation activities, without any a prior hypothesis made by the researcher. In fact, putting multiple choice answers in the questionnaires the researcher implicitly formulate hypothesis on the more likely answers and, in turn, it influences the choice of the respondent. In our analysis this subjectivity is minimized because the link between innovation activities and other variables is investigated through multivariate analyses.

6.2 KOF data

Data on Swiss firms' innovation activities has been collected each three years by the Konjunkturforschungsstelle (KOF) of the Eidgenössische Technische Hochschule Zürich since 1990. However, in this dissertation the data used to compare the attitude to innovation of Ticino's firms to those of Switzerland refers to the survey conducted in 2002[75] (Arvanitis et al., 2004).

Data was collected sending questionnaires[76] to 6500 firms located in all the cantons of Switzerland and operating in the secondary and tertiary sector[77]. The response rate was about of 40%. The sample of 2002 considered in our analyses counts of 2556 firms[78].

In KOF' survey, as in IRE' surveys, the notion of innovative firms is defined in a subjective way. In fact, each entrepreneur was free to judge him/her-self as innovator if he/she introduced at least one product or process innovation in the three previous years.

The information collected by the KOF' survey are either quantitative or qualitative and mainly focused on the internal and external sources of innovation, the behaviour of innovator in the field of cooperation and on the major obstacles to innovation.

The results are published by seco (State Secretariat for Economic Affairs) and they allow temporal and international comparisons[79].

[75] The use of KOF's cross-section data 2002 has been possible thanks to an informal agreement with Dr. Heinz Hollenstein that states the confidential and strictly scientific use of them. Only results of the analyses will be therefore published.
[76] See http://www.kof.ch/pdf/inno02_de.pdf (German version); http://www.kof.ch/pdf/inno02_fr.pdf (French version); http://www.kof.ch/pdf/inno02_it.pdf (Italian version).
[77] See Appendix 25
[78] The original KOF's sample was of 2586 firms, but we decided to exclude 29 firms operating in the field of associative, cultural and personal services (Noga 90-93), as they are not present in IRE' survey. Moreover, we excluded the only firm of the primary sector because it was not sufficient to do a comparison with the 26 observed by the IRE' survey.
[79] For more details see section 3.1

6.3 Dataset expansion

We expanded the IRE' and KOF' samples by using secondary statistics and the results of an original work of Hermann and Leuthold (2003), which analysing 182 national polls' results of the last 20 years draws an interesting ideological portrait of Switzerland and highlighted the major political contentious and regional differences in terms of opinions, social values and mentalities.

The key-variable (ID) to combine surveys results with these additional data was the municipality's code defined by the SFSO. In fact, the major aim of this expansion was to introduce characteristics of space in the sample. Thus, at the end of the expansion for each firm we obtained new variables (referred to the political positioning, the percentage of population with university degree, the number of foreign commuters, the sectoral economic structure, the firms' density, etc.) according to its spatial location (municipality).

Since the impact of spatial characteristics on firms' attitude to innovation is the major aim of this dissertation, this expansion represents an important value added to the original datasets and it allows to investigate dimensions that have not been considered in previous studies based on that data[80].

Moreover, while usually empirical studies focalise their attention on micro- or alternatively on macro-data (as R&D public or university expenditures, GDP, etc.), in our analysis the micro- and macro- data are joined and the existence of links between the firms' activities and the spatial dimension is tested by descriptive and multivariate analysis.

CONCLUSIONS

The originality of this work is due to the use of data usually not supplied by national institutions in charge of secondary statistics. Besides, both surveys (of IRE and KOF) jointly investigated innovation activities of the secondary and tertiary sector, but their marginal contribution will be distinguishable observing the sectors' dummy variables' results. This fact is quite uncommon in studies on innovation, which have usually preferred to focus their investigations on the manufacturing sector only.

Moreover, we will compare results of surveys conducted in the same period but at two different spatial levels: national and regional. On one hand, this fact implies an important work of variable selection (because some differences exist between the considered surveys) and it prevents to use original variables collected in only one survey for compared analyses. On the other hand, comparing the results we will obtain a major and specific knowledge of local and national characteristics of firms' innovative behaviours.

Furthermore, in IRE's data analyses, the link between innovation activities and the characteristics of the firm and its spatial location is investigated through multivariate analyses and not using a multiple choice questionnaire explicitly focused on innovation activities and their determinants.

Finally, the expansion of IRE's and KOF's datasets allows to introduce a spatial dimension that will have a key role in the analyses of this work, which will be focused on the role of spatial characteristics on the innovation activities of the firms.

[80] Alberton S. and Bossi F. (2001, 2003, 2004, 2002, 2003a, 2004a) and Arvanitis S., Von Arx J., Hollenstein H. and Sydow N. (2004)

CHAPTER 7: STEREOTYPED DEFINITION OF PERIPHERY AND SWISS LOW DENSITY AREAS

The identification of innovation determinants of firms located in peripheral areas is the main objective of our empirical analysis. Moreover, we would like to observe, if in Ticino the innovative firms' behaviour is similar or not to that of firms located in Swiss peripheral territories. Since Ticino regions are in a peripheral area (see Part I), the analysis of the attitude to innovation of firms located in urban areas will be investigated only at the national level and compared to Ticino's results. The KOF dataset is therefore essential to compare and contrast the innovation determinants of firms located in peripheral areas to those of firms located in agglomerations.
In this chapter we will define an indicator of periphery (7.1), present the methodology considered to investgate innovation determinants (7.2) and describe the main charactheristics of Swiss peripheral areas (7.3).

7.1 "Periphery" measure

The absence of a periphery's definition obliges us to consider a measure that could be considered valid from a theoretical and empirical point of view. According to the literature reviewed in Part II, the ***spatial concentration of socioeconomic agents*** (e.g. density of firms or inhabitants per hectare) is one of the most important characteristics of the peripheral areas. Thus, in this work we will assume the ***density of firms*** [81] as a ***synthetic indicator of periphery***.

There are several technical reasons to adopt such an indicator in empirical analyses:

- It is a measure that could be easily computed in each country and that could be observed at more spatial levels (in this work at the municipalities' and districts' level).
- The density of firms is generally highly correlated with the density of other socioeconomic elements (workers, population, etc.) [82].
- Being continuous it can be entered in innovation models as an indicator of the periphery degree and the local network that economic actors can develop (see section 8.5).
- Transforming this indicator in several categories of density[83], it becomes possible to observe the distribution of other spatial elements according to the density level of the area (see section 7.3). The ambiguity of periphery's definition can therefore be overcome assuming firms' density as a good indicator of it (in terms of degree) and observing the presence of specific socioeconomic elements (high presence of traditional and mature economic activities, scarcity of firms doing R&D and Science Based, weak presence of high qualified workers, sectoral specialisation, etc.) in peripheral areas (in terms of kind).
- Finally, it allows the researcher to freely define thresholds' values distinguishing peripheral areas from urban areas (see section 8.5).

[81] Defined as the number of firms per hectare of "settlement and urban areas". The choice to consider the "Settlement and urban areas" as defined by the SFSO (see Appendix 26) to compute our "Periphery Indicator" (number of firms per hectare), is due to the fact that the percentage of non settlement areas (woods, forests, brush forests, agricultural areas, lakes, rivers, etc.) of Swiss municipalities is highly heterogeneous. Thus, considering only the "Settlement and urban areas", the density of firms in Swiss municipalities could be compared without distortions.
[82] In Switzerland the Pearson correlation between firms' and population's density in the municipalities is of 0,795.
[83] For our descriptive analyses we will adopt 8 categories: 1. from 0 to 0,5 firms per hectare; 2. from 0,5 to 1 firms per hectare; 3. from 1 to 1,5 firms per hectare; 4. from 1,5 to 2 firms per hectare; 5. from 2 to 2,5 firms per hectare; 6. from 2,5 to 3 firms per hectare; 7: from 3 to 3,5 firms per hectare; 8. from 3,5 to infinite firms per hectare.

7.2 Methodology

Being interested in comparing the innovative attitude of Ticino's firms to those of the rest of Switzerland, the main constraint is the use of variables present in the IRE's dataset as well as in the KOF's dataset. Taking into account this constraint and the final objective of our investigations, we defined a list of variables refered to: the firms' size, the workers' qualifications, the competitive context, the juridical structure of the firm, the appropriability capacity, the technological opportunities, the external sources of knowledge (networks), the market demand and the socioeconomic characteristics of the territory in which it is located.

To identify the attitude to innovation of firms located in Swiss peripheral areas we decided to adopt a twofold methodology:

- Descriptive analyses to highlight the Swiss peripheral areas characteristics and compare them to the stereotyped definition of peripheral regions.

- Multivariate analyses to implement a model keeping into account simultaneously several variables that can contribute to explain the decision to innovate a firm.

In section 7.3 the analyses will therefore be focused on the relationship between our "periphery indicator" (firms' density) and some key socioeconomic variables, while the identification of innovation's determinants will be investigated with analytical techniques that allow to identify the marginal impact of several variables on the probability to be an innovative firm (Chapter 8).

To investigate the likely impact of spatial environment on innovation activities we will consider the municipalities' and districts' levels. While municipalities are political institutions, the district level is an institutional space unit considered by the SFSO to present secondary statistic results. The number of Districts in 2000 was 184[84]. In Switzerland, Districts are an institutional level between Municipalities and Cantons, but 8 relatively small Swiss Cantons correspond to a single District: Uri, Obwalden, Nidwalden, Glarus, Zug, Basel-Stadt, Appenzell Innerrhoden and Genève.

The choice to observe the main characteristics of peripheral areas at different institutional levels is due to the fact that municipalities areas could be to small to capture the significant characteristics of the environment in which innovative firms are located. Indeed, spillovers effects and economic agents mobility (costumers, workers, etc.) impose to consider at least an higher level of observation[85].

However, the main aim of this study is to distinguish innovation's determinants of firms settled in peripheral areas from those located in agglomerations. Thus, we will use firms' density as a criterion to distinguish core and periphery consistently from an economic point of view and Conurbation/Rural areas SFSO's definition as a more normative and territorial point of view.

[84] Since 2003 they have been reduced to 175 (see Appendix 27).

[85] We excluded other spatial levels for several reasons: the region of territorial planning (« Régions d'aménagement du territoire »; RAT) and the Region of spatial mobility (RMS) have been excluded because they are not defined by the SFSO as geographical institutional levels, because they usually are less numerous than districts (RAT are 140 and RMS 106) and they polarise around a central municipality. Thus, their density is improved by the presence of this centre preventing to consider in the analyses areas with a relatively low density, but a wider surface than municipalities.

The objective is to answer to four research questions that will be explained in section 8.1 and to investigate innovation's determinants of firms settled in various territorial contexts.

7.3 Descriptive analyses of Swiss "peripheral areas"

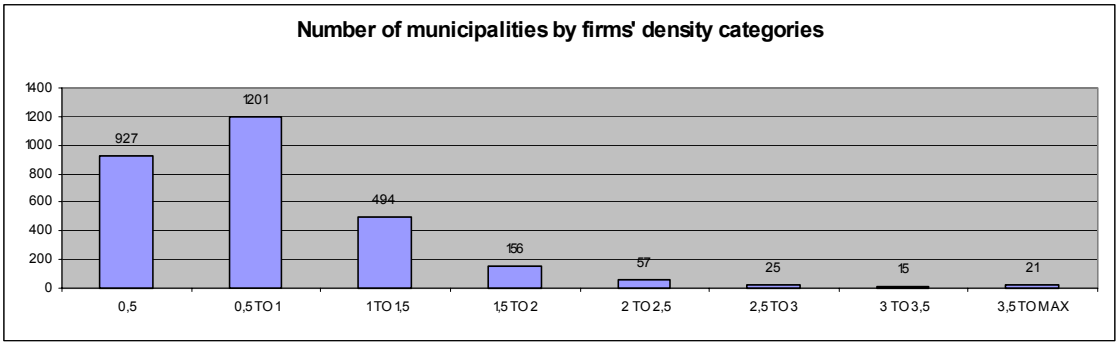
In this section we will present some descriptive statistics with the aim to highlight the major characteristics of Swiss areas classified by their firm's density. Moreover, we will show that the Conurbation/Rural classification of municipalities defined by the SFSO is quite well correlated with the municipality and district firms' density. Both classifications are therefore measuring a similar phenomenon. However, Conurbation/Rural classification uses a single threshold of concentration to share urban and rural areas, which is not suitable to capture the several attitudes to innovation of firms. By contrast, firms' density is a continuous measure that allows to classify areas in several categories and to observe the attitude to innovation of firms located in each of these areas.

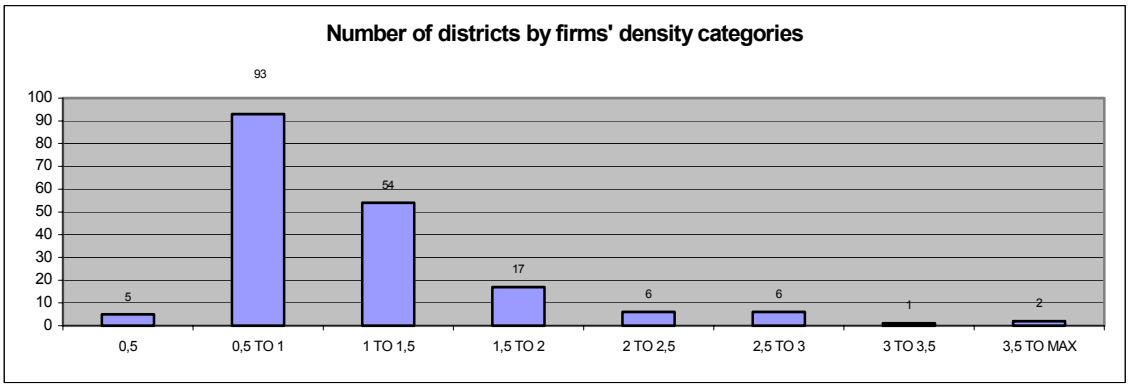
To carry out our descriptive analyses, after having observed the distribution of municipalities and districts according to their firms' density, we chose 8 density categories:

1. from 0 to 0,5 firms per hectare;
2. from 0,5 to 1 firms per hectare;
3. from 1 to 1,5 firms per hectare;
4. from 1,5 to 2 firms per hectare;
5. from 2 to 2,5 firms per hectare;
6. from 2,5 to 3 firms per hectare;
7. from 3 to 3,5 firms per hectare;
8. from 3,5 to infinite firms per hectare.

The distribution of municipalities and districts by their firms' density (Graphic 10) shows that municipalities and districts have on average a density between 0,5 and 1 firms per hectare. The number of municipalities with a lower density (less than 0,5 firms per hectare) are more numerous than those with a density over 1 (respectively 927 and 768). By contrast, this is not the case if we observe the distribution of districts. In fact, only 5 districts have a very low density (under 0,5), whereas 86 of them exceed the density of 1 firm per hectare. The average density in the districts is of 1,14 firms per hectare, whereas among municipalities it is of 0,82 firms per hectare.

Graphic 10: Distribution of municipalities and districts by density categories in Switzerland



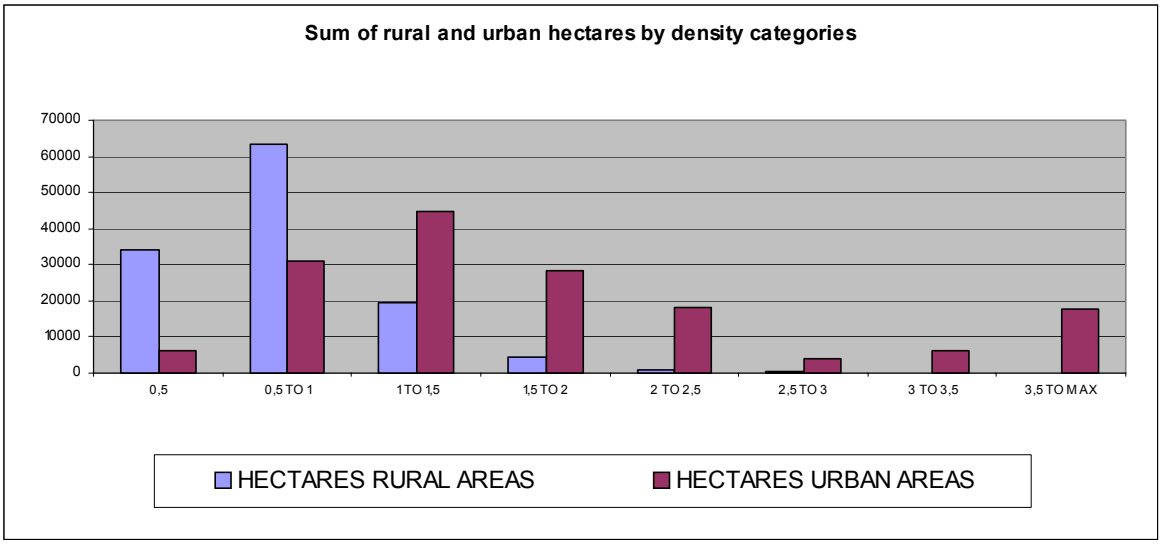


Source: SFSO data (Swiss land use statistics, census of firms 2001, census of population 2000) and personal elaboration

After having assigned each municipality and district to a density category according to its total density, we computed the sum of urban and rural hectares (as defined by the SFSO). The results (Graphic 11) show an higher presence of rural territory in categories refering to low density areas and an higher presence of urban areas in the higher density categories. More precisely, rural areas are well present in density categories which include municipalities and districts with a firms' density lower than 1 firm per hectare[86]. In all the other higher categories, the sum of the urban hectares exceed the rural ones. These results confirm that firms' density and Conurbation/Rural are describing a similar phenomenon: the peripheral degree of the areas.

[86] See details in Appendix 28

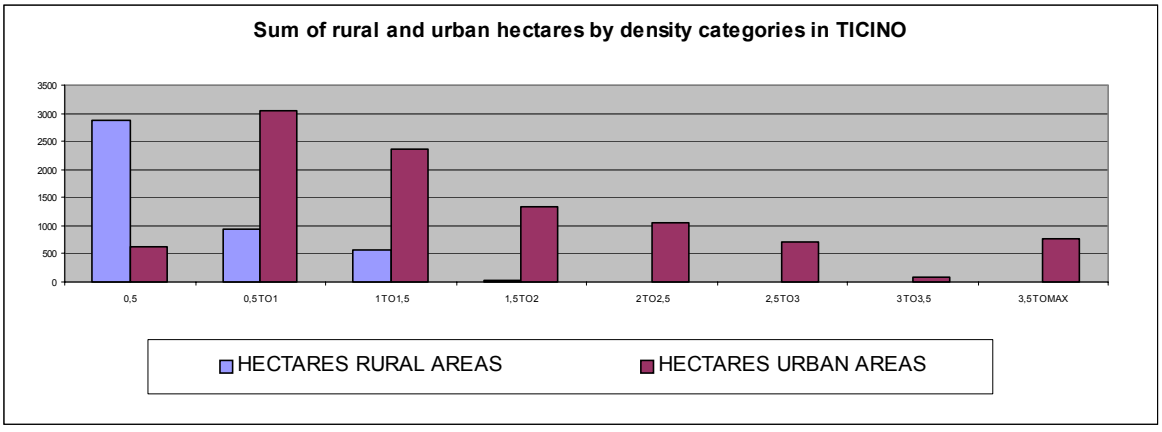
Graphic 11: Distribution of rural and urban areas by density categories in Switzerland



Source: SFSO data (Swiss land use statistics, census of firms 2001, census of population 2000) and personal elaboration

In Ticino the majority (71,4 %) of municipalities have a density inferior to 1 firm per hectare[87] and the average density among municipalities is similar to the national one (0,86 firms per hectare). In Ticino are present 8 districts and none of them has a firms' density exceeding 2 firms per hectare. The average density in the districts is of 1,02 firm per hectare.

Graphic 12: Distribution of rural and urban areas by density categories in TICINO



Source: SFSO data (Swiss land use statistics, census of firms 2001, census of population 2000) and personal elaboration

Differently from the national level, the distribution of Ticino's conurbation and rural areas by density categories at the municipality level (Graphic 12) reveals an important presence of urban territory in low density categories (particularly high in the second category)[88].

This means, as already reported in section 1.2.2, that in Ticino conurbations are relatively little populated by firms. This phenomenon is not observable considering districts, because urban

[87] See details in Appendix 29
[88] See details in Appendix 30

municipalities classified in low density categories, are included in districts with a relatively high total density (due to the presence of other more dense municipalities).

In the following sections, we will present the main socioeconomic characteristics of these areas in Ticino and in Switzerland and compare our results to those obtained by the "stereotyped" definition of a peripheral areas.

7.3.1 Low density areas of Switzerland

As seen in Chapter 5, according to a stereotyped definition of peripheral areas their characteristics could be summarized as follow:

- absence of agglomeration and low density of population;
- presence of agriculture, forests and wild woods;
- an economy dominated by traditional and mature industries, with a low presence of companies that undertake R&D activities (Science based firms) and a low economic diversification;
- a social, cultural and institutional proximity (implying an homogeneity of visions and ideas, a low presence of high qualified workers, etc.);
- firms are usually not offensive in their strategies;
- rent seeking.

In the following paragraphs we will consider several descriptive statistics based on SFSO data. In particular collected by the Swiss population Census of 2000, the Swiss Firms Census of 2001 and the KOF' survey of 2002. Using these data, we computed indicators useful to identify the main characteristics of low density areas of Switzerland and verify if they correspond to those we have just presented above.

a) Low density of population and presence of agriculture, forests and wild woods

In Switzerland, firms' density in municipalities and districts is well correlated with the presence of population[89]. Thus, as usually assumed for peripheries, in low density areas the number of inhabitants is low and it grows with the increase of firms' density[90].

From a territorial point of view, Switzerland is dominated by agricultural areas, wooded areas and unproductive territories (Table 27). The settlement and urban areas in which firms could be located represent only the 7% of the national territory. Since our densities are computed considering these kind of areas (see section 7.1), in this study the meaning of peripheral areas does not include wooded and unproductive areas, because they are areas in which firms are not present by definition.

Moreover, the firms of the primary sector was excluded from our datasets because they are completely absent in KOF' survey and scarcely present in IRE's one. For this reason, even agricultural areas are excluded from the computation of firms' density. **The firms' density of our empirical analyses are therefore computed taking into account only the "Settlement and urban areas"**[91].

[89] Pearson correlations between firms' density and the number of inhabitants in 2000 are of 0,498 at the municipality level and 0,723 at the district one. These correlations are significant at the 0,01 level (2-tailed).
[90] See details in Appendix 31
[91] See details in Appendix 26

Table 27: Swiss National territory utilization in 1992/1997 (in hectares)

Utilization	Hectares	Percentage of national territory
Wooded areas	1'271'524	31,8%
Agricultural areas	1'525'118	38,1%
Settlement and urban areas	278'961	7,0%
Unproductive areas	923'984	23,1%
Swiss national territory	3'999'587	

Source: SFSO, Arealstatistik 1992/97

b) Typology of economic activities

To distinguish Traditional and Science based firms, we adopted the Pavitt taxonomy (1984) and we observed the distribution of these firms in the 8 categories of density. As expected, the results[92] show an higher presence of traditional firms in low density areas and a lower presence in areas densely populated of firms. Pearson correlation is in fact negative either considering municipalities (- 0,176) or districts (- 0,563).

By contrast the presence of Science based firms has an oscillatory trend[93]. However, the mean of Science based firms per category in the lower density areas is generally inferior to those of higher ones. Pearson correlation is in fact positive: 0,069 considering municipalities and 0,091 considering districts. The idea that these kind of firms are usually scarcely located in peripheral areas is therefore confirmed.

Another way to measure the economic diversification is the degree of economic sector specialisation. To observe this phenomenon we decided to consider 7 sectors[94] and to observe their per cent presence in each municipality and district of Switzerland, and across the firm's density categories. The results could be summarized as follow[95]:

- **The primary sector** (SECTOR 1) is clearly concentrated in the more low density areas (where the number of firms per hectare is inferior to 0,5) and quite inexistent in the others areas;
- Differently from the primary sector, **the manufacturing sector** (SECTOR 2) is well present in each density categories, but mainly in low density areas than in more dense ones;
- As the secondary sector, **the industry of energy and building** (SECTOR 3) are mainly located in low density areas, but not absent in dense ones;
- **Trade activities, hotels and restaurants** (SECTOR 4) are well present in each density category (it is the sector with the highest average share of firms in municipalities), but slightly more present in high density areas if measured by municipalities and slightly more present in low density areas if measured by districts;

[92] See details in Appendix 32
[93] See details in Appendix 33
[94] Sectors are defined by an aggregation of several NOGA classifications' branches (see Appendix 22). The seven sectors include the following branches: SECTOR_1 from 1 to 14, SECTOR_2 from 15 to 37, SECTOR_3 from 40 to 45, SECTOR_4 from 50 to 55, SECTOR_5 from 60 to 64, SECTOR_6 from 65 to 74, SECTOR_7 from 80 to 93.
[95] See details in Appendix 34 and 35

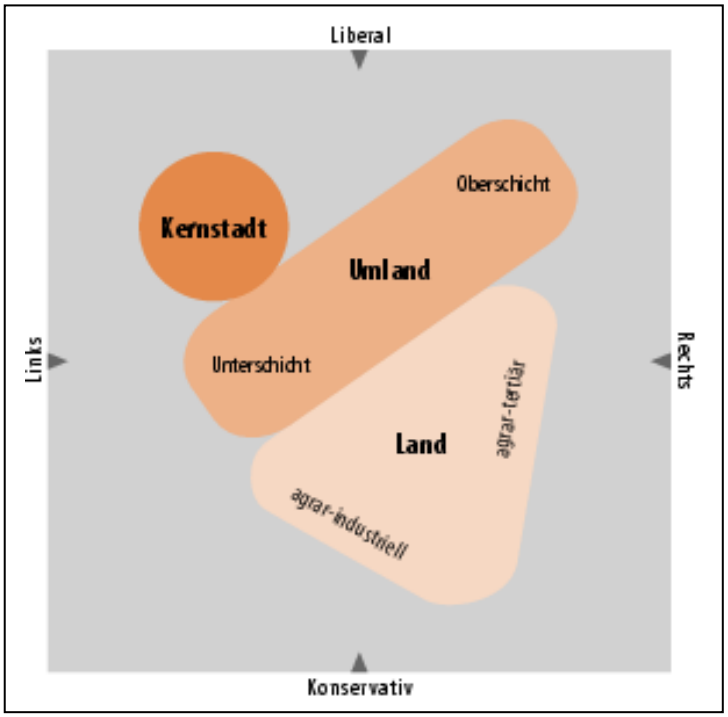
- **Transport and communications activities** (SECTOR 5) are relatively more important in the economies of low density areas;
- Differently from secondary activities, **services to business** (banks, insurances, etc. - SECTOR 6) are clearly more present in high density areas;
- Not surprisingly, due to the federalist system of Switzerland, **public service activities** (education, public institutions, health, etc. - SECTOR 7) are homogenously present in each density category, but slightly more in high density ones.

In Swiss low density areas, the local economy is therefore characterised by shares of firms operating in the primary, manufacturing, energy and transport sectors and generally higher than those of more dense areas. However, all the seven economic sectors are present in low density areas. A low economic diversification of these areas is therefore not verified.

c) Social, cultural and institutional proximity

In low density areas the presence of economic activities is lower than in more dense areas (by definition). This fact implies a lower number of employments and, in turn, a lower average of active population present in municipalities and districts[96].

Figure 15: Political positioning of urban and peripheral areas



Source: Hermann and Leuthold (2003), p.35

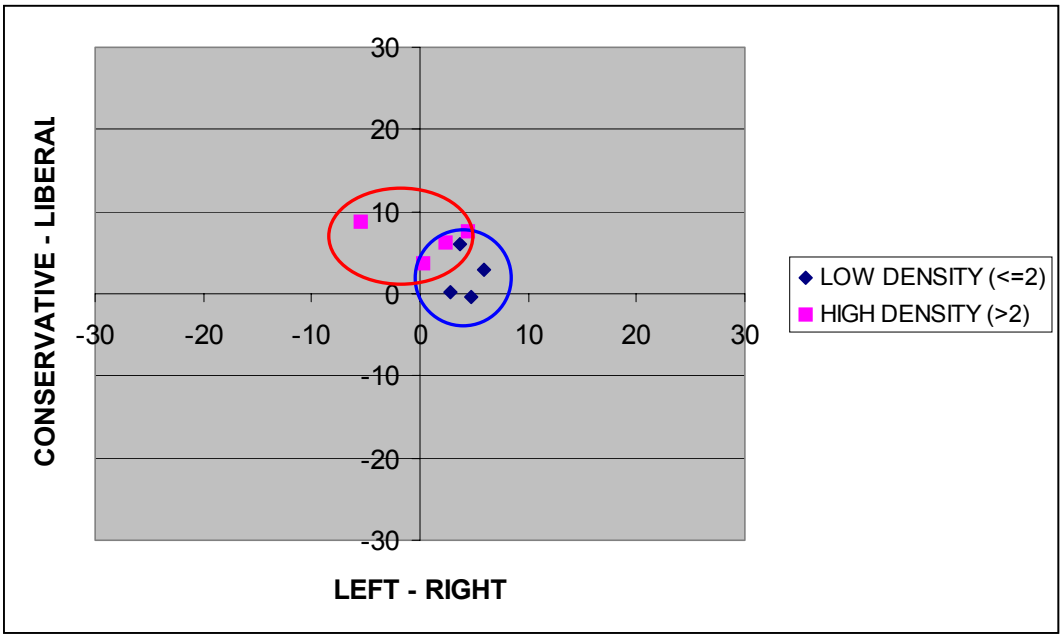
Moreover, people living in these areas are generally thought to be aged and mainly conservative rather than innovative. However, these ideas drawn by common sense require an empirical verification. As indicator of institutional proximity in peripheral areas of Switzerland we decided to adopt their political positioning as defined by Hermann und Leuthold (2003, p.35). As already

[96] The measure of active population living in Swiss peripheral areas confirm this phenomenon. See details in Appendix 36

reported in section 2.3, Swiss cities have a left and liberal attitude, while more rural territories are more right and conservative positioned. To reach this conclusion, the authors distinguished three different socio-geographical milieus with a certain subjective degree and using criteria different from those of SFSO.

The results is the subdivision of the local mental structure in three main areas (see Figure 15): cities ("Kernstadt"), suburban areas ("Umland") and rural areas ("Land"). Differently from the stereotyped definition of peripheral areas, that consider them as less heterogeneous than urban areas, the political positioning of citizens living in suburban and rural areas appears more wide and diversified than those living in Swiss cities. However, their attitude is mainly conservative and close to the right political positioning, whereas cities tend to be populated by citizen who are more liberal and sustaining ideas of the left parties.

Graphic 13: Low and high density municipalities' political positioning



Source: Hermann and Leuthold (2003) and personal elaboration

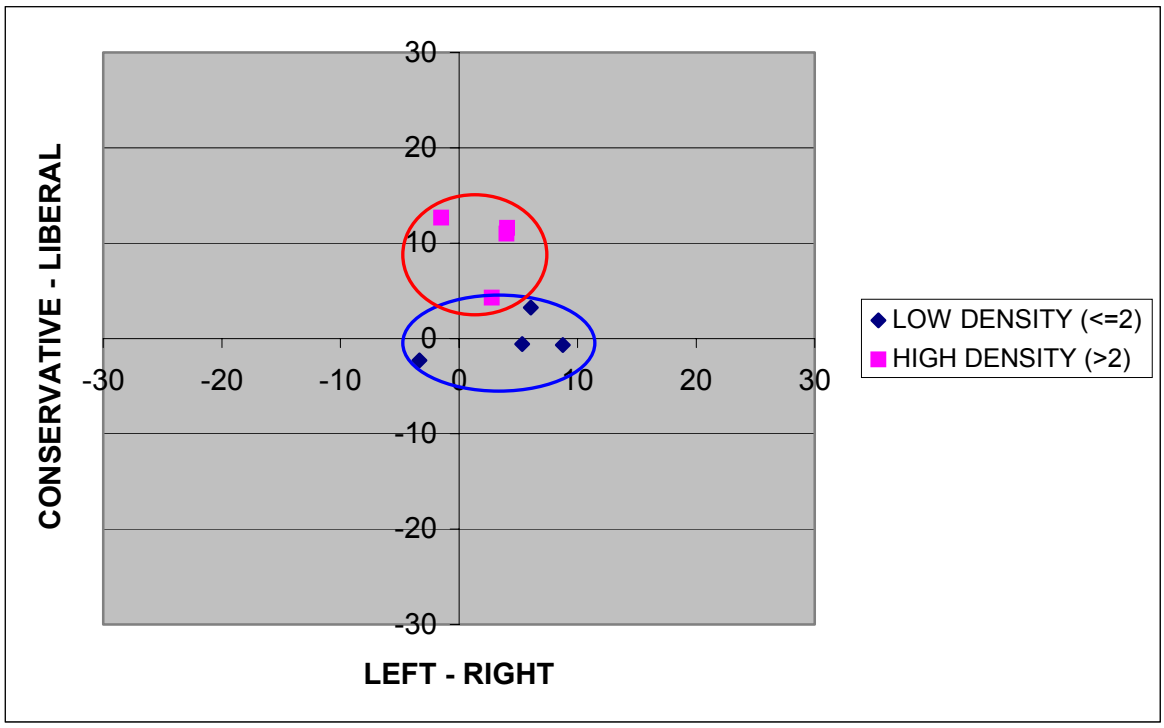
In addition, it should be considered that Switzerland is divided in three main cultural and linguistic regions: German, French and Italian. As shown by Hermann und Leuthold (2003), this difference leads to a different political positioning of citizens (see Figure 4). In particular, the rural areas ("Land") mainly correspond to the German regions, while the suburban areas and the cities are present in each linguistic region of Switzerland. The Swiss rural areas are therefore dominated by the Swiss German culture. This fact can explain a relatively homogeneous and conservative attitude of these areas.

Observing the political positioning of municipalities and districts in the low (less than 2 firms per hectare[97]) and high (more than 2 firms per hectare) density categories (Graphics 13 and 14), we lead to a similar conclusion of Hermann und Leuthold (2003): the low density categories are usually right and conservative as suburban and rural areas considered by the authors, while

[97] One decided to highlight the different political positioning choosing two arbitrary low and high density areas definitions.

more high density areas are usually left and liberal as the Swiss cities distinguished by Hermann und Leuthold are.

Graphic 14: Low and high density districts' political positioning

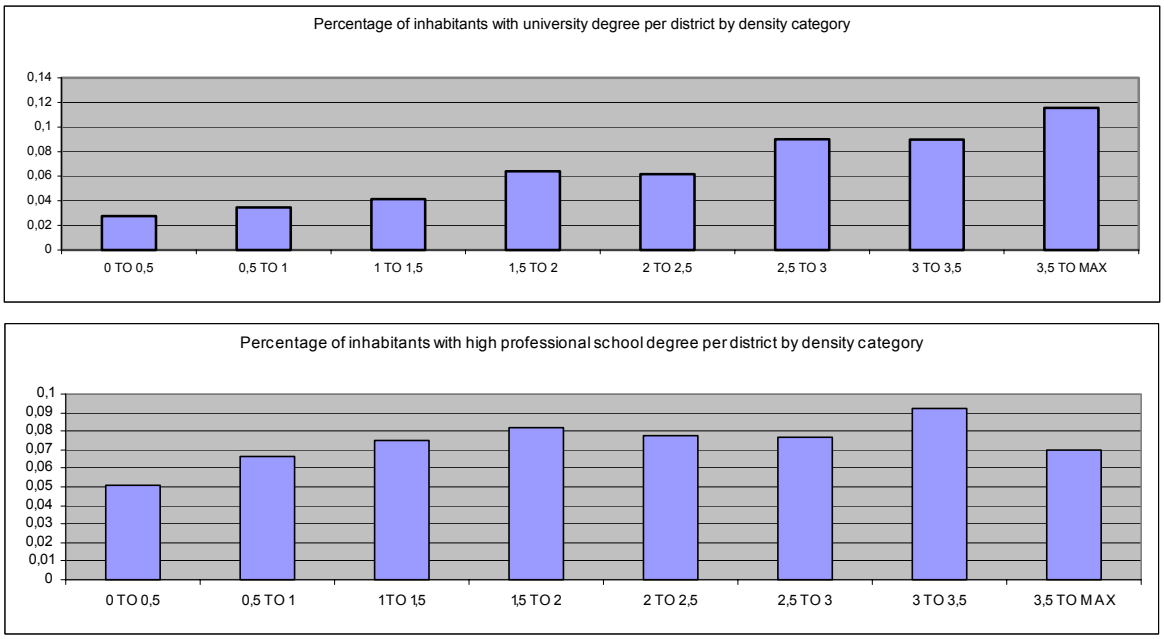


Source: Hermann and Leuthold (2003) and personal elaboration

The higher presence of traditional economic activities lead usually to a low employment of high qualified workers. Thus, peripheral areas are generally considered as scarcely populated by high qualified workers. To verify this general idea, we decided to measure the presence of high qualified workers by the share of inhabitants with an university degree or an high professional school degree[98]. Their distribution across firms' density categories shows in both cases a positive correlation (either considering data per municipality or district). However, while inhabitants with university degrees are clearly more present in high density areas, those with an high professional school degree are relatively well present in lower density categories too (Graphic 15)[99].

[98] See definition in Appendix 46.
[99] See details at the municipality level in Appendix 37

Graphic 15: Inhabitants with university[100] or high professional school degrees[101] by density categories (2000)



Source: SFSO data (census of firms 2001, census of population 2000) and personal elaboration

d) Firms' strategies

As seen in section 3.3, the main characteristics of firms adopting offensive strategies are: an important activity of independent R&D and special relationship with science-technology institutions, a frequent introduction of radical innovations[102] and patent as protection means of innovation.

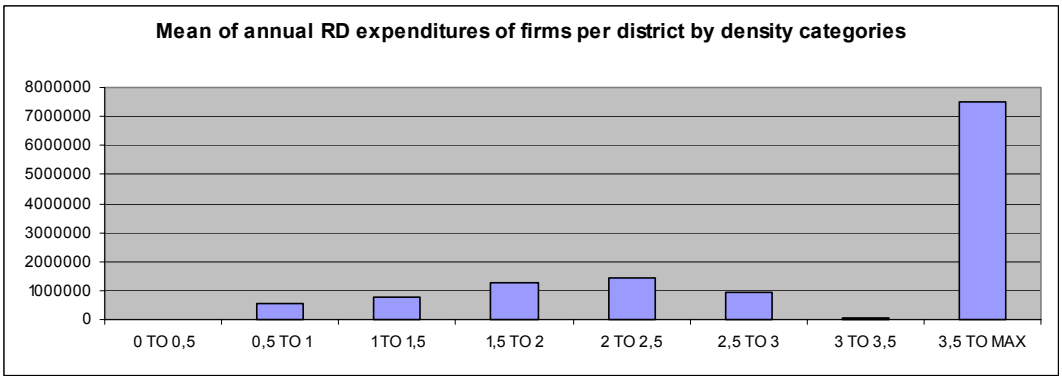
As seen above, in Swiss low density areas, the presence of Science based firms (as defined by the Pavitt Taxonomy, 1984) is lower than in more dense areas. In literature, Science based firms are supposed to be more innovative than others, since their R&D activities allow them to regularly find novelties to introduce into the market. However, R&D activities are done not only by Science based firms. The use of Pavitt taxonomy to observe the spatial distribution of R&D activities is therefore too simple. Similarly, the secondary statistics of the SFSO about the private R&D activities of the firms are not useful because they are computed by the triennial firms' census using a sample of firms that does not guarantee any significant result at sub-national levels. To observe the importance of R&D activities in our density categories, we therefore decided to exploit the information collected by the KOF' survey.

In KOF sample are considered about 0,7% of the firms present in Switzerland. This share is about the same in each firms' density category except for the lower one[103]. Even if the results could not be considered representative of the real situation in absolute terms, measuring the relative importance of R&D expenditures of firms located in different areas, we observe an interesting

[100] Categories 33 and 34 according to SFSO classification
[101] Categories 31 and 32 according to SFSO classification
[102] See definition in the introduction of Chapter 3
[103] See details in Appendix 38

phenomenon: firms located in more dense areas tend to invest much more in R&D than firms located in low density areas (Graphic 16)[104]. Being R&D expenditures the main prerequisite of offensive business strategies, we conclude that in low density areas this kind of strategy is not common.

Graphic 16: Annual R&D expenditures by density categories



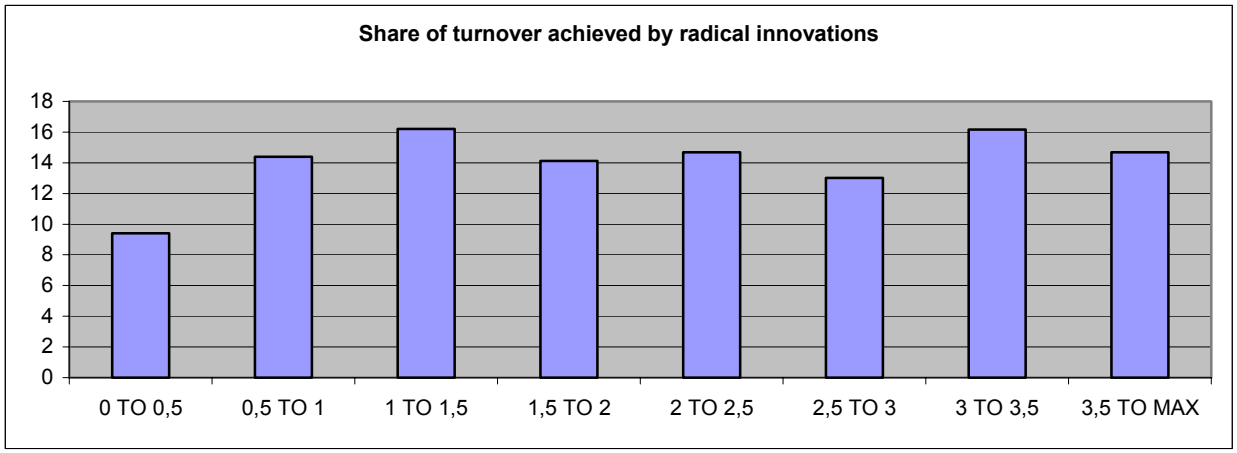
Source: SFSO data (census of firms 2001), KOF survey 2002 and personal elaboration

From KOF's dataset we even obtained information on the cooperations with scientific institutions and their geographical localisation. Sharing firms by the firms' density of the area in which they are located, we can observe their attitude to acquire R&D services by universities, private and public institutions and other firms[105]. The results show the absence of specific attitudes of firms located in the different areas and a clear positive correlation between the share of firms entertaining strategic relationships and the density of the areas in which they are located. The majority of firms declared that their R&D suppliers are located in Switzerland. Another important number of partners are mainly located in the European Union Countries. The only exceptions to this general behaviour, is an higher presence of firms having relationships with USA and Japanese partners in more dense areas. Firms interested in international networks are therefore mainly located in urban areas.

In KOF' survey firms that have introduced radical innovations are identified as well as the share of turnover achieved by these innovations. The distribution of firms having introduced radical innovation and that of the share of turnover achieved across density categories does not reveal a clear positive or negative trend[106], but the lowest values in terms of turnover are obtained in the lowest density category (Graphic 17). However, the Pearson correlation between these two variables and the firms' density is slightly negative (respectively -0,072 with the share of innovative firms and -0,054 with the importance of the turnover achieved). Thus, this indicator reveals a certain homogenous spatial distribution of firms introducing radical innovations.

[104] See details at municipality level in Appendix 39
[105] See details in Appendix 40
[106] See details of firms having launched radical innovation in Appendix 41

Graphic 17: Radical innovations by density categories (at the municipality level[107])



Source: SFSO data (census of firms 2001), KOF survey 2002 and personal elaboration

Another indicator of offensive strategies is the use of patents as means of innovation's protection. Computing the correlation between firms having used patents and launched a product or process innovation[108] by firms' density categories (Table 28), are obtained only few significant results and no clear trends across more or less dense areas. Thus, as for radical innovations, the use of patents confirm a non specific strategy of firms located in low density areas.

Table 28: Pearson correlation between the use of Patents and innovation (of product and process) by density categories (at the municipality level[109])

Firm's density category	Patents and INNOPD	Patents and INNOPC
0 TO 0,5	0,185	-0,129
0,5 TO 1	,194(**)	-0,087
1 TO 1,5	,118(*)	0,016
1,5 TO 2	,224(**)	-0,038
2 TO 2,5	,189(*)	-0,056
2,5 TO 3	0,167	0,012
3 TO 3,5	0,158	-0,024
3,5 TO MAX	,167(**)	0,111

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
Source: Personal elaboration using KOF's dataset

e) Rent seeking

The Swiss **federalist system**, **fiscal equalisation** and the **national regional policy** have allowed to maintain an infrastructural level of peripheral regions higher than in other countries. Indeed, a lot of power is delegated to the "low" levels of the institutional hierarchy. Thus, even peripheral

[107] At the district level the sample of some categories has too few observations to obtain reliable results.
[108] INNOPD and INNOPC are dummy variables. See details in section 8.3.
[109] At the district level the sample some category has too few observations to obtain reliable results.

municipalities have a full decisional power in some specific topics, such as territorial planning or infrastructural investments, and the amount of an additional[110] municipal tax to finance their public activities. Moreover, in the last thirty years regional policy has financially supported rural and mountainous regions in their infrastructural investments, so that it indirectly has done the fiscal equalisation among cantons and among municipalities. In this context, the public intervention acts as a centrifugal force and the **rent seeking**, that is usually considered higher in big cities (see section 4.1.3), becomes a profitable means to financially sustain entrepreneurial activities in peripheral regions[111].

To empirically verify if low density areas rent seeking is more diffuse than in high density areas is quite hard. However, since rent seeking is usually an attitude adopted by left and conservative parties (aiming to Welfare State and preservation of an actual regime), the fact that this political positioning is typical of poor and rural regions, as shown in Figure 15 by Hermann und Leuthold (2003), and that low density categories are usually more conservative than areas with high firm's density (Graphic 13 and 14), the idea of a rent seeking diffusion in these areas is plausible.

In Table 29 are summarised the main results of this section. The "peripheral areas" of Switzerland, spatially defined a priori by their firms' density, are now known by additional socioeconomic characteristics that allow us to avoid any confusion or generalisation caused by stereotyped ideas about the meaning of peripheral areas. Moreover, having verified many similarities between Swiss low density areas and the general definition of them, the reliability of our "periphery indicator" (number of firms per hectare), already verified by the comparison with the definition of Conurbation and Rural areas of the SFSO (see section 7.1), will be examined further on. Finally, the knowledge of socioeconomic characteristics of each firms' density category will help us to interpret the results of our investigation on the innovation's determinants of firms located in low density areas.

[110] Additional to the national and cantonal one
[111] For more details on this aspect see Monitoreg projects' results in Alberton and Bossi (2002, 2003, 2004).

Table 29: Swiss "peripheral areas" characteristics

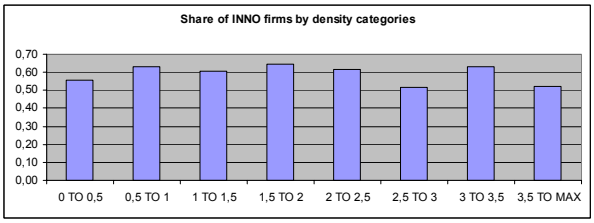
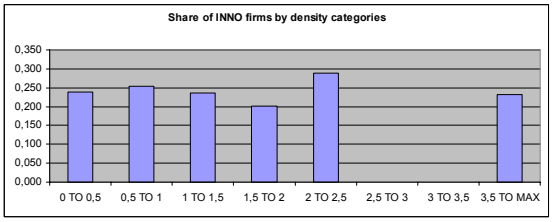
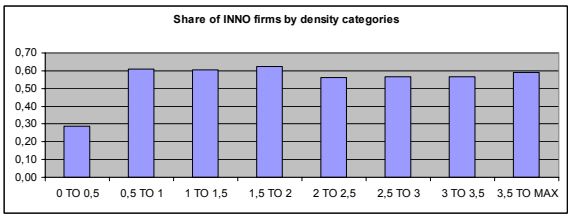
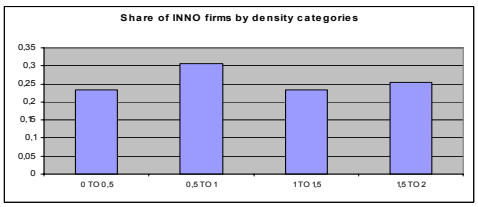
STEREOTYPED DEFINITION OF PERIPHERAL AREAS	SWISS LOW DENSITY AREAS
Absence of agglomeration	By definition
Low density of population	Number of inhabitants lower than in high density areas
Presence of agriculture, forests and wild woods	Excluded from our analyses
An economy dominated by traditional and mature industries	Presence of traditional firms higher than in high density areas
A low presence of companies that undertake R&D activities (Science based firms)	Presence of Science based firms generally inferior to those of high density areas
Low economic diversification	Shares of firms operating in the primary, manufacturing, energy and transport sectors generally higher than those of more dense areas. The diversification is therefore not low.
Low active population	Average of active population present in municipalities and districts lower than in high density areas.
Homogeneity of visions and ideas (political positioning)	The attitude is mainly conservative and close to the right political positioning.
Low presence of high qualified workers: *Academics degrees* *Professional high school degrees*	Inhabitants with an university degree are clearly more present in high density areas, those with an high professional school degree are relatively well present in each density category.
Firms are usually not offensive in their strategies: *Low R&D expenditures*	The higher investments in R&D are those of firms in high density areas.
Few R&D partnerships	Firms interested in international networks are mainly located in high density areas.
Few radical innovations	Homogenous spatial distribution of firms introducing radical innovations.
Few patents' use	No clear trends across more or less dense areas.
Rent seeking	The regional policy, the federalist system and the conservative positioning lead firms in poor regions to attempt to obtain financial support from public actors.

7.3.2 Innovation diffusion in Ticino and Swiss low density areas

The diffusion of innovation in areas with different firms' densities is a key information to start the investigation about the relationship between the innovation activities and the socioeconomic characteristics of the territory in which the firms are located. If we observed a clear positive or negative correlation between the share of firms innovating (in municipalities and districts) and the firms' density, it would be enough to combine this result with the socioeconomic elements present in low and high density areas emerged in the previous section, to draw the characteristics of the more and the less favourable environment for innovating.

However, this methodology does not allow to identify the marginal contribution of each element to innovation, which is our main research's aim. Moreover, as we can see in Graphic 18[112], a linear correlation between the share of innovative firms[113] and density categories does not exist even distinguishing firms that have launched product innovations from those that have launched process innovations[114].

Graphic 18: Innovation by density categories in Switzerland (KOF sample) and Ticino (IRE sample)

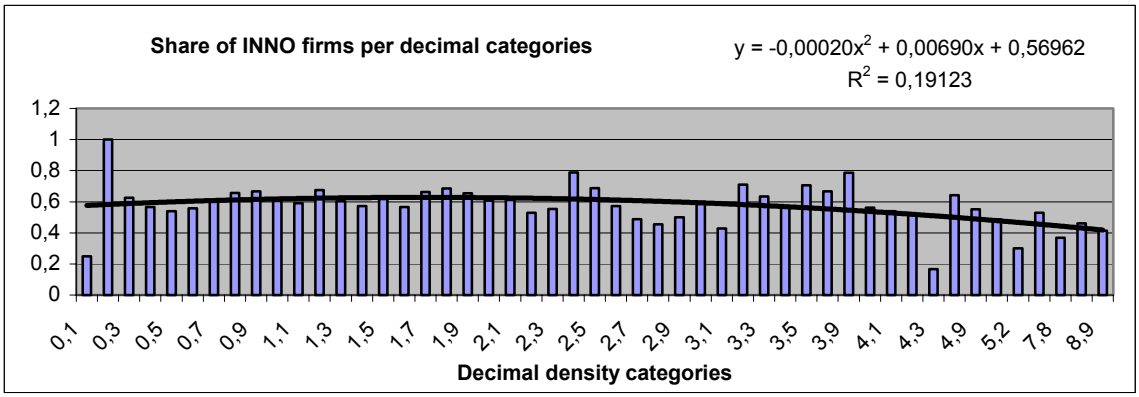
Switzerland	Ticino regions
Municipalities	***Municipalities***
	
Districts	***Districts***
	

Source: KOF's, IRE' surveys, SFSO's data and personal elaboration

The relationship between firms' density in municipalities or districts and the share of innovative firms in the area is apparently non linear. A more accurate investigation is therefore needed to identify the exact nature of the shape.

[112] In Ticino there are no districts having a density over 2 firms per hectare. The absence of observation in Categories 6 and 7 in the Graphic referred to municipalities of Ticino is due to the absence of the 7 municipalities with a density between 2,5 and 3,5 firms per hectare in the IRE sample.
[113] Innovative firms (INNO firms) are firms that have innovated "at least once in the last three years". See details in section 8.3.
[114] See details in Appendix 43 and 44

Graphic 19: Share of innovative firms per municipality by decimal density categories

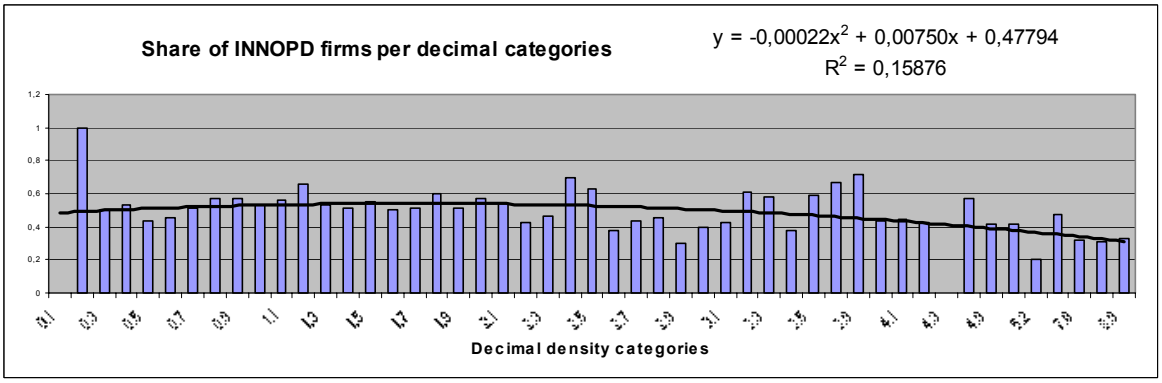


Source: KOF's survey 2002, SFSO's data and personal elaboration

Reducing the dimension of the density categories to 0,1 firms per hectare in municipalities, the graphical representation reveals a parabolic shape (Graphic 19): the increasing of firms' density is firstly positively correlated with the share of innovative firms located in the municipalities, but after a specific density level (that in Graphic 11 correspond to the category including densities from 1,60 to 1,69 firms per hectare) the share of innovative firms tend to decrease.

Since the KOF sample is not stratified by density, this result should be interpreted with caution. However, in relative terms, the distribution of firms by these categories in the Switzerland and in KOF sample is very similar (the correlation is 0,967)[115]. Thus, the result obtained could be considered realistic.

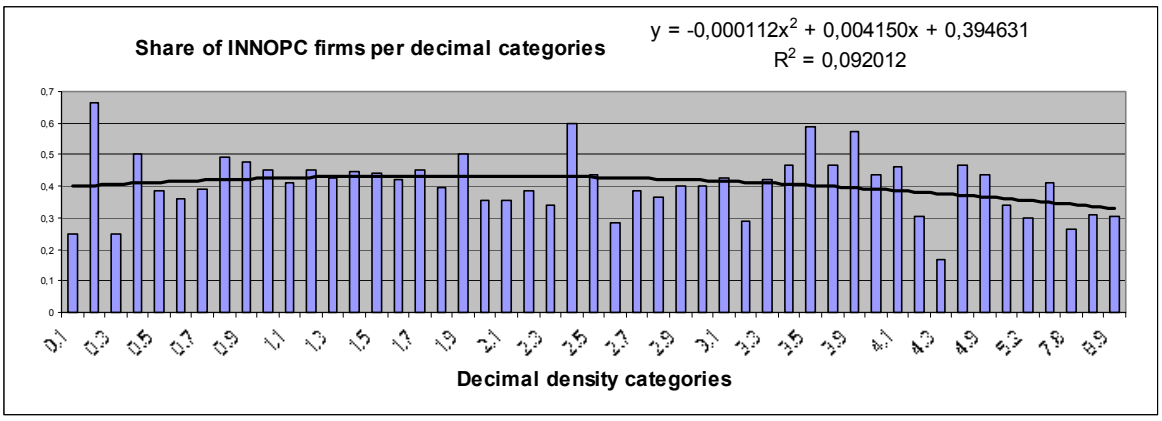
Graphic 20: Share of firms having launched product innovations per municipality by decimal density categories



Source: KOF's survey 2002, SFSO's data and personal elaboration

[115] See details in Appendix 45.

Graphic 21: Share of firms having launched process innovations per municipality by decimal density categories

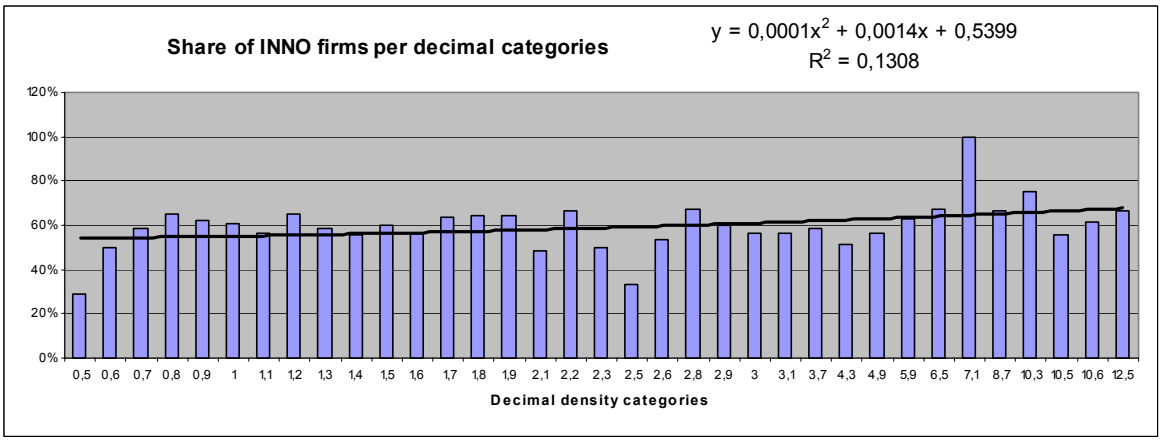


Source: KOF's survey 2002, SFSO's data and personal elaboration

Applying the same procedure to the firms that have launched product innovations, we obtain a similar distribution and a maximal value in the same category (Graphic 20). In the case of process innovations, the maximal point of the trend-line reaches a slight higher level: when the firms' density is around 1,70 and 1,79 unit per hectare (Graphic 21). Even if we had no expectations about a different distributions for product and process innovations, the results seem consistent with reality. In fact, process innovations are more frequent in the service sector and service sector is more present in urban areas. Thus, it is not surprising to find an higher "saturation threshold" for processes.

At the district level, the distribution of innovative firms across density categories generates a completely different trend-line (Graphic 22): the relationship is characterised by an increasing share of innovative firms as the firms' density in the district increases.

Graphic 22: Share of innovative firms per district by decimal density categories



Source: KOF's survey 2002, SFSO's data and personal elaboration

The same analyses conducted for product and process innovations give different results[116]: in the case of product innovation, the function of the trend-line reveals a less than proportional increase of innovative firms as the density in the district increases. Differently, the share of firms having launched process innovations decreases until the 1,3 decimal category (implying densities between 1,20 and 1,29 firms per hectare) and it increases more than proportionally after this threshold.

Trying to give an interpretation to these results is quite an hard task. The multitude of factors acting in favour and against the innovative activities of firms prevent any synthetic conclusion. To simplify results, saying that in some cases it exists a saturation point (congestion), while in others the increase of density is increasingly favourable to innovative activities, could be misleading because no causality links could be extracted from these observations.

Two significant results emerged from these graphical representations: a non homogeneous distribution of innovative firms across density categories and important differences between the municipality and the district level. While in municipalities the high level of density correspond to a decreasing share of innovative firms, in the case of districts the trend is positive.

This could mean that a saturation threshold does not exist at the district level, or that it will be reached at higher levels of density. However, what is certain (as already discussed in section 4.3) is that shifting to an higher spatial level, the results will change because they consider different socioeconomic phenomena. Since districts are wider than municipalities, they are able to be more efficient in capturing the externalities of firms' interactions and other regional dynamics. **The correct level to investigate innovative phenomena is therefore the district level.**

Finally, it should be stressed that the aim of this study is not to know if firms located in low density areas are less or more innovative than high density ones, but rather which are the factors playing a role in the innovation activities in peripheral areas. Thus, to capture the marginal contribution of each factor to innovation we should leave the descriptive analyses and the macro-approach, and to introduce multivariate analyses.

[116] See details in Appendix 50

CHAPTER 8: DETERMINANTS OF INNOVATION IN TICINO AND SWISS PERIPHERAL AREAS

The aim of this section is therefore to obtain detailed information about the main factors influencing innovation activities of firms located in peripheral areas of Switzerland. Moreover, a focus will be made on three Ticino regions (RLVM, RMVM and RTV), whose results will be compared to those of the rest of the nation. Hereafter we will therefore define our research questions and adopt multivariate analyses so as to find an answer to them.

8.1 Research questions

In Part II we highlighted the main factors that the literature consider to have a direct or indirect effect on the innovative attitude of the firms. Keeping into account these factors and those emerged from our further discussions on the likely influences of peripheral areas' socioeconomic characteristics on innovation activities, we will implement a *logit* model and find an answer to the following research questions:

i) Which is the marginal contribution to innovation of the classical determinants of innovations (Internal firm's factors, Market, Networks) in Switzerland?

> *Are these results independent from the spatial context (Urban and Rural areas) and the type of innovation (INNOPD, INNOPC)?*

ii) Which is the marginal contribution to innovation of the spatial environment (spatial variables and firms' density) in Switzerland?

> *Are these results independent from the spatial context (Urban and Rural areas) and the type of innovation (INNOPD, INNOPC)?*

iii) Are innovations' determinants of firms located in the three Ticino regions similar to those of innovative firms of Switzerland located in Urban, Rural, Low or High density areas?

iv) Which are the innovations' determinants of firms settled in Low and High density areas of Switzerland and Ticino regions?

8.2 The empirical model

The expected positive return to innovation activity p_i^* for a firm *i* is taken to be a function of a set of firm-specific and exogenous variables that conditions the profitability of innovation activities.

This concept could be expressed formally as:

$$p_i = \beta X_i + u_i$$

p_i is not directly observable, but submitting a questionnaire we could observe whether a firm *i* innovated or not in products or processes in the three previous years. The implicit assumption is that, when the firm expect positive returns from innovation, it innovates. This observable binary variable I_i takes a value of 1 when the firms has innovated, and 0 otherwise. Thus, we can write:

$$I_i = 1 \quad \text{if } p_i^* > 0$$
$$I_i = 0 \quad \text{otherwise}$$

The expected return from innovation, given the impact of the explanatory variables, will therefore be:

$$E(p_i^* \mid x_i)$$

Hence, the probability of observing that the firm is innovative is given by:

$$\text{Prob}(I_i = 1) = \text{Prob}(u_i > -bx_i) = 1 - F(-bx_i)$$

Where F is the cumulative density function for the residuals u_i.

We therefore suppose p_i as a sgmoid (S-shaped) function of Z, which is a linear function of the explanatory variables ($Z_i = \beta_1 + \beta X_i$), defined as following:

$$p_i = F(Z_i) = 1/(1 + e^{-Zi})$$

Thus, once the coefficients of the explanatory variables will be known, knowing the values of the explanatory variables (or choosing a "mean" case) it will be possible to compute the incidence of each variable on the probability of being in the presence of an innovative firm. The computation will be multiplying the marginal effect of Z on the probability, denoted by f(Z), by the coefficient of the variable:

$$f(Z)\,\beta_i = [e^{-Zi} / (1 + e^{-Zi})^2]\,\beta_i$$

This empirical model[117] will be applied to KOF's and IRE's datasets in order to identify the innovation determinants of firms located in Ticino and peripheral regions of Switzerland.

8.3 The dependent variables

In the IRE dataset and our empirical analyses, firms are considered innovative in products, processes or non innovative according to the answers that entrepreneurs gave to the following questions[118]:

> *Have you launched completely new products or services into the market in the last three years? (Yes/No)*
>
> *Have you introduced important newness in yours production processes in the last three years? (Yes/No)*

[117] For more details see e.g. Dougherty C. 2002, Chapter 11.

[118] In IRE questionnaires two additional type of innovation were considered: innovation of organisation and the entrance of products into new markets. However, only product and process innovations will be used as dependent variables because in KOF survey these two additional innovations were not identified.

In the KOF dataset, the questions considered to define innovative firms are similar:

Have you launched innovations in the period 2000-2002?
- *Yes: product innovations or process innovations?*
- *No: Neither product nor process innovations*

As the questions of the two surveys are very similar, we defined three dependent variables that could be considered identical in the two dataset. The variables are the following:

Dependent variables	Description
INNOPD	Dummy variable: INNOPD = 1 if the firm has launched product innovations in the last three years; INNOPD = 0 otherwise.
INNOPC	Dummy variable: INNOPC = 1 if the firm has launched process innovations in the last three years; INNOPC = 0 otherwise.
INNO	Dummy variable: INNO = 1 if the firm has launched at least one product or one process innovations in the last three years; INNO = 0 otherwise.

As discussed in Chapter 3, the decision to launch product rather than process innovations could imply a different innovation strategy (e.g. offensive rather than defensive) of the firms and, in turn, different determinants (e.g. high or low competition). The availability of two dependent variables for product and process innovations will be therefore crucial to investigate possible differences in the marginal contribution to innovation of each factor. By contrast the variable INNO will be used when the issue analysed does not require a differentiated analysis for firms that have launched products rather than process innovations or vice versa.

8.4 The explanatory variables

As briefly reported in section 7.2, the explanatory variables were chosen so as to obtain useful information to answer to our research questions (see section 8.1) and under two constraints: to be available either in IRE's or in KOF's dataset, and not to generate multicollinearity. The result of this selection process is presented in Table 30[119].

The internal characteristics of the firms, their market and network will give useful information about the classical determinants of innovations. The choice of explanatory variables referring to internal characteristics allows us to consider the dimension of the firm (*Firm' size*), the quality of its workers *(% Academic employees*), the corporate governance (*Autonomous firm*), the economic activity and the effects of different technological opportunities among industries (*Sectors*).

The market dimension is considered either from the supply point of view (importance of *Local competitors*), or the demand point of view (importance of local and foreign markets: *Local market and % Export*)[120]. The formal and informal relationships that firms settle to improve their innovative activities, are considered by several explanatory variables which measures the importance of several external sources of knowledge: customers, suppliers of input, softwares, equipments, competitors, firms of the same company (partners), universities, research institutions, consulting firms.

[119] See definitions in Appendix 46. Moreover, descriptive statistics of each variable are reported in Appendix 47 (KOF) and Appendix 48 (IRE).
[120] No variables are available in both datasets for measuring the marked demand dynamic.

Table 30: The explanatory variables

Internal characteristics	Spatial environment	Periphery's indicators
Firm' size	***Municipality level***	***Municipality level***
% Academic employees	*Right & liberal municipality*	*Firms' density in the municipality*
Autonomous firm	*% Municipality pop. with university degree*	
Manufacturing (Sector_2)	*Municipality trans-border workers*	
Energy sector (Sector_3)	*% Municipality firms of the same sector*	
Trade sector (Sector_4)		
Transport sector (Sector_5)		
Services for businesses (Sector_6)		
Market		
Local competitors		
Local market		
% Export		
Network	***District level***	***District level***
Customers' knowledge	*Right & liberal district*	*Firms' density in the district*
Input suppliers' knowledge [121]	*% District pop. with university degree*	
Software suppliers' knowledge [121]	*District trans-border workers*	
Equipments suppliers' knowledge [121]	*% District firms of the same sector*	
Competitors' knowledge		
Partners' knowledge		
Universities' knowledge [121]		***SFSO***
R&D institutes' knowledge [121]		*URBAN*
Consultants' knowledge [121]		

The absence of appropriability indicators (e.g. R&D expenditures, number of patents, etc.) is due to the absence of data available in IRE's dataset (except for the share of Personal computers used for R&D activities). However, since in KOF's dataset these data exist[122], we will compute a model to observe the marginal contribution of these variables.

The contribution of the spatial environment on the innovation activities of the firms will be observed through several variables referred to socioeconomic factors located in proximity of the firms or measuring the social, economical and cultural homogeneity of the areas: the political positioning (*Right & liberal*), the proximity of a qualified population (*% Pop. with university degree*), the presence of foreign workers and (indirectly) the proximity of to the national frontier (*Trans-border workers*), and the proximity of firms operating in the same economic sector, which is a sort of indicator of the local economic specialisation and the potential intra-sectoral network (*%Firms of the same sector*).

These latter variables, partly considered in the descriptive analysis of peripheral areas as well (see section 7.3.1), will be present in models referred to the municipality level as well as in models referred to the district one. In the models computed at the district level, these variables will have an identical value for all the firms located in the same district, whereas the Internal, Market and Network variables will still be observed at the firm's level.

[121] Not exactly the same in KOF's and IRE's models.
[122] See details in Appendix 49.

The impact of firms' density on the innovative capacity of the firms will be introduced into the models by a continuous variable of density at the municipality and district level (*Firms' density*) and can be considered an indicator of periphery and the local network potential.

Finally, we will distinguish *Urban* and *Rural areas* splitting the sample according to the SFSO definition of *Conurbations* and *Rural areas*[123].

8.5 Results of the innovation models and answers to the research questions

In this section we will answer to the research questions (see section 8.1) interpreting the results of logit models computed at the national level using the KOF' sample and at the Ticino's level using the IRE' sample.

In the following section we will first investigate which level of observation is more suitable to analyse innovative phenomena in Swiss and Ticino's areas (section 8.5.1), than we will focus our attention on the differences between *Rural* and *Urban areas* (section 8.5.2), and finally on the marginal contribution of the several variables considered in the models at the national (8.5.3) and Ticino's level (8.5.4).

At the national level we present the estimations of INNO, INNO RURAL, INNO URBAN, INNOPD and INNOPC, while for Ticino regions the estimations of INNO RURAL and INNO URBAN are omitted as we would like to know if Ticino regions are more similar to *Rural areas* or *conurbation* of Switzerland (Research questions *iii)*) and not to identify the differences between *Rural* and *Urban areas* of Ticino regions.

The details of the logit models' results are reported in the Appendix (from 51 to 53), while in the Tables (form 31 to 35) we present results in a synthetic way using "+" and "–" to illustrate the sign of the significant variables and " * " to illustrate their level of significance: at 99,9% level by " **** ", at 99% level by " *** ", at 95% level by "**", at 90% level by " * ".

8.5.1 The choice of the observation's level

Since a specific theoretical reference does not exist, it is not possible to consider a priori one of the two levels of observation (municipality and district) that has correctly or incorrectly specified. However, since Swiss municipalities have generally a very small spatial dimension, it is meaningful to expect that the district level is more relevant to measure the contribution of the spatial context on the innovation capacity of the firms. The comparison of results in Table 31 and Table 32 seems to confirm this hypothesis.

Observing the results obtained at the national level using spatial variables and firms' density at the municipality level (Table 31), we notice that INNO RURAL, which refers to areas where socioeconomic agents and firms are generally dispersed, likely suffer from a lack of robustness of the observations. The high R-square is therefore misleading. By contrast, the results of the INNO URBAN model are very similar to those obtained without splitting the sample (INNO). We can therefore conclude that the municipality level is not suitable to carry out investigation of innovative phenomena in *Rural areas*.

[123] See Appendix 2

Table 31: Estimation of innovation in Switzerland (at the municipality level)

	INNO		INNO RURAL		INNO URBAN		INNOPD		INNOPC	
R square (Nagelkerke)[124]	0,23		0,42		0,22		0,26		0,17	
N	1423		238		1185		1423		1423	
Firm' size	+	****	+	****	+	****	+	****	+	****
% Academic employees	+	**			+	**	+	**		
Autonomous firm										
Energy sector (Sector_3)	-	****	-	****	-	****	-	****	-	****
Trade sector (Sector_4)	-	****			-	***	-	****	-	****
Transport sector (Sector_5)	-	***			-	***	-	***	-	**
Services for businesses (Sector_6)										
Local competitors	-	*			-	*	-	**		
Local market									-	*
% Export	+	**			+	**	+	****		
Customers' knowledge							+	**		
Input suppliers' knowledge							+	**		
Software suppliers' knowledge					+	*			+	****
Equipments suppliers' knowledge							-	*		
Competitors' knowledge										
Partners' knowledge									-	*
Universities' knowledge	+	**			+	**				
R&D institutes' knowledge										
Consultants' knowledge										
Right & liberal municipality	+	*			+	**				
% Municipality pop. with university degree										
Municipality trans-border workers	-	**			-	**	-	*	-	*
% Municipality firms of the same sector										
Firms' density in the municipality										
Constant			-	**			-	*	-	****

Source: KOF's survey 2002, SFSO's data and personal elaboration

The comparison of the two types of innovation (INNOPD and INNOPC) in Table 31 reveals the existence of several differences: in particular, the INNO and the INNOPD models give similar results for the variables referring to the "Internal characteristics" of the firm and to the "Market". Differences are by contrast present among the marginal contribution of variables referring to the "Network". By contrast, the INNOPC model present a lower number of significant coefficients (e.g. % *Academic employees* and *Local competitors* have not a significant impact on INNOPC,

[124] Nagelkerke's R-Square is a further modification of the Cox and Snell coefficient (which is an attempt to imitate the interpretation of multiple R-Square based on the likelihood) to assure that it can vary from 0 to 1. That is, Nagelkerke's R^2 divides Cox and Snell's R^2 by its maximum in order to achieve a measure that ranges from 0 to 1. Therefore Nagelkerke's R^2will normally be higher than the Cox and Snell measure but will tend to run lower than the corresponding OLS R^2. Nagelkerke's R^2 is part of SPSS output and is the most-reported of the R-squared estimates.

while in INNO and INNOPD they have). Nontheless, the results of "Spatial variables" and the "periphery indicator" are the same in both innovation's "type-models" (INNOPD and INNOPC): the significant impact of just one variable (*Municipality trans-border workers*). Since this last result could be due to the choice of the municipality level, that could not allow to capture the spatial dynamics influencing the innovation activities of the firms, our future analyses will be carried out at the district level.

Table 32: Estimation of innovation in Switzerland (at the district level)

	INNO		INNO RURAL		INNO URBAN		INNOPD		INNOPC	
R square (Nagelkerke)	0,21		0,34		0,21		0,25		0,15	
N	1639		321		1318		1639		1639	
Firm' size	+	****	+	****	+	****	+	****	+	****
% Academic employees	+	***			+	**	+	**	+	**
Autonomous firm										
Energy sector (Sector_3)	-	****	-	****	-	****	-	****	-	****
Trade sector (Sector_4)	-	****			-	****	-	***	-	****
Transport sector (Sector_5)	-	***			-	***	-	***	-	*
Services for businesses (Sector_6)	-	*			-	**	-	*		
Local competitors							-	**		
Local market									-	*
% Export	+	**			+	*	+	***		
Customers' knowledge			+	**			+	**		
Input suppliers' knowledge							+	**		
Software suppliers' knowledge	+	*			+	**			+	****
Equipments suppliers' knowledge	-	*			-	*	-	**		
Competitors' knowledge			-	**						
Partners' knowledge									-	**
Universities' knowledge	+	**			+	**				
R&D institutes' knowledge	-	*	-	*						
Consultants' knowledge										
Right & liberal district										
% District pop. with university degree			-	**						
District trans-border workers	-	***	+	**	-	***	-	*	-	*
% District firms of the same sector										
Firms' density in the district										
Constant									-	***

Source: KOF's survey 2002, SFSO's data and personal elaboration

The results obtained at the district level are consistent with our expectations. In fact, the INNO RURAL model presents an higher number of significant variables and a lower R-square. Moreover, in all the models the number of significant variables increased especially among networks variables.

From an econometric point of view the models with spatial variables referred to the municipalities are therefore misspecified. The "correct" variables (those at the district level) being omitted, the computation leads to biased coefficients and invalid t test (testing the significance). However, the biased coefficients are only those of variables that have a significant relationship with the omitted variables (covariance non equal to 0). This last aspect explains why the signs and the significance of internal variables are quite similar at both levels, while the number of significant network's variables is higher at the district level. So that, while the internal variables (microeconomic characteristics of the firm) are independent from the spatial dimension considered (covariance equal to 0), the covariance between the networks' variables and the spatial variables is not 0. Thus, in absence of spatial variables at the district level the network's variables mimicked their behaviour becoming biased and their t test invalid.

8.5.2 Swiss rural and urban innovation's models

Comparing the results of INNO to those of INNO RURAL in Table 32, two main aspects emerge. On one hand the number of variables with a significant impact on innovation activities is lower in *Rural areas.* On the other hand, the INNO RURAL model reveals the existence of specific innovations' determinants of *Rural areas*.

The use of *customers' and competitors' knowledge,* as well as *the percentage of population with an university degree* have a significant impact only on the innovative activities of firms settled in *Rural areas*. Moreover, the presence of an high number of *trans-border workers* tends to favour innovative activities in *Rural areas*, while it has a negative impact on innovation in all the other models presented in Table 32.

Another particularity of *Rural areas* is the non significant impact of the *percentage of academic employees* and the use of *universities' knowledge,* as well as a negative impact of the *percentage of population with an university degree.* It could therefore be concluded that the innovativeness of firms in *Rural areas* does not depend on academic knowledge and workers. By contrast, it depends on the availability of people coming from closer foreign regions.

Furthermore, in *Rural areas* a significant sectoral difference is present only between the manufacturing (Sector 2) and the energy and building sector (Sector 3), which are the sectors mainly present in Swiss low density areas (see section 7.3.1). Thus, in *Rural areas* the firms of the secondary sector are not significantly more innovative than those of other sectors as observed among those settled in *Urban areas*.

Besides, none of the market variables (local competitors, local market and percentage of export) has a significant impact on the innovation activities of firms settled in *Rural areas*, while in *Urban areas* firms exporting goods are usually more innovative. These results are consistent with the idea that in these regions, where the public interventions to support innovative investments are higher (leading to rent seeking – see section 5.3), the market laws do not work properly and therefore they do not influence the innovative behaviour of firms as observed in other areas.

The INNO URBAN results are very similar (except for the non significance of one variable) to those obtained in the INNO model, where all the firms present in KOF dataset are considered. Since the INNO URBAN model considers 1318 firms, while the INNO RURAL only 321 firms, it is not surprising that the results are similar to the INNO model. However, even through the sample is not stratified territorially, the proportion of firms in Swiss *Urban* municipalities is of 81,7%

(Table 5), which is not far from the 80,4% of firms considered in the INNO URBAN model if compared to those present in the INNO model (1318 over 1639).

Moreover, the distinction of *Urban* and *Rural areas* is not useless because it allows to observe the specific characteristics of innovative firms in these two kind of areas and the non significance impact of the variable referred to the firms' density in the district. Thus, controlling for the other variables in the models, neither in *Urban* nor in *Rural areas* the agglomeration of firms increase the probability of incurring in innovative firms. If these results could be expected for *Rural areas*, where a critical mass of economic agents hardly exists, the absence of a significant impact of this variable in Swiss *Urban areas* is an important result, because it occurs even if important urban agglomeration on the national territory exist (see Chapter 1). Finally, even the concentration of firms of the same sector in the district (*% District firms of the same sector*) results not significant. Thus, at the national level, two of the major characteristics observed in several successful innovative regions (agglomeration and economic specialisation) do not emerge as significant innovation's determinants.

8.5.3 The product and process innovations models

To highlight the differences between product and process innovations' determinants is not the main aim of this thesis. However, the distinction of these two types of innovation can help us in interpreting the results obtained at the different spatial context. In fact, comparing the results of INNOPD and INNOPC models we can identify the variables that are independent on innovations' types and look for similarities or differences with INNO RURAL and INNO URBAN models.

The major differences between product and process innovations' determinants concern the "market" and "network" variables. In fact, while product innovations are discouraged by the presence of local competitors and favoured by export, process innovations are negatively influenced by an high share of local market's turnover.

Among the external sources of knowledge the more significant differences concern the impact of the knowledge acquired by various kind of suppliers. While product innovations are favoured by the acquisition of knowledge by suppliers of inputs (which very likely become part of the final innovative products) the innovation processes are favoured by the knowledge acquired by software's suppliers (which probably contribute to improve production process using informatics' technologies). By contrast, the reasons of the negative impact of equipments' suppliers' knowledge on product innovation can only be hypothesised: either it has not led to an innovation when the survey was conducted or the firms have done an inefficient use of the information achieved.

The similar results obtained for "internal" and "spatial environment" variables (except for two variables: Services for businesses and Partners' knowledge), the marginal contribution of the variables owning to these two categories could be considered independent from the innovation type. An eventual difference between the INNO RURAL and INNO URBAN models should therefore be considered a "spatial" effect.

8.5.4 The determinants of innovation in Switzerland

After having focused our attention on the differences existing between the different models, we will now consider in details the marginal contribution of each explanatory variable referring our comments to the results obtained at the district level (Table 32).

Firm' size – The natural log of the number of firms' employees positively contributes to the innovative activity of the firms. At the national level, this marginal contribution of the SIZE is independent from the spatial context (either in *Rural* or *Urban areas* signs are positive) and the type of innovation (either for product or process innovation signs are positive). These results are consistent with the idea that return to scale achieved by reason of size are internal to the firm (see section 3.2 and 4.1.1). Moreover, as shown in other previous studies (see section 3.2.) and according to Schumpeter's first hypothesis, the relationships of firms' size and the probability to be innovative is generally positive.

% Academic employees – The share of workers with an academic degree is generally positively related to the innovation activity of the firms (INNO). However, there is no evidence that this is the case in *Rural areas*. Thus, in Switzerland, innovative firms located in *Rural areas* do not benefit from a marginal "advantage" employing academic workers. This could be due to the kind of economic activities done in these areas.

Autonomous firm – There is no evidence of a marginal contribution of the juridical autonomy to innovation activities.

Sectors – The reference variables of sectors' dummy variables is Sector 2, which correspond to the manufacturing sectors. *Ceteris paribus*, and consistently with our previous observations (see Graphic 3 in section 2.3), Sector 3 (energy and building), 4 (trade and hotels), 5 (transports and communication) and Sector 6 (services for businesses) are generally (see INNO model) less innovative than the manufacturing sector. However, a significant and negative impact of Sector 6 exist only in INNO URBAN and INNOPD models. Moreover, as already said in section 8.5.2, only firms of Sector 3 result less innovative than those of Sector 2 in *Rural areas*. Excluding the case of *Rural areas*, it could be concluded that firms of the manufacturing sector are more innovative than those of other sectors except for Service for businesses. By contrast, in *Rural areas* there are not important differences between sectors, except for the one of energy and building which is generally less innovative than the others.

Local competitors – The share of local competitors is a good indicator of the type of market in which the firms operate. On one hand, it reveals if the firm is more or less in competition with local or "national/international" markets (the more the share of local competitors is small, the higher is the share of non local competitors). On the other hand, a low or high presence of local competitors allows to know if the firm has a local monopoly or not.

Differently from the (misleading) results obtained at the municipality level (Table 31), the impact of this variables is rarely significant. The only significant results is those obtained in the INNOPD model, where the impact of an important share of local competitors has a negative impact on innovation. This result is consistent with the second hypothesis of Schumpeter (see section 3.2), according to which the firms having a monopoly power are more innovative than the others. By contrast, the idea of Porter (1990), according to which a strong competition between local firms within the same industry is an important determinant of the pace of innovation is therefore in contrast with these results.

Finally, according to some authors (see comments to Graphic 2 in section 2.3 and section 3.2.), competitions has a different impact on product and process innovations. However, as the coefficient of local competitors' variable is not significant in the case of process innovation, there is no evidence to analyse these issues.

Local market – The share of turnover achieved on local markets is another indicator of the market dimension in which the firm operates. The results show a low and negative significance of this factor only for process innovations. Thus, even if local market demand is considered one of the most important incentives to innovate by Porter (1990), except for firms launching process innovations, it has not a significant impact on innovation.

% Export – Similarly to the previous two variables, the share of turnover achieved on foreign markets reveals the competitive spatial dimension of the firm. This variable is significant only in the models referred to the whole territory (INNO), *Urban areas* and product innovation. Since the sign is positive, it allows us to conclude that firms operating on international markets are more innovative than those more "locally oriented".

Customers' knowledge – According to the results obtained in *Rural areas* and for product innovations, the more the knowledge obtained by customers is considered important for the firm, the higher is the probability that it is innovative. The impact of this variable is therefore neither independent from the spatial context, nor from the type of innovation.

Input suppliers' knowledge – The probability to be innovative is higher in firms settled in *Urban areas* and considering the knowledge obtained from suppliers of inputs as important for their innovations. A similar result is obtained in INNOPD model. Since inputs could be directly part of a new product, the importance of this knowledge source is comprehensible. The impact of this variable is therefore neither independent from the spatial context, nor from the type of innovation.

Software suppliers' knowledge – Firms considering software' suppliers as an important source of knowledge for innovation activities, have generally an higher probability to be innovative. However, there is evidence of a similar result only by firms located in *Urban areas* or having launched process innovations. The impact of this variable is therefore neither independent from the spatial context, nor from the type of innovation.

Equipments suppliers' knowledge – Firms having declared that equipments' suppliers are an important source of knowledge, have a lower probability to be innovative than others firms. In particular, this is true in *Urban areas* and for product innovation. These results could be explained by the fact that an important number of innovative firms (INNO, INNO URBAN or INNOPD) scored this external source of knowledge as scarcely important, while non innovative firms scored it as an important source of knowledge for their innovation activities. Thus, these firms have not yet generated an innovation when the survey was conducted or they have done an inefficient use of the information achieved.

Competitors' knowledge – The fact to consider competitors as an important source of knowledge decreases the probability of being innovative in *Rural areas*. As for the previous variable, the reason of a negative sign could be due to a "time lag" effect or an inefficient use of the information achieved. However, this result is not completely unexpected because, as already reported in Chapter 3, similar results where obtained in a study of Leiponen (2002), who argued that the tendency to collaborate on R&D activities with outside partners and the innovation output are depressed in technological regimes where competitors and suppliers are important sources of knowledge.

Partners' knowledge – The importance of partners as source of knowledge is inversely linked to the likelihood to launch process innovation. The reason can be due to the "time lag" effect or an inefficient use of the information achieved.

Universities' knowledge – Universities are an important external source of knowledge with a positive impact on innovation and especially in *Urban areas*, where we observed the highest shares of relationships with foreign universities (see section 7.3.1 letter *d)*).

R&D institutes' knowledge – Firms considering research institutions as an important source of knowledge are usually less innovative and this happens especially in *Rural areas*. The negative impact of this source is unexpected and can be explained by a "time lag" effect or an inefficient use of the information achieved.

Consultants' knowledge – This variable, referred to the importance of consulting companies as a source of knowledge, is never significant.

Appropriability - To test the impact of the appropriability variables *R&D expenditures* and *Patents*[125] were temporarily introduced in the models of product and process innovation. The results show a positive marginal contribution of both appropriability variables in the case of product innovation, and a non significant impact in the case of process innovation. Thus, the use of patents as means to protect new products and the investments in R&D activities leads to an increasing probability of being an innovative firm.

Right & liberal district – This variable expresses the political positioning on the diagonal Right & Liberal vs. Left & Conservative of the area in which the firm is settled. At the district level, this indicator of the institutional proximity (see section 7.3.1) is never significant. Thus, a significant difference between firms located in right & liberal districts and those located in left & conservative districts do not exist.

% District pop. with university degree – At the district level, the presence of an high share of population with a university degree has surprisingly a negative impact on the innovation capacity of firms located in *Rural areas*. This result can be explained by the fact that the qualified population living in the area is not working in local firms (either because it is not an active population or because the mobility of these workers is high) or that innovative firms settled in *Rural areas* do not employ academic workers (see section 8.5.2).

District trans-border workers – The presence of an high number of commuters in the areas generally decrease the probability of being an innovative firm. This result is independent from the type of innovation (INNOPD, INNOPC), but not independent from the spatial context. In fact, firms located in *Rural areas* with an high number of foreign workers take advantage of this presence and result more innovative than firms settled in *Rural areas* with a low number of commuters. Since the presence of academic workers in innovative firms of *Rural areas* is not significant, this workforce is probably employed for labour intensive works.

% Districts' firms of the same sector – The presence of others firms of the same sector (and therefore the eventual local sectoral specialisation and intra-sectoral interactions of firms) does not significantly contribute to the innovation capacity of the firms. Thus, since the important presence of local competitors and firms operating in the same sector do not have a significant and positive

[125] See definition in Appendix 49.

impact on innovation, the idea that a strong competition between local firms within the same industry determines the pace of innovation, as Porter argued (1990), is not confirmed. Moreover, there is no evidence that the presence of a strong concentration of a single industry in a given area is a more conductive environment for innovation as suggested by MAR works. Neither the presence of localised economies, nor that of urbanisation economies (see section 4.1.1) is therefore empirically verified.

Firms' density in the districts – The assumption that led us to introduce a density variable in the logit models is that not only the presence of specific socioeconomic resources in the area (that refers to the absolute dimension of periphery) can contribute to the explanation of innovation diffusion, but also the spatial concentration of firms can (according to the "relative dimension" of periphery). Moreover, the density of firms is not only an indicator of periphery, but also of the local network potential (the availability of some external sources of knowledge: partners, competitors, suppliers, customers and consulting firms).

At the district level the density of firms (expressing agglomeration as well as geographical proximity – see section 4.3) does not have any significant marginal impact on the innovation activities of the firms. This result is not completely unexpected, as we know that:

- Extreme high or low levels of geographical proximity could respectively favour or contrast innovation activities (see section 3.4.2). Thus, it is meaningful to expect that between the two extremes could exist situations in which the impact of geographical proximity on innovation is neither positive nor negative.
- The need of external knowledge could be different according to the production phases (see section 3.4.2). In particular, imitation of competitors' innovative processes or imitative R&D activities need rapidity and flexibility. Thus, activities of innovation production are generally internalised and they do not need geographical proximity between firms.
- It is often difficult to disentangle geographical proximity from the other forms of proximity (see section 3.4.2). Many descriptive approaches having exalted the role of geographical proximity could have confused its effects with those of other forms of proximity. In the logit models, this confusion is avoided because other forms of proximity are partially captured by other variables. Thus, a non significant marginal contribution of geographical proximity could appear.

Later on (section 8.5.6), the investigation on the role of firms' density on innovation activities will be completed observing the role of the explanatory variables in several spatial contexts defined according different levels of density. Indeed, even if the marginal contribution of geographical proximity is non significant, we would like to investigate the behaviour of innovative firms in low and high density areas.

8.5.5 The determinants of innovation in Ticino regions

In Table 33 we report the results of the logit models computed using the IRE dataset at the district level (the municipality level was discarded for the same reasons considered at the national level[126]) and those obtained in *Rural* and *Urban areas* at the national level (the same results presented in Table 32). Putting beside these results, it will be easier for us to investigate if the firms located in the three Ticino regions have similar innovation's determinants of those considered in the national

[126] In appendix 52 the results obtained at the municipality level are anyhow presented.

sample and if they are more similar to those of *Rural* or *Urban areas* of Switzerland (3rd Research Questions – see section 8.1).

Table 33: Estimation of innovation in the Ticino regions (at the district level) and Switzerland

	TICINO			SWITZERLAND		
	INNO	**INNOPD**	**INNOPC**	**INNO**	**INNO RURAL**	**INNO URBAN**
R square (Nagelkerke)	0,31	0,2	0,28	0,21	0,34	0,21
N	876	875	874	1639	321	1318
Firm' size	+ ****	+ ****	+ ****	+ ****	+ ****	+ ****
% Academic employees	+ **	+ ***	+ **	+ ***		+ **
Autonomous firm		- *				
Energy sector (Sector_3)	- ****	- ***	- ****	- ****	- ****	- ****
Trade sector (Sector_4)	- *			- ****		- ****
Transport sector (Sector_5)				- ***		- ***
Services for businesses (Sector_6)			- **	- *		- **
Local competitors	- ****	- ***	- ***			
Local market	- **					
% Export	- **		- ***	+ **		+ *
Customers' knowledge		+ *			+ **	
Suppliers' knowledge						
Competitors' knowledge	- **	- ***			- **	
Partners' knowledge						
Edu. Instit. & Consultants' knowled.	- **		- **			
Right & liberal district						
% District pop. with university degree[127]					- **	
District trans-border workers[128]				- ***	+ **	- ***
% District firms of the same sector						
Firms' density in the district						
Constant						

Source: IRE' surveys , SFSO's data and personal elaboration

The observation of Table 33 emerges similarities between the results obtained in Ticino and those obtained in Switzerland for explanatory variables referred to the internal characteristics of the firms. By contrast, the computations of the coefficients referred to the "market" and more "spatial" phenomena (networks and proximities) lead to more heterogeneous results. These results are therefore consistent with the descriptive analyses presented in the first part of this work, where the particularity of Canton Ticino's territorial and socioeconomic characteristics were highlighted.

Nonetheless, at first sight a clear similarity of Ticino's results and INNO RURAL or INNO URBAN national results does not emerge. A detailed analysis of each explanatory variables'

[127] Absent in the Ticino's models to avoid multicollinearity problems.
[128] Absent in the Ticino's models to avoid multicollinearity problems.

impact on innovation is therefore required to explain the differences. In section 8.5.6. we will then consider an eventual similarity with LOW or HIGH density areas.

Firm' size – The marginal contribution of firm' size in Ticino is exactly the same obtained in the innovation models computed at the national level. Moreover, the impact is significant and positive independent from the type of innovation (INNO, INNOPD or INNOPC). Thus, independently from the average firm size in Ticino (10,6 employees per firm), Switzerland (10,3 employees per firm), *Rural* (10,1 employees per firm) and *Urban areas* (10,4 employees per firm), the impact of this variable on innovation is always significant and positive.

% Academic employees – The presence of academic workers in Ticino's firms is significant and positively related to the probability to innovate (either in product or in processes). This result is exactly the same obtained with the KOF' sample. Moreover, since at the national level the coefficient is significant only in the *Urban areas*, Ticino's results are more similar to those of the *Urban areas*. Thus, even if the three Ticino regions are considered as periphery of a peripheral region, the academic workers are a source of innovation.

Autonomous firm – Differently from the national level, where this variable is never significant, in Ticino it appears to play a role on product innovations. The negative impact of this variable could be explained by the relatively lower capacity to generate product innovations of local production units that are not owned by bigger firms with other plants in the rest of the nation. On our opinion, it is likely that these latter firms could exploit R&D efforts of other bigger plants, while autonomous ones could not. Thus, for them it becomes more difficult to launch product innovations, which usually needs more R&D investments than process innovations.

Sectors – The results of sectors variables differ from those at the national level for the non significance of some sectors (5 and 6, as well as the 4th in INNOPD and INNOPC). This means that in Ticino's the manufacturing sector is significantly more innovative than the energy & building and trade sector, but not more than the transport & communication and Service for business sectors. At the national level, this slightly less important sectoral differentiation is present in *Rural areas*. For this aspect, Ticino's is therefore more similar to Swiss *Rural areas*.

Local competitors – As at the national level, the share of local competitors does not have a significant influence on the probability to innovate of the firms. By contrast, in Ticino an important presence of local competitors has a negative impact on innovation. The more innovative firms in Ticino are those that operate as local monopolists. However, a low number of local competitors could mean that the competitors are settled in the rest of Switzerland or in a foreign country. Thus, their innovation capacity could be explained as the result of a national or international competition. Moreover, firms with numerous local competitors could be more cautious in investing in innovation activities, because in a peripheral region with scarce financial resources the risk of a self- or partners' failure is high (see section 5.3).

Local market – Differently from the national level, Ticino's results show a significant and negative impact of this variable's coefficient on INNO. Thus, the innovative firms of Ticino sell their products or services to non local customers. This could be interpreted as a non satisfactory quality of clients requests. Indeed, even if at the national level his statements do not find evidence, according to Porter (1990), what makes a nation innovative, are customers that are sophisticated and looking for better products and services. The traditional tastes of local customers living in Ticino regions, could therefore lead to this results.

% Export – Differently from the results obtained at the national level, the marginal contribution of this variable to innovation is significant and negative in INNO and INNOPC models. Thus, firms achieving an important share of their turnover on the foreign markets are less likely innovative than those selling few products to them. A possible explanation of these results is that positive incentives to innovate are obtained achieving an important share of turnover in the rest of Ticino and Switzerland (which are the markets complementary to the local and foreign markets considered in the model), but other interpretations are possible. For instance, as supposed for local markets, the quality of foreign customers could be of traditional good, so that there will be few incentives for firms to innovate.

Customers' knowledge – Firms declared to consider highly important the relationships with customers that have, in general, an higher attitude to innovate in products. At the national level, a significant and positive impact of this variable was found in *Rural areas*. According to the importance assigned by firms launching product innovations, it could appear difficult to understand the negative impact of local markets on innovation (in general). However, for product innovation, the local market impact was not significant and the use of customers' knowledge as a source of innovation is not equivalent to sell them goods or services. Thus, there is no inconsistence of the results.

Suppliers' knowledge – No empirical evidences allow to conclude that suppliers are a source of knowledge for Ticino's innovative firms.

Competitors' knowledge – To entertain relationships with competitors has a negative marginal effect on the innovation capacity of the firm, and in particular for product innovations. This result is the same obtained for *Rural areas* at the national level.

Partners' knowledge – As at the national level, in Ticino regions the impact of this variable is not significant.

Educational institutions and Consultants' knowledge – The relationships entertained with educational institutions or consulting companies have a significant and negative impact on innovation (INNO) and in particular on process innovation. This variable[129] does not allow us to share the effects of educational institutions and services to business companies. Thus, a comparison with the national situation is not possible.

Appropriability – Introducing the variable *Personal computers used for R&D activities* [130] in the models INNOPD and INNOPC, the contribution of this variable results highly significant and positive in both models. The positive and significant influence of R&D activities on innovation is therefore confirmed as well at the national as at Ticino's level.

Spatial environment **-** Some of the variables referred to the spatial environment were excluded from the models at the district levels, because of multicollinearity problems. However, computing the model using the spatial variables previously omitted (*% District pop. with university degree* and *District trans-border workers*) and excluding *Right & liberal district, % District firms of the same sector* and *Firms' density in the district*, we observed that network's variables'[131] results do

[129] It joins the score given to the importance of relationships with educational institutions and those with Service for business companies. The use of two different variables was excluded because highly correlated.
[130] See details in Appendix 49.
[131] See details in Appendix 53.

not change as well as those of the two spatial variables previously omitted, which result not significant.

Differently from the national level, where the percentage of *population with university degree* and *the number of trans-border workers* have a significant impact on innovation, in Ticino none of the "spatial environment" variables has a significant influence on the innovative activities of the firms. The innovative capacity of Ticino's firms is therefore influenced by some of the internal, market and network characteristics, but not by the spatial environment as defined in our models.

Finally, even at Ticino's level, the firms' density has not a significant influence on innovation. The reasons of this absence of geographical proximity externalities could be the same considered for the national level (see section 8.5.4).

8.5.6 Innovations' determinants in low and high density areas

As seen in section 7.3.2, the share of innovative firms is not homogeneously distributed across the firms' density categories. Nonetheless, using a macroeconomic and descriptive approach, it was not possible to identify the reasons of such a spatial distribution of innovative firms. The aim of this last section is therefore to know more about the innovation's determinants in areas characterised by different levels of firms' density.

In the previous logit models, we chose the Urban dummy variable[132] to split our datasets. However, since the definition of this variable is normative and not worldwide adopted, we will distinguish more or less peripheral areas on the basis of our "periphery measure" (see section 7.1) and investigate their specific characteristics in terms of innovation's determinants.

Since neither theoretical nor empirical fundaments exists to define the maximal firms' density in a peripheral area, to distinguish "HIGH" and "LOW" density areas we decided to adopt an exploratory approach and to observe the results obtained sharing KOF' sample into *low* and *high density areas* adopting two different thresholds:

- first, considering in *low density areas* the 25% of firms presents in the dataset and located in the districts with the lower firms' density, and in *high density areas* the rest of the firms (see results in column "1st QUARTILE" of Table 34 for *low density areas*, and in column "2nd + 3rd + 4th QUARTILE" of Table 35 for *high density areas*).
- Then, the threshold distinguishing *low* and *high density areas* shifts to the 50% of the dataset (see results in column "1st + 2nd QUARTILE" of Table 34 for *low density areas* and in column "3rd + 4th QUARTILE" of Table 35 for *high density areas*).

To highlight the consequences of shifting the threshold towards higher levels of firms' density on the coefficients significance, we coloured them according to these effects:

	Including areas with higher density
	Loses significance
	Stays significant
	Becomes significant

[132] As defined by the SFSO. See details in Appendix 2.

The variation of significance means the "gain" or the "loss" of a specific factor as innovations' determinant, while a stable significance means a sort of independency from a spatial variation. This analysis is therefore crucial to answer our fourth research question (see section 8.1) and more in general to investigate which are the main differences among innovative firms settled in peripheral areas and those located in more agglomerated areas.

Table 34: Innovation in Swiss low density areas[133]

	INNO RURAL		1ST QUARTILE		1ST + 2nd QUARTILE	
R square (Nagelkerke)	0,34		0,35		0,25	
N	321		367		827	
Firm' size	+	****	+	****	+	****
% Academic employees						
Autonomous firm						
Energy sector (Sector_3)	-	****	-	***	-	****
Trade sector (Sector_4)					-	**
Transport sector (Sector_5)					-	**
Services for businesses (Sector_6)						
Local competitors						
Local market						
% Export					+	**
Customers' knowledge	+	**	+	***	+	**
Input suppliers' knowledge			+	*		
Software suppliers' knowledge						
Equipments suppliers' knowledge						
Competitors' knowledge	-	**	-	***		
Partners' knowledge						
Universities' knowledge						
R&D institutes' knowledge	-	*				
Consultants' knowledge						
Right & liberal district			+	**	+	*
% District pop. with university degree	-	**	-	**	-	*
District trans-border workers	+	**	+	**		
% District firms of the same sector						
Firms' density in the district						
Constant						

Source: KOF's survey 2002, SFSO's data and personal elaboration

In Table 34 the focus is on the *low density areas*. The shift from the 25% to the 50% of the firms considered in low density areas means that we will include more dense areas among the *low* ones. Thus, the definition of *low density area* becomes less strict. By contrast, in Table 35 the focus is on *high density areas*. The shift towards an higher density level therefore means that we will

[133] Details in Appendix 54.

progressively include less areas among those considered highly dense of firms. Thus, the definition of *high density areas* becomes more and more strict.

The results presented in Table 34 show as well the results obtained in *Rural areas* using the SFSO definition and already reported in Table 33. The aim of putting the results of *Rural areas* beside the more strict definition of *low density areas* (1ST QUARTILE), is to highlight the similarity between these two models (either for the number of observation considered in the models, the R square value, as well as the significant coefficients and their signs). The only variables having a different significance in the two models are part of the "network" and "spatial environment" variables: *Input suppliers' knowledge* (positive and significant only in the 1ST QUARTILE's model), *Right & liberal district* (positive and significant in the QUARTILE's model), and *R&D institutes' knowledge* (negative and significant only in INNO RURAL model).

Table 35: Innovation in Swiss high density areas[134]

	INNO		INNO URBAN		2nd + 3rd + 4th QUARTILE		3rd + 4th QUARTILE	
R square (Nagelkerke)	0,21		0,21		0,21		0,22	
N	1639		1318		1272		812	
Firm' size	+	****	+	****	+	****	+	****
% Academic employees	+	***	+	**	+	**	+	***
Autonomous firm								
Energy sector (Sector_3)	-	****	-	****	-	****	-	***
Trade sector (Sector_4)	-	****	-	****	-	***		
Transport sector (Sector_5)	-	***	-	***	-	***		
Services for businesses (Sector_6)	-	*	-	**				
Local competitors								
Local market								
% Export	+	**	+	*	+	**		
Customers' knowledge								
Input suppliers' knowledge								
Software suppliers' knowledge	+	*	+	**	+	*		
Equipments suppliers' knowledge	-	*	-	*				
Competitors' knowledge								
Partners' knowledge								
Universities' knowledge	+	**	+	**	+	**	+	*
R&D institutes' knowledge	-	*						
Consultants' knowledge								
Right & liberal district								
% District pop. with university degree								
District trans-border workers	-	***	-	***	-	****	-	****
% District firms of the same sector								
Firms' density in the district								
Constant								

Source: KOF's survey 2002, SFSO's data and personal elaboration

[134] Details in Appendix 55.

Similarly, the INNO URBAN results (Table 35) are more similar to those obtained in the model considering the largest definition of *high density areas* (see column "2nd + 3rd + 4th QUARTILE", Table 35). Moreover, it is the most similar to the INNO model results obtained before (see Table 32) without splitting the dataset.

Using the firms' density as "periphery" indicator we can now observe dynamics that were not highlighted by the definition of *Urban* and *Rural areas* proposed by the SFSO.

Considering the models referred to *low density areas* when they include the 1st QUARTILE and the 1st + 2nd QUARTILE (Table 34), we observe the following coefficients' significance dynamics[135]:

- **The internal variables stay or become significant**. Two variables are independent from the spatial context: the *Firm' size* and the lower innovativeness of firms operating in the *Energy and building sector* (Sector 3) if compared to the manufacturing one. Moreover, the sectoral dummy variables reveal the significant higher innovativeness of the manufacturing sector among the others when the definition of low density areas becomes less strict.
- **The market variables stay non significant except for the share of export**. The share of turnover achieved on foreign markets becomes an innovation's determinant if the definition of *low density areas* becomes larger.
- **The network variables maintain or lose their significance**. The significance of the *Customers' knowledge* variables results independent from the spatial context, while *Input suppliers' knowledge* and *Competitors' knowledge* lose their significance.
- **The spatial environment variables maintain or lose their significance.** The right and liberal positioning of the district marginally contributes to explain the innovative character of a firm settled in an area where the density is low. The variable referred to the percentage of population with university degree does exactly the same, but the sign is opposite. The impact of trans-border workers on innovation is particularly interesting, because it is significant and positive only in areas with the lower firms' density level, it lost significance when the definition of *low density areas* becomes larger and, as we will comment later in details, it will be negative in *high density areas*.

Considering the *high density areas* (Table 35), we observe the following coefficients' significance dynamics[136]:

- **The internal variables stay or become not significant**. The *Firm' size*, the percentage of *academic employees* and the *Energy sector* dummy variable stay highly significant independently from the density's threshold. By contrast, other sectoral differences disappears when we consider a stricter definition of *high density areas*.
- **The only significant market variable loses its significance.** The share of turnover achieved on foreign markets does not play any significant impact on innovation in areas

[135] We do not enter into details of the coefficients' signs because they are the same emerged in the previous analyses (see Table 33) and because the aim of this section is to stress the effects of a threshold shift on the marginal contribution of the explanatory variables to the probability of being or not being an innovative firm in different spatial contexts.

[136] We do not enter into details of the coefficients' signs because they are the same emerged in the previous analyses (see Table 33) and because the aim of this section is to stress the effects of a threshold shift on the marginal contribution of the explanatory variables to the probability of being or not being an innovative firm in different spatial contexts.

where firms' density is high. Its impact is therefore limited to areas with a medium density levels (*low density areas* or *high density areas* largely defined).

- **One spatial environment variable becomes not significant and one stays significant.** The importance of knowledge acquired by software suppliers stop to play a significant impact on innovation when the definition becomes stricter. By contrast, the knowledge coming from universities has a significant and positive impact on innovation independently from the density's threshold.
- **The only significant variable stays significant.** Similarly to the university's knowledge, the number of trans-border present in the district plays a significant impact on innovation. However, its impact is negative.

Considering the results of low and high density areas (Table 34 and 35) at the same time, it is possible to distinguish the variables independent from the threshold shift. In particular, there are two variables which stay significant in all the models considered:

- *Firm' size*
- A lower innovativeness of the *3rd sector.*

Thus, this two variables can be considered ***determinants of innovation without any spatial restriction***. In fact, they are significant innovation's determinant either in low or high density areas.

Besides, one can identify the ***determinants of innovations in low density areas only***, observing the variables stay significant after the threshold' shift:

- Achievement of information by *customers*
- *Political positioning*
- Low % of people with *university degree* in the district

Finally, the ***determinants of innovations in high density areas only*** are:

- % of *academic employees*
- Achievement of information by *Universities*
- Low number of *trans-border workers* (by contrast, in very low density areas their presence favours innovation)

Moreover, it can be observed that the % of turnover due to export plays a significant and positive impact on innovation only in the areas with a medium density levels: in *low density areas* or *high density areas* largely defined (in model $1^{st} + 2^{nd}$ QUARTILE and $2^{nd} + 3^{rd} + 4^{th}$ QUARTILE).

In *high density areas* the role of university is therefore important: because the innovative firms employ higher share of *academic employees* and *academic knowledge*. By contrast, the knowledge and the skills of *the trans-border workers* has usually a negative impact on the innovation activities. We can therefore conclude that the innovative firms considering the knowledge produced by the universities as highly important are usually settled in agglomerations. By contrast, the innovativeness of firms settled in *low density areas* is favoured by the an high availability of foreign workforce, while the use of an academic knowledge and workers do not influence their innovativeness. Policy makers should therefore take into account these different exigencies of innovative firms settled in different spatial contexts.

Finally, observing the Ticino's INNO model's results presented in the previous section (Table 33), one conclude that the status of innovation's determinant of *Firms' size* and the lower innovativeness of the *3rd sector* is confirmed. Moreover, in Ticino an high share of academic employees has a positive impact on innovation, but the achievement of information by the university is negative (the effects of current collaborations are therefore not yet measurable in terms of innovation).

The results obtained for the *market variables*, which have all a significant and negative impact on innovation in Ticino show that, even if Ticino is close to the most dynamic region of Italy and the transport's flows across Ticino are very intensive (see section 1.4), the innovative firms of the three Ticino regions are those that do not export goods or services (in Italy and in other countries). Moreover, although the high number of commuters (see *trans-border workers*) moving each day from the closer Italian provinces to the Ticino's firms, the innovativeness of them is not influenced by the presence of these workers.

In terms of innovations' determinants it is therefore difficult to highlight the consequences on Ticino's economy of Milan's metropolis vicinity. However, if we consider that in Ticino the local environment (see *spatial environment* variables in the model) does not play a significant role in innovation phenomena, it is meaningful to argue that the influences of non local territorial and socioeconomic characteristics could have an impact on the innovative behaviours of firms. An investigation at more extended and international spatial levels (e.g. border regions) should therefore carry out to have an answer to this hypothesis. To improve the knowledge of innovation, it is therefore important to consider internal characteristics of the firms as well as the territorial and socioeconomic reality in which the firms are settled. Indeed, without joining in a model the economic dimension to more social, institutional and geographical, one risks to see only one side of the medal.

8.5.7 Answers to the research questions

The results of the multivariate analyses presented in this chapter allow us to answer to the research questions as following:

i) *Which is the marginal contribution to innovation of the classical determinants of innovations (Internal firm's factors, Market, Networks) in Switzerland? Are these results independent from the spatial context (Urban and Rural areas) and the type of innovation (INNOPD, INNOPC)?*

The marginal contribution of *many classical determinants* of innovation results significant in the innovation models considered to analyse the national context. However, differences have been observed comparing the results obtained in *Urban* and *Rural areas*, as well as those referred to product and process innovations: in general, in *Urban areas* the number of variables having a significant impact on innovation are more numerous than in *Rural areas*, and those of the product innovation's model more numerous than those of the process innovations' model.

The contribution to innovation of the "*internal variable*" appears more independent from the spatial context and the type of innovation. In particular, *firm' size* has always a significant and positive influence on innovation activities of firms independently from the density level of the analysed areas. Differently, the marginal contribution of the *percentage of academic workers* is mainly significant and positive in high density areas. The fact to be an *autonomous firm* is never significant, except for product innovation in Ticino. Furthermore, the innovativeness capacity of

firms of the manufacturing sector is generally higher than in other sectors, but not in extremely *low* or *high density areas* (in these areas the sectoral innovativeness is therefore more homogeneous). Moreover, the coefficients of these variables are those with the highest levels of significance. Their identification as innovation determinants in several studies since many years is therefore not surprising.

In Switzerland, among *market variables*, only the share of export has a significant impact on innovation (INNO), but not in extremely *low* or *high density areas* (where the impact is not significant). Product innovations are negatively influenced by an important presence of local competitors and positively by export, while process innovations decreases if the percentage of local sales increases. The market variables are therefore dependent on space and type.

Firms' network, which literature considers among the most important innovations' determinants because it allows firms to acquire external knowledge and develop new ideas and innovations, are not always significant or a source of positive impact on innovation activities. Differences are present either between *Rural* and *Urban areas*, *low* and *high density areas*, or product and process innovations. A synthetic description of the results is not possible, but the positive impact on innovations of *customers' knowledge* in *Rural* and *low density areas* and the positive effects of *university's knowledge* in *Urban* and high density areas could be considered the most typical external sources of these areas.

The different *appropriability variables* considered, revealed a significant and positive impact of R&D activities on product innovations. Thus, the process innovation results not dependent on a factor that is considered the engine of firms' innovation and their competitive strategies.

ii) *Which is the marginal contribution to innovation of the spatial environment (spatial variables and firms' density) in Switzerland? Are these results independent from the spatial context (Urban and Rural areas) and the type of innovation (INNOPD, INNOPC)?*

Among the variables referred to the spatial environment considered in our models, the presence of *trans-border workers* is the only one that, in general, has a significant impact on innovation activities independently from the spatial context or type of innovation (except in *low density areas* largely defined). However, while in *Rural* and very *low density areas* the impact is positive, in *Urban* and *high density areas* the impact is negative.

The other variables are not significant or only in specific spatial context. This is the case of the *right & liberal positioning* of the district, that increases the probability of being innovative only in *low density areas* (strictly defined and considering a median threshold). As well as the case of the *percentage of inhabitants with a university degree* in the district, that decreases the probability of being innovative in *Rural* and in *low density areas* (strictly defined and considering a median threshold).

The *presence of others firms of the same sector* does not significantly contribute to the innovation capacity of the firms. Thus, there is no evidence that the presence of a strong concentration of a single industry in a given area is a more conductive environment for innovation as suggested by MAR and other authors' works.

At the district level the *density of firms* does not have any significant marginal impact on the innovation activities of the firms. This result could appear in contrast with the idea that clusters of

industries and agglomerations favour innovation activities. However, it should be taken into account that:

- Extreme high or low levels of geographical proximity could respectively favour or contrast innovations activities (see section 3.4.2).
- Activities of innovation production are generally internalised and do not need geographical proximity between firms.
- Descriptive approaches having exalted the role of geographical proximity could have confused its effects with those of other forms of proximity. In the logit models this confusion is avoided because other forms of proximity are partially captured by other variables. Thus, a non significant marginal contribution of geographical proximity could appear.

iii) *Are innovations' determinants of firms located in the three Ticino regions similar to those of innovative firms of Switzerland located in Urban, Rural, Low or High density areas?*

The results of Ticino regions are more similar to those of *high density areas* of Switzerland, but with some exception (the university' knowledge has a negative impact on innovation and the number of trans-border workers have no significant impact on it).

In particular, the *internal characteristics* of firms lead to controversial results: on one hand, the significant and positive impact of a *firm' size* and the *percentage of academic workers* can lead to conclude that internal characteristics of Ticino's innovative firms are similar to those of Swiss *Urban areas*. On the other hand, these two variables are innovation's determinants in every spatial context and the low sectoral innovativeness' differentiation is more a characteristic of *Rural areas*.

In Ticino the impact of the three *market variables* is significant and negative if we consider a large definition of innovation (INNO). By contrast, in Switzerland, only the share of export has a significant impact on innovation in specific spatial contexts. The results of Ticino are therefore an *unicum*. In our opinion, this could be due to specific territorial and socioeconomic characteristics:

- A low number of local competitors as (positive) innovation's determinant could mean that the competitors favouring innovative activities are settled in the rest of Ticino and Switzerland or in foreign countries. However, this last hypothesis is infirmed by the negative impact of export. Thus, the innovation capacity could be explained as the result of a national competition. Moreover, since in peripheral regions as Ticino, the financial resources are scarce and the risk of a self- or partners' failure is high (see section 5.3), firms with numerous local competitors could be more cautious in investing in innovating activities.
- The innovative firms of Ticino sell their products or services to "non local" customers, because customers living in Ticino regions have traditional tastes not stimulating innovation.
- The fact that firms achieving an important share of their turnover on the foreign markets are less likely innovative than those selling few products to them, could mean that positive incentives to innovate are obtained achieving an important share of turnover in the rest of Ticino and Switzerland (which are the markets complementary to the local and foreign markets considered in the model), and that the quality of foreign customers is too traditional, so that there will be few incentives for firms to innovate.

In Ticino, the majority of *network's variables* is not significant. The only variable leading to a significant and similar result to the rest of Switzerland is the negative impact of competitors' knowledge on innovation. The marginal negative contribution of this variable is significant in Ticino, as well as in Swiss *Rural* and *low density areas*. It is therefore a result due to the peripheral character of Ticino. Differently, the negative and significant contribution of university's knowledge (usually positive in agglomerations) could be read as the fruit of preliminary collaborations between firms and the new university institutions that have not generated innovation jet.

Finally, the absence of significant results for *spatial variables* lead us to conclude that the spatial environment of Ticino regions (firms' density included) does not play an important role in defining the innovation capacity of the firms. The innovation activities of Ticino's firms are therefore more due to their microeconomic characteristics than the macro ones.

iv) *Which are the innovations' determinant of firms settled in low and high density areas of Switzerland and Ticino regions?*

The observation of significance variations of a specific factor when the density's threshold is shifted to an higher level of density, allowed us to identify which explanatory variables are independent from a spatial variations and which are specific of a particular firms' density level (see results of section 8.5.6).

The innovative firms settled in Ticino's regions have internal characteristics not very different from the firms located in other more or less dense areas of Switzerland (see sections 8.5.5 and 8.5.6), but their market strategies, networks and influenceability towards spatial environment reveal a specific behaviour that stresses the necessity for scientists and policy makers of avoiding any generalisation when dealing with innovation phenomena.

Finally, the case of Ticino shows that is not an easy task to highlight the consequences of foreign metropolis' vicinity (e.g. Milan) on the innovation activities of a peripheral region (e.g. Ticino) focusing the analyses on the peripheral region only. An empirical investigations at a trans-national spatial levels (e.g. border regions) can therefore be a future interesting follow up of this resarch project.

FINAL CONCLUSIONS

The major result of this study is certainly of empirical proofing the existence of specific innovation's determinants according to the territorial and socioeconomic characteristics of the areas in which firms are settled. However, other innovative methodological aspects introduced by this empirical study should be highlighted and considered as part of the results obtained.

Firstly, ***few authors have focused their investigations on the determinants of innovation in peripheral areas***. The more recent scientific contribution in this field are: the paper of Coronado D., Acosta M. and Fernández A., titled "Attitudes to innovation in peripheral economic regions" (2005), the Project PIS "Peripheral Innovation Systems" (2005), and the works of Amonon Frenkel (e.g. 1996, 2000) on the innovation potential of lagging regions. The empirical evidence of specific attitude to innovation of firms settled in peripheral areas presented in this work should therefore be considered as an incentive to implement the scientific investigations in this field.

Secondly, the choice of the ***density of firms*** as a periphery indicator should be considered as a newness in the field of empirical studies on innovation determinants. This variable is certainly available or easily computable in many other countries of the world. The diffusion of investigations based on it can therefore lead to inter-national comparisons and to an interesting scientific debate in the field of innovation theory and regional sciences.

Thirdly, another innovative methodological aspect introduced in this work, is the use of ***micro- and macro-variables in the same model*** estimating the innovation determinants of the firms. In doing so, the eventual link between a firms' attitude to innovation and the spatial environment in which the firm is located is not only captured by asking them which is their network, but also letting the model answer to one of the most controversial questions of regional sciences: should the territory be considered an additional actor of regional development models? Since innovation is considered the heart of territorial competition, a significant impact of spatial variables on the innovation activities of the firms is a clear and not subjective answer to this question.

Fourth, ***the observation of the effect of several threshold levels on the innovations determinants*** allows to observe which characteristics are dependent on the firms' density level and which are not. The exploratory approach can therefore be considered a methodology to obtain useful information about innovation phenomenon in different spatial contexts.

Finally, the availability of data collected in the same period with dedicated surveys at the national and sub-national level and the expansion of the two datasets with other secondary statistics' data gives the possibility to ***compare the results at different spatial levels*** (national and sub-national; municipalities and districts). The choice to study the innovation phenomenon at different spatial levels can certainly be helpful for policy makers that would like to define more efficient economic instruments to incentive innovation.

APPENDIX

Appendix 1: Questionnaire

Identificazione dell'azienda

1. Nome e sede dell'impresa

2. Forma giuridica

Il vostro stabilimento/la vostra impresa è:
Una sola risposta possibile

O Un'impresa giuridicamente autonoma, senza legami giuridici con altre imprese

O Un'impresa giuridicamente autonoma, ma affiliata a un gruppo.
In questo caso, specificare se è:

O a) la casa madre

O b) una filiale

3. Origine

3.1 La vostra impresa è nata dallo scorporamento di un settore d'attività di un'altra impresa già attiva nel vostro settore o in uno complementare sul territorio locale (spin-off)?

O Sì O No

a) Se sì, come si chiama(va) quest'impresa?

.....

b) Se sì, dove si trova(va) questa impresa?

Una sola risposta possibile

O Regione Tre Valli
O Resto del Ticino
O Resto della Svizzera
O Zona frontiera (in territorio italiano)
O Estero (eccetto la zona di frontiera)

3.2 La vostra impresa ha generato sul territorio locale, attraverso lo scorporamento di un suo settore d'attività (spin-off), altre imprese ora attive nel vostro settore o in settori ad esso correlati?

O Sì O No

a) Se sì, quante?

.....

b) Se sì, su quale territorio si trova/no questa/e impresa/e?

Più risposte possibili

O Regione Tre Valli
O Resto del Ticino
O Resto della Svizzera
O Zona frontiera (in territorio italiano)
O Estero (eccetto la zona di frontiera)

4. Struttura del capitale e provenienza del capitale di terzi

.....%	Capitale proprio				
.....%	Capitale di terzi →	Proveniente da:	Ticino	.....%	**100%**
			Svizzera	.....%	
100%	**TOTALE**		Estero	.....%	

5. Effettivi

5.1 **Attuale numero degli effettivi secondo la loro funzione e qualifica (proprietario/i compreso/i)** *Sono da includere le persone impiegate a tempo parziale trasformandole in tempi pieni (per es. due impiegati al 50% equivalgono a un effettivo).*

		Funzioni					
		Direttive	Amministrative	Produttive (di prodotti o servizi)	Logistiche e di distribuzione	Ricerca e sviluppo	**TOTALE**
Qualifiche	**Personale non qualificato**						
	Apprendisti						
	Personale accademico						
	Personale semi-qualificato non accademico*						
	Personale qualificato non accademico*						

* Escludendo il personale che è in possesso di un titolo accademico (universitario, di un politecnico federale o di Scuola Universitaria Professionale), per giudicare se una persona è semi-qualifica o qualificata, si tenga conto del titolo di studio in suo possesso, della sua formazione continua (esperienza di lavoro, corsi in e fuori azienda, ecc.) e lo si metta in relazione con il tipo di lavoro da essa svolto attualmente.

5.2 **Numero d'impiegati (compreso il proprietario) suddiviso secondo il luogo di residenza**
Non si deve considerare la nazionalità, ma il luogo di residenza dell'impiegato.
Ogni persona impiegata va considerata come un'unità lavorativa, indipendentemente dalla percentuale d'impiego.

…….. Regione Tre Valli

…….. Resto del Ticino

…….. Resto della Svizzera

…….. Zona frontiera (in territorio italiano)

…….. Estero (eccetto la zona di frontiera)

_____

…….. **TOTALE**

6. Massa salariale lorda

6.1 A quanto ammonta la massa salariale lorda annuale (2002)?

Per massa salariale lorda si intende la somma dei salari e degli oneri sociali

…… (in CHF)

6.2 Qual è stata la ripartizione percentuale di questi costi in base alle seguenti funzioni lavorative?

…….. % Direttive

…….. % Amministrative

…….. % Produttive

…….. % Logistiche e di distribuzione

…….. % Ricerca e sviluppo

100% TOTALE

Volume d'affari

Qual è stato il volume d'affari annuale medio degli ultimi tre anni (2000-2001-2002)? *(per le banche si indichi la cifra di bilancio)*

…… (in CHF)

Importanza dei mercati esteri

Facendo una media degli ultimi tre anni (2000-2001-2002), in quale percentuale il volume d'affari è stato conseguito sui mercati esteri? ..... (in %)

Concorrenti

Qual è il numero di imprese concorrenti e dove sono localizzate?
Una risposta per ogni riga

Regione Tre Valli	O 0	O 0-5	O 6-10	O 11-20	O Non quantificabile
Resto del Ticino	O 0	O 0-5	O 6-10	O 11-20	O Non quantificabile
Resto della Svizzera	O 0	O 0-5	O 6-10	O 11-20	O Non quantificabile
Zona frontiera (in territorio italiano)	O 0	O 0-5	O 6-10	O 11-20	O Non quantificabile
Estero (eccetto la zona di frontiera)	O 0	O 0-5	O 6-10	O 11-20	O Non quantificabile

In quali nazioni principalmente?

.....
.....
.....

Attività e innovazioni

Sotto quale ramo di attività NOGA vi classificate?

Vedere lista dei rami d'attività nell'ultima pagina

N°.....

Descrizione:

.....

Ricerca, sviluppo e innovazioni

		Intra-muros	Out-sourcing
11.1 Qual è stata la spesa annuale media degli ultimi tre anni (2000-2001-2002), in attività di Ricerca e Sviluppo?	Nessuna spesa	O	O
	meno di CHF 50'000.-	O	O
Per Intra-muros si intendono attività di Ricerca e Sviluppo effettuate da collaboratori interni mentre con Outsourcing attività di Ricerca e Sviluppo commissionate all'esterno	tra i 50'000.- e i 100'000.- (CHF)	O	O
	tra i 100'000.- e i 150'000.- (CHF)	O	O
	tra i 150'000.- e i 200'000.- (CHF)	O	O
	oltre CHF 200'000.-	O	O

11.2 Qual è la ripartizione percentuale di queste spese tra la Ricerca e lo Sviluppo?

…….. % Ricerca …….. % Sviluppo **= 100%**

11.3 Negli ultimi <u>tre anni</u> quanti prodotti o servizi completamente nuovi avete introdotto sul mercato?
Da intendersi come prodotti e servizi precedentemente inesistenti sul mercato locale e internazionale

O Nessuno O 1 O 2 O più di 2

Descriverli brevemente:

……

……

11.3.1 Facendo una media degli ultimi <u>tre anni</u>, in quale percentuale il volume d'affari è stato conseguito grazie a prodotti o servizi completamente nuovi?

…… (in %)

11.4 Negli ultimi <u>tre anni</u> avete proceduto a innovazioni importanti nel campo dei processi produttivi?

(Acquisti di nuovi macchinari, adozione di nuove tecnologie di produzione integrate da computer, ecc.)

Sì O No O

<u>Se sì</u> , quali?

……

……

11.5 Negli ultimi <u>tre anni</u> avete proceduto a importanti innovazioni a livello di organizzazione aziendale?

(riorganizzazione delle funzioni della vendita, della produzione, delle risorse umane, ecc.)

Sì O No O

<u>Se sì</u>, di che tipo?

……

……

11.6 Negli ultimi <u>tre anni</u> avete aperto nuovi mercati?

Sì O No O

<u>Se sì</u>, quali e dove?

……

Relazioni d'affari

Principali fornitori o partner per tipo di fornitura e localizzazione geografica

Qual è il numero dei vostri principali fornitori o partner?
Indicare in ogni riquadro il numero corrispondente di fornitori o partner.

		Localizzazione				
		Regione Tre Valli	Resto del Ticino	Resto della Svizzera	Zona di frontiera	Estero (eccetto la zona di frontiera)
Tipo di fornitura	**Input produttivi ***					
	Ricerca e sviluppo**					
	Trasporti e logistica					
	Finanziamenti					
	Totale					

* materie prime, macchinari, pezzi ricambio, componenti tecnologie informatiche e di comunicazione, energia, licenze produttive, …

** studi di mercato, ricerca di nuovi prodotti, ricerca di nuovi materiali, ricerca di nuove tecnologie, consulenze, perizie, servizi in out-sourcing, …

Clienti

13.1 Come avviene la vostra commercializzazione?

Indicate la ripartizione percentuale

…... % per mezzo d'intermediari commerciali (distributori, rappresentanti,…) [su mercati intermedi]

…... % direttamente presso il consumatore [sul mercato finale]

100 % TOTALE

13.2 In che modo si ripartisce il vostro mercato?

Indicare la ripartizione percentuale dei vostri clienti <u>in base alla cifra d'affari media realizzata</u> (vedi cifra fornita alla domanda 7).

…….. %	Regione Tre Valli
…….. %	Resto del Ticino
…….. %	Resto della Svizzera
…….. %	Zona frontiera (in territorio italiano)
…….. %	Estero (eccetto la zona di frontiera)
100 %	**TOTALE**

Fattori di produzione

Dotazione infrastrutturale

14.1 Struttura dei fattori di produzione
Indicare la ripartizione percentuale tra i fattori di produzione <u>in base al loro costo</u>

…..%	fattore lavoro (risorse umane)
…..%	fattore capitale (macchine, tecnologie, attrezzature, capitali...)
100%	**TOTALE**

14.2 Grado di automazione dei processi produttivi

a) Disponete di un sistema di gestione aziendale integrata <u>ERP</u> (es. SAP)?	Sì O	No O
b) Disponete di una rete informatica interna del tipo <u>Intranet</u> (per collaborazioni interne all'impresa)?	Sì O	No O
c) Disponete di una rete informatica parzialmente aperta del tipo <u>Extranet</u> (per collaborazioni con l'esterno)?	Sì O	No O

d) Siete allacciati a Internet?	Sì O	No O
Se sì, quanti Personal Computer e Laptop sono allacciati ad Internet?	……	
e) Disponete di una rete informatica aziendale? (ovvero non via web, come è il caso della rete Intranet)	Sì O	No O
f) Quanti Personal Computer e Laptop possiede complessivamente l'impresa?	……	
g) I mezzi informatici e di comunicazione sono utilizzati per le seguenti funzioni: *Indicare la ripartizione percentuale*	……. %	Gestione e amministrazione
	……. %	Produzione
	……. %	Marketing e vendita
	……. %	Logistica e distribuzione
	……. %	Ricerca e sviluppo
	100%	**TOTALE**

Relazioni con partner, fornitori, clienti, settori correlati o di supporto

Relazioni d'affari

Indicare il grado d'importanza delle relazioni intrattenute con i vari attori, in base al ruolo strategico che esse hanno per lo sviluppo di prodotti o servizi innovativi, la riduzione dei costi di produzione, l'acquisizione di nuovi mercati, di know-how, ecc.
Con le cifre da 1 a 4 si deve intendere: 1= relazioni insignificanti; 2= relazioni poco rilevanti; 3= relazioni importanti; 4= relazioni molto importanti

	Importanza delle relazioni intrattenute			
	1	**2**	**3**	**4**
Fornitori	O	O	O	O
Clienti	O	O	O	O
Concorrenti	O	O	O	O
Partners (imprese dello stesso ramo o di rami complementari)	O	O	O	O
Distributori	O	O	O	O
Associazioni professionali (AITI, SSIC, Ccia-TI, ATED, SCTA, FEAT, ..)	O	O	O	O
Università della Svizzera Italiana (facoltà e istituti di ricerca connessi)	O	O	O	O
Scuola universitaria professionale della Svizzera Italiana (dipartimenti e istituti connessi - ICIMSI, IDSIA, IST)	O	O	O	O
Altre università e scuole politecniche fuori cantone o all'estero	O	O	O	O
Altri istituti di ricerca o laboratori tecnici svizzeri o esteri	O	O	O	O
Sistema finanziario				
➢ Locale (Regione Tre Valli)	O	O	O	O
➢ Cantonale	O	O	O	O
➢ Svizzero	O	O	O	O
➢ Zona di frontiera (in territorio italiano)	O	O	O	O
➢ Estero (eccetto la zona di frontiera)	O	O	O	O
Servizi specializzati alle imprese*				
➢ Locali (Regione Tre Valli)	O	O	O	O
➢ Cantonali	O	O	O	O
➢ Svizzeri	O	O	O	O
➢ Zona di frontiera (in territorio italiano)	O	O	O	O
➢ Esteri (eccetto la zona di frontiera)	O	O	O	O
Formazione professionale **				
➢ Locale (Regione Tre Valli)	O	O	O	O
➢ Cantonale	O	O	O	O
➢ Svizzera	O	O	O	O
➢ Zona di frontiera (in territorio italiano)	O	O	O	O
➢ Estera (eccetto la zona di frontiera)	O	O	O	O
Servizi dell'amministrazione pubblica				
➢ Locale (Regione Tre Valli)	O	O	O	O
➢ Cantonale	O	O	O	O
➢ Svizzera	O	O	O	O
➢ Zona di frontiera (in territorio italiano)	O	O	O	O
➢ Estera (eccetto la zona di frontiera)	O	O	O	O

* marketing, consulenze aziendali, ricerca e selezione di personale, pubblicità, collaudi e analisi tecniche, studi di ingegneria, …
** offerta pubblica e privata

Qualità del sistema in cui operate

Valutazione del sistema in cui operate

Esprimete un vostro giudizio sul sistema in cui operate:

Per ogni riga dare una valutazione della situazione attuale e della tendenza futura da voi prevista (non auspicata).

	Situazione attuale				*Tendenza futura*		
Condizioni dei fattori	- -	-	+	++	**Peggiora -mento**	**Status quo**	**Migliora-mento**
Risorse finanziarie (disponibilità e accesso al capitale)	O	O	O	O	O	O	O
Risorse umane (quantità, competenze professionali e costo del personale)	O	O	O	O	O	O	O
Risorse fisiche (abbondanza, qualità, accessibilità e costo della terra, delle acque, delle fonti energetiche, condizioni climatiche, posizione geografica,…)	O	O	O	O	O	O	O
Conoscenze (patrimonio di conoscenze scientifiche e di mercato disponibili presso istituzioni di formazione e di ricerca, associazioni di categoria, ecc.)	O	O	O	O	O	O	O
Infrastruttura (qualità, accesso e costi dei sistemi di trasporto, di comunicazione, di distribuzione della posta, di assistenza sanitaria, scuole, asili, ecc.)	O	O	O	O	O	O	O
Condizioni della domanda							
Qualità degli acquirenti (sono esigenti? fanno pressione per ottenere prodotti e servizi diversificati e di qualità? Orientano la produzione grazie a preferenze rivelate in anticipo?)	O	O	O	O	O	O	O
Spazio di sostegno – settori correlati							
Presenza di settori complementari a monte della produzione (R&S, tecnologie, componenti, input produttivi vari)	O	O	O	O	O	O	O
Presenza di settori complementari a valle della produzione (distribuzione, logistica,...)	O	O	O	O	O	O	O
Fiscalità	O	O	O	O	O	O	O
Regolamentazione	O	O	O	O	O	O	O
Legislazione in favore dell'innovazione/del turismo	O	O	O	O	O	O	O
Regole pianificatorie in materia di gestione del territorio	O	O	O	O	O	O	O
Sostegno pubblico allo sviluppo economico e delle imprese	O	O	O	O	O	O	O
Formazione di base (scuole pubbliche)	O	O	O	O	O	O	O
Formazione superiore e tecnica (università e scuole superiori professionali)	O	O	O	O	O	O	O
Sostegno delle Associazioni di categoria (AITI, Ccia-TI, SSIC,...)	O	O	O	O	O	O	O

Strategie future

Cambiamenti previsti

17.1 Nelle vostre strategie di medio-lungo termine, vi è pure la possibilità di una delocalizzazione di una parte o della totalità delle attività?

Sì O No O

Se sì, verso dove?
Una sola risposta

O Regione Tre Valli
O Resto del Ticino
O Resto della Svizzera
O Zona di frontiera (in territorio italiano)
O Estero (eccetto la zona di frontiera)

Di quali attività si tratta?

……

……

……

17.2 Nelle vostre strategie di medio-lungo termine prevedete un ampliamento delle attività?

Sì O No O

Se sì, di che tipo?
Più risposte possibili

O Aumento del personale
O Introduzione di nuovi impianti
O Costruzione di nuovi stabili
O Introduzione di nuove tecnologie informatiche e di comunicazione
O Introduzione di nuovi prodotti/servizi
O Operare su nuovi mercati
O Adottare nuove logiche organizzative
O Altro:

……

……

Nome e cognome di chi ha compilato il questionario:

……

Numero di telefono:

……

Luogo e data:

……

Firma:

……

Ringraziamo sentitamente per la preziosa collaborazione!

Appendix 2: Swiss conurbations and NUTS definition

Per "zona urbana" s'intendono:

- gli agglomerati,
- le altre città che non appartengono ad un agglomerato.

Un agglomerato è un'entità che adempie le seguenti condizioni :

a) Un agglomerato è un insieme di territori di comuni adiacenti che conta almeno 20'000 abitanti.

b) Un agglomerato comprende una zona centrale formata da un comune-nucleo e, a seconda dei casi, da altri comuni che soddisfano i presupposti seguenti: totalizzare almeno 2'000 impieghi; il rapporto tra il numero di persone che lavorano sul loro territorio e il numero delle persone attive occupate che vi risiedono dev'essere superiore o uguale a 0,85. Questi comuni devono inoltre formare una zona edificata continua con il comune-nucleo o avere una frontiera comune con esso oppure ospitare almeno 1/6 della popolazione attiva occupata del comune-nucleo.

c) Un comune che non appartiene alla zona centrale fa parte dell'agglomerato se:
• almeno 1/6 della sua popolazione attiva residente lavora nella zona centrale definita in precedenza e
• sono realizzate tre delle cinque condizioni seguenti:

1. Deve sussistere continuità della zona edificata tra il comune e il comune-nucleo dell'agglomerato; in altre parole, gli spazi non edificati (terreno agricolo o foresta) non devono superare 200 m.
2. La densità combinata abitanti/impieghi per ettaro di superficie di habitat e di superficie agricola (esclusi i pascoli alpini) dev'essere superiore a 10.
3. L'aumento demografico dev'essere maggiore di 10 punti rispetto alla media nazionale registrata negli ultimi dieci anni. (Questo criterio non si applica ai comuni che non fanno ancora parte di un agglomerato; per gli altri è considerato un criterio valido indipendentemente dall'aumento registrato).
4. Almeno 1/3 della popolazione attiva occupata residente deve lavorare nella zona centrale. Per i comuni il cui territorio confina con due agglomerati, tale è realizzata se almeno il 40% della popolazione attiva occupata residente lavora nelle due zone centrali, di cui almeno 1/6 in entrambe.
5. La quota di persone residenti attive nel settore primario non deve superare il doppio della media nazionale. (Per il 1990, a causa del calo massiccio della media nazionale dal 6,2% al 4,1% e in deroga a tale disposizione, il valore limite è stato fissato al 10,3%; ciò significa che è stato preso in considerazione unicamente un calo netto di 2,1 punti).

Per "città" si intende qualsiasi comune con almeno 10'000 abitanti.

Source: Schuler 1997

The NUTS nomenclature was created and developed according to the following principles:

a) The NUTS favours institutional breakdowns.
Different criteria may be used in subdividing national territory into regions. These are normally split between normative and analytic criteria:

normative regions are the expression of a political will; their limits are fixed according to the tasks allocated to the territorial communities, according to the sizes of population necessary to carry out these tasks efficiently and economically, and according to historical, cultural and other factors;
analytical (or functional) **regions** are defined according to analytical requirements; they group together zones using geographical criteria (e.g., altitude or type of soil) or using socio-economic criteria (e.g., homogeneity, complementarity or polarity of regional economies).
For practical reasons to do with data availability and the implementation of regional policies, the NUTS nomenclature is based primarily on the **institutional divisions** currently in force in the Member States (normative criteria).

b) The NUTS favours regional units of a general character.
Territorial units specific to certain fields of activity (mining regions, rail traffic regions, farming regions, labour-market regions, etc.) may sometimes be used in certain Member States.
NUTS excludes specific territorial units and local units in favour of regional units of a general nature.

c) The NUTS is a three-level hierarchical classification
Since this is a hierarchical classification, the NUTS subdivides each Member State into a whole number of NUTS 1 regions, each of which is in turn subdivided into a whole number of NUTS 2 regions and so on.
At the regional level (without taking the municipalities into account), the administrative structure of the Member States generally comprises two main regional levels (Länder and Kreise in Germany, régions and départements in France, Comunidades autonomas and provincias in Spain, regioni and provincie in Italy, etc.).
The grouping together of comparable units at each NUTS level involves establishing, for each Member State, an additional regional level to the two main levels referred to above. This additional level therefore corresponds to a less important or even non-existent administrative structure, and its classification level varies within the first 3 levels of the NUTS, depending entirely on the Member State: NUTS 1 for France, Italy, Greece, and Spain, NUTS 2 for Germany, NUTS 3 for Belgium, etc.

The NUTS Regulation lays down the following minimum and maximum thresholds for the average size of the NUTS regions.

Level	Minimum	Maximum
NUTS 1	3 million	7 million
NUTS 2	800 000	3 million
NUTS 3	150 000	800 000

At a more detailed level, there are the districts and municipalities. These are called "Local Administrative Units" (LAU) and are not subject of the NUTS Regulation.
It is though foreseen in the Regulation that after two years the Commission will publish a report on the feasibility to extend the NUTS breakdown to a fourth level.

Source: © European Communities, 1995-2005, http://europa.eu.int/comm/eurostat/ramon/nuts/basicnuts_regions_en.html

Appendix 3: Urban and rural municipalities per canton in 2000

Cantons	*Number of municipalities located in conurbations (urban areas)*	*Number of municipalities located in rural areas*	*Total of municipalities*
Aargau	86	146	232
Appenzell I.Rh.		6	6
Appenzell A.Rh.	5	15	20
Bern	88	312	400
Basel-Landschaft	52	34	86
Basel-Stadt	3		3
Fribourg	58	184	242
Genève	42	3	45
Glarus		29	29
Graubünden	24	188	212
Jura	7	76	83
Luzern	15	92	107
Neuchâtel	19	43	62
Nidwalden	8	3	11
Obwalden		7	7
St. Gallen	36	54	90
Schaffhausen	9	25	34
Solothurn	61	65	126
Schwyz	15	15	30
Thurgau	21	59	80
Ticino	**133**	**112**	**245**
Uri		20	20
Vaud	123	261	384
Valais	37	123	160
Zug	10	1	11
Zürich	127	44	171
Switzerland	979	1917	2896

Source: Swiss Federal Statistical Office (SFSO)

Appendix 4: Location of the conurbations

Name of the conurbations	*Cantonal location*
A0121 Wetzikon-Pfäffikon (ZH)	ZH
A0230 Winterthur	ZH
A0261 Zürich	ZH & SZ
A0351 Bern	BE & FR
A0371 Biel/Bienne	BE
A0404 Burgdorf	BE
A0581 Interlaken	BE
A0942 Thun	BE
A1061 Luzern	LU & NW & SZ
A1344 Lachen	SZ
A1372 Schwyz	SZ
A1509 Stans	NW
A1711 Zug	ZG
A2125 Bulle	FR
A2196 Fribourg	FR
A2546 Grenchen	BE & SO
A2581 Olten-Zofingen	AG & SO
A2601 Solothurn	BE & SO
A2701 Basel (CH)	AG & BL & BS & SO
A2939 Schaffhausen (CH)	SH & ZH
A3203 St. Gallen	AR & OW
A3231 Heerbrugg (CH)	SG
A3271 Buchs (SG) (CH)	SG
A3336 Rapperswil-Jona-Rüti	SG & ZH
A3425 Wil (SG)	SG & TG
A3787 St.Moritz	GR
A3901 Chur	GR
A4001 Aarau	AG & SO
A4021 Baden-Brugg	AG
A4082 Wohlen (AG)	AG
A4201 Lenzburg	AG
A4401 Arbon-Rorschach (CH)	AR & SG & TG
A4436 Amriswil-Romanshorn	TG
A4566 Frauenfeld	TG
A4671 Kreuzlingen (CH)	TG
A5002 Bellinzona	**TI**
A5113 Locarno	**TI**
A5192 Lugano (CH)	**TI**
A5250 Chiasso-Mendrisio (CH)	**TI**
A5586 Lausanne	VD
A5890 Vevey-Montreux	VD & FR
A5938 Yverdon-les-Bains	VD
A6002 Brig-Visp	VS
A6153 Monthey-Aigle	VD & VS
A6248 Sierre-Montana	VS
A6266 Sion	VS
A6421 La Chaux-de-Fonds-Le Locle (CH)	NE
A6458 Neuchâtel	NE
A6621 Genève (CH)	GE & VD
A6711 Delémont	JU
Isolated cities	
9001 Lyss	BE

Source: Swiss Federal Statistical Office (SFSO)

Cantons	*Cantons' abbreviations*
Zürich	ZH
Bern	BE
Vaud	VD
Aargau	AG
St. Gallen	SG
Genève	GE
Luzern	LU
Ticino	**TI**
Valais	VS
Basel-Landschaft	BL
Solothurn	SO
Fribourg	FR
Thurgau	TG
Basel-Stadt	BS
Graubünden	GR
Neuchâtel	NE
Schwyz	SZ
Zug	ZG
Schaffhausen	SH
Jura	JU
Appenzell A.Rh.	AR
Glarus	GL
Nidwalden	NW
Uri	UR
Obwalden	OW
Appenzell I.Rh.	AI
Switzerland	CH

Appendix 5: Socioeconomic characteristics

Name of the conurbation	Popu-lation in 2000	Rank	Active pop. in 2000	Rank	Firms In 2001	Rank	Employees in 2001	Rank
A0261 Zürich	1080728	1	632878	1	62490	1	676040	1
A2701 Basel (CH)	479308	2	254001	2	24362	3	287560	2
A6621 Genève (CH)	471314	3	251833	3	24877	2	255410	3
A0351 Bern	349096	4	197540	4	17659	4	228781	4
A5586 Lausanne	311441	5	164968	5	15973	5	171989	5
A1061 Luzern	196550	6	107307	6	9961	6	107577	6
A3203 St. Gallen	146385	7	79691	7	8415	7	91203	7
A0230 Winterthur	123416	8	68844	8	5664	10	59511	10
A5192 Lugano (CH)	**120800**	**9**	**60048**	**10**	**8345**	**8**	**70633**	**8**
A4021 Baden-Brugg	106736	10	60728	9	5455	11	58786	11
A2581 Olten-Zofingen	101909	11	55961	11	5001	12	55481	12
A1711 Zug	95557	12	55499	12	8236	9	65233	9
A2196 Fribourg	94867	13	50235	13	4563	13	51206	13
A0942 Thun	89522	14	47831	15	4108	17	36914	17
A0371 Biel/Bienne	88896	15	48074	14	4533	14	46291	15
A5890 Vevey-Montreux	81484	16	40905	18	3904	18	31801	20
A4001 Aarau	79883	17	44169	16	4227	16	47077	14
A6458 Neuchâtel	77832	18	40951	17	4250	15	41324	16
A2601 Solothurn	72888	19	40013	19	3555	20	36883	18
A3901 Chur	66235	20	36737	20	3685	19	35272	19
A3425 Wil (SG)	64162	21	34806	21	3109	23	28092	22
A2939 Schaffhausen (CH)	61399	22	32831	22	3248	22	31500	21
A4401 Arbon-Rorschach (CH)	55866	23	30008	23	2719	26	24728	28
A5113 Locarno	**53682**	**24**	**25949**	**27**	**3268**	**21**	**25328**	**26**
A6266 Sion	52226	25	26605	24	2949	24	27586	24
A3231 Heerbrugg (CH)	48992	26	26328	25	2616	27	24766	27
A6421 La Chaux-de-Fonds-Le Locle (CH)	47545	27	23771	29	2386	30	26668	25
A3336 Rapperswil-Jona-Rüti	46337	28	26011	26	2278	31	19331	31
A5002 Bellinzona	**45196**	**29**	**21860**	**30**	**2509**	**28**	**21652**	**29**
A5250 Chiasso-Mendrisio (CH)	**44827**	**30**	**21285**	**31**	**2863**	**25**	**27880**	**23**
A0121 Wetzikon-Pfäffikon (ZH)	44015	31	25141	28	2425	29	21105	30
A6153 Monthey-Aigle	32469	32	16437	34	1538	37	14303	36
A6248 Sierre-Montana	32350	33	16477	33	1700	33	13559	38
A1344 Lachen	31840	34	18074	32	1688	34	10539	46
A6002 Brig-Visp	31083	35	15202	37	1763	32	17249	32
A5938 Yverdon-les-Bains	29774	36	14816	39	1608	35	13444	39
A1509 Stans	27675	37	15684	35	1563	36	14313	35
A0404 Burgdorf	27197	38	15010	38	1469	39	16036	34
A4566 Frauenfeld	27005	39	15364	36	1515	38	16912	33
A4201 Lenzburg	25903	40	14548	40	1367	41	13741	37
A2546 Grenchen	25118	41	13593	41	1176	46	12431	42
A4671 Kreuzlingen (CH)	24978	42	13567	42	1378	40	12954	40
A4436 Amriswil-Romanshorn	24306	43	12825	44	1153	47	10280	48

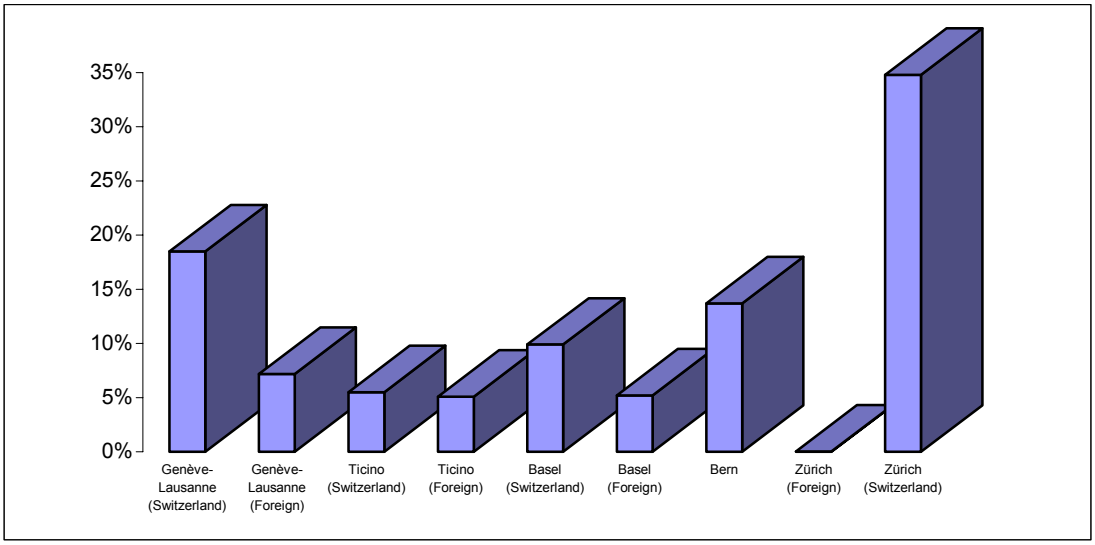
Source: Swiss Federal Statistical Office (SFSO)

Appendix 6: Spatial distribution of the workers (active population employed) inside the conurbations

	Name of the conurbations	Active population 2000	Active population employed 2000	Percentage living in the suburbs	Percent living in the centre town
1	A0261 Zürich	632878	605596	67,0%	33,0%
2	A2701 Basel (CH)	254001	242479	66,0%	34,0%
3	A6621 Genève (CH)	251833	236519	61,2%	38,8%
4	A0351 Bern	197540	189781	62,8%	37,2%
5	A5586 Lausanne	164968	155571	61,7%	38,3%
6	A1061 Luzern	107307	102800	70,1%	29,9%
7	A3203 St. Gallen	79691			
8	A0230 Winterthur	68844			
9	A4021 Baden-Brugg	60728			
10	A5192 Lugano (CH)	60048	56916	78,6%	21,4%
11	A2581 Olten-Zofingen	55961			
12	A1711 Zug	55499			
13	A2196 Fribourg	50235			
14	A0371 Biel/Bienne	48074			
15	A0942 Thun	47831			
16	A4001 Aarau	44169			
17	A6458 Neuchâtel	40951			
18	A5890 Vevey-Montreux	40905			
19	A2601 Solothurn	40013			
20	A3901 Chur	36737			
21	A3425 Wil (SG)	34806			
22	A2939 Schaffhausen (CH)	32831	31477	45,7%	54,3%
23	A4401 Arbon-Rorschach (CH)	30008	28782	77,5%	22,5%
24	A6266 Sion	26605	25213	48,0%	52,0%
25	A3231 Heerbrugg (CH)	26328	25287	86,6%	13,4%
26	A3336 Rapperswil-Jona-Rüti	26011	25083	84,0%	16,0%
27	A5113 Locarno	25949	24438	72,6%	27,4%
28	A0121 Wetzikon-Pfäffikon (ZH)	25141	24275	59,3%	40,7%
29	A6421 La Chaux-de-Fonds-Le Locle (CH)	23771			
30	A5002 Bellinzona	21860	20721	64,4%	35,6%
31	A5250 Chiasso-Mendrisio (CH)	21285	20343	83,2%	16,8%
32	A1344 Lachen	18074			
33	A6248 Sierre-Montana	16477			
34	A6153 Monthey-Aigle	16437			
35	A1509 Stans	15684			
36	A4566 Frauenfeld	15364			
37	A6002 Brig-Visp	15202			
38	A0404 Burgdorf	15010			
39	A5938 Yverdon-les-Bains	14816			

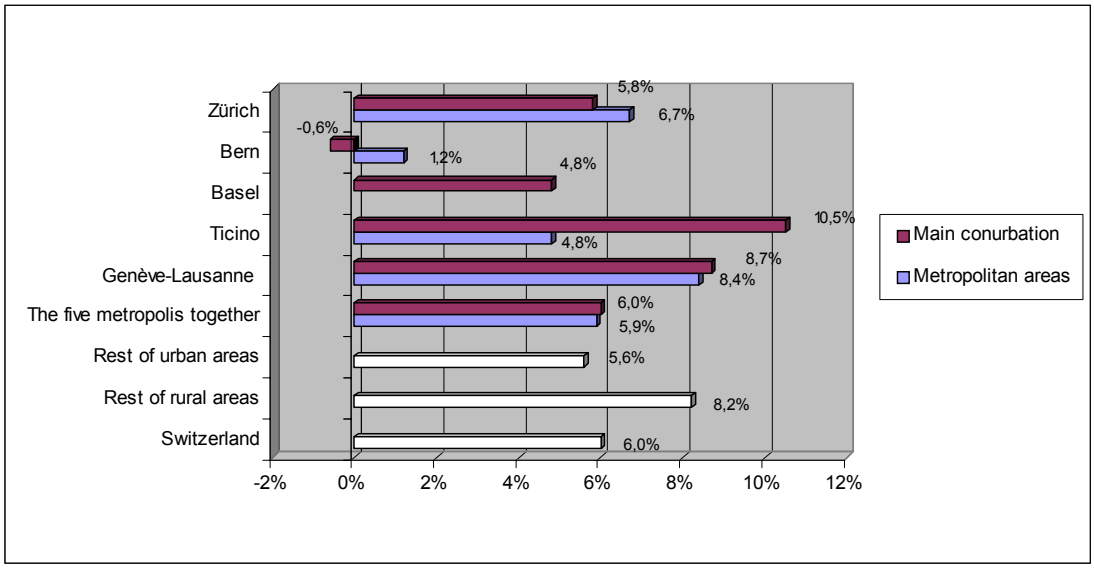
Source: Swiss Federal Statistical Office (SFSO) and personal computations

Appendix 7: Share of population among Swiss metropolis in 2000 (in total: 4,8 mio of inhabitants including foreign areas)



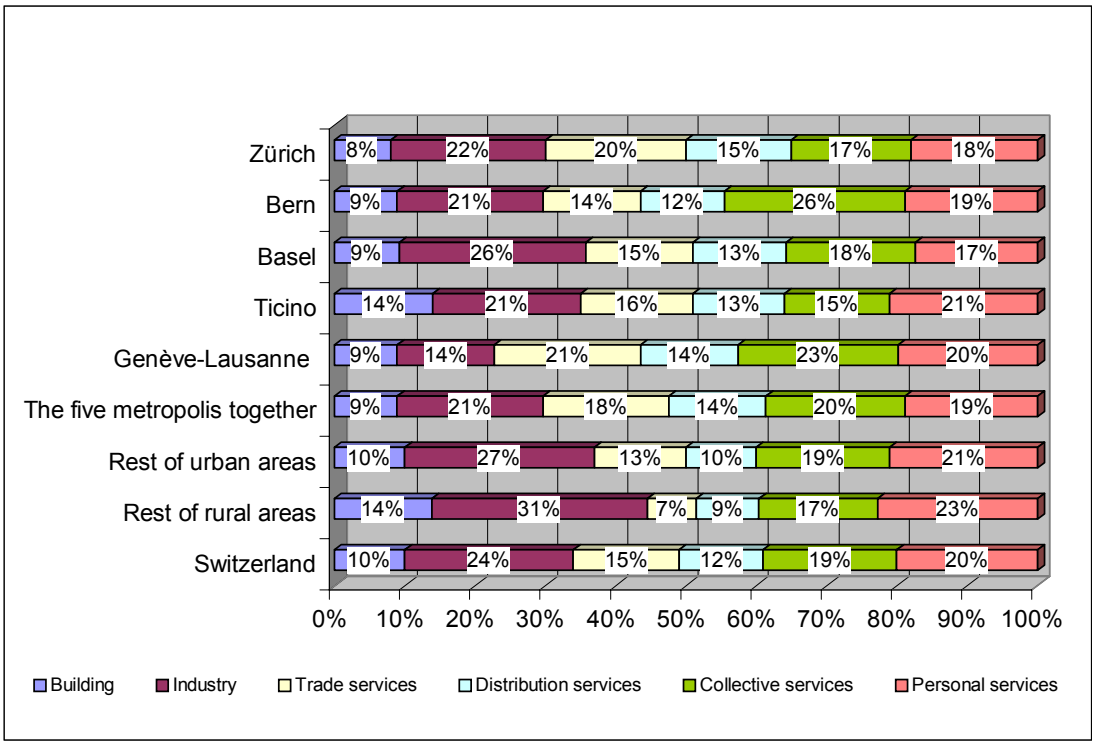
Source: Swiss Federal Statistical Office (SFSO)

Appendix 8: Variation of inhabitants during the period 1990-2000 (including foreign areas)



Source: Swiss Federal Statistical Office (SFSO)

Appendix 9: Share of workers by economic activity over the total of workers in Swiss metropolis in 2001 (including foreign areas)



Source: Swiss Federal Statistical Office (SFSO)

Legend of the economic activities:

Economic sectors	Economic branches
Building	--
Industry	--
Trade services	financial intermediation, insurace, renting and business activities, computer and related activities, software consultancy and supply, other computer services n.e.c.
Distribution services	wholesale trade, transports, communications
Collective services	community and social services
Personal services	retail trade, hotels and restaurants, personal services

Appendix 10: Socioeconomic resources of Lombardia's provinces

Provinces	*Resident population in 2001*	*Share of regional population*	*Firms in 2001*	*Share of firms in 2001*	*Employees in 2001*	*Share of employees*
Varese	814055	9,1%	67.377	8%	283.443	8%
Como	537046	6,0%	46.051	6%	183.751	5%
Lecco	311122	3,5%	25.757	3%	110.892	3%
Sondrio	176565	2,0%	13.969	2%	48.463	1%
Milano	3614108	40,5%	358.075	44%	1.571.877	46%
Bergamo	968723	10,9%	84.261	10%	362.621	11%
Brescia	1106373	12,4%	100.745	12%	407.611	12%
Pavia	489751	5,5%	40.411	5%	131.964	4%
Lodi	195474	2,2%	14.415	2%	53.794	2%
Cremona	334087	3,7%	25.722	3%	96.777	3%
Mantova	375159	4,2%	33.102	4%	131.219	4%
Lombardia	**8922463**	**100%**	**809.885**	**100%**	**3.382.412**	100%

Source: Istat 2001

Appendix 11: Socioeconomic resources of Piemonte's provinces

Provinces	*Resident population in 2001*	*Share of regional population*	*Firms in 2001*	*Share of firms in 2001*	*Employees in 2001*	*Share of employees*
Torino	2165619	51%	182.112	51%	750.588	53%
Vercelli	176829	4%	14.196	4%	54.252	4%
Biella	187249	4%	17.013	5%	70.233	5%
VCO	159040	4%	13.721	4%	44.966	3%
Novara	343040	8%	27.914	8%	115.419	8%
Cuneo	556330	13%	49.618	14%	181.990	13%
Asti	208339	5%	17.138	5%	57.404	4%
Alessandria	418231	10%	35.198	10%	128.953	9%
Piemonte	**4214677**	**100%**	**356.910**	**100%**	**1.403.805**	100%

Source: Istat 2001

Appendix 12: Evolution of the resident economic population[1] 1980-2000

	1980	1990	2000	Share in 2000	Absolute variation '80-'90	Absolute variation '90-'00	Percentage variation '80-'90	Percentage variation '90-'00
RTV	27'153	26'276	27'326	8,9%	-877	1'050	-3.2%	4.0%
RLVM	54'993	56'877	62'217	20,3%	1'884	5'340	3.4%	9.4%
RMVM	45'363	47'713	50'195	16,4%	2'350	2'482	5.2%	5.2%
Bellinzonese	36'849	39'471	42'315	13,8%	2'622	2'844	7.1%	7.2%
Luganese	101'541	111'844	124'793	40,7%	10'303	12'949	10.1%	11.6%
TICINO	**265'899**	**282'181**	**306'846**	**100%**	**16'282**	**24'665**	**6.1%**	**8.7%**

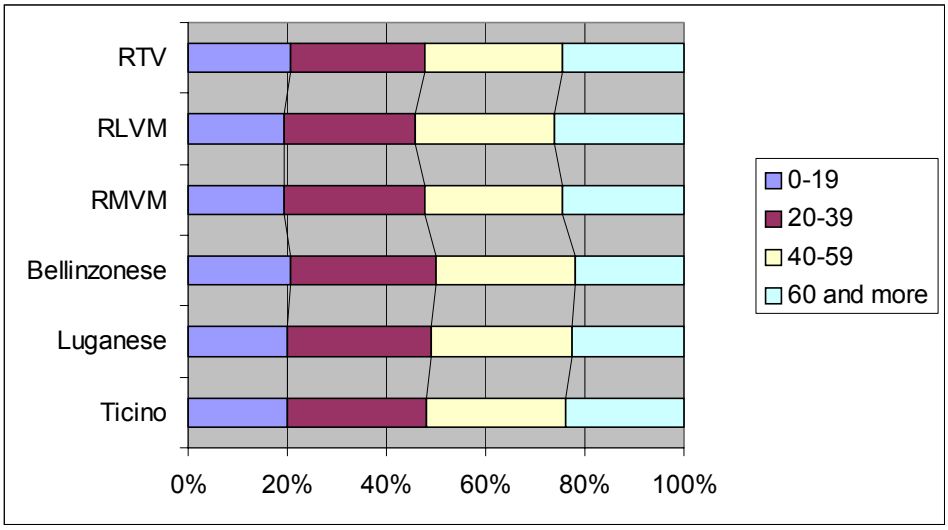
Source: Alberton and Bossi 2004, SFSO data

Appendix 13: Spatial density of the population in 2001

	RTV	RLVM	RMVM	Bellinzonese	Luganese	TICINO
Permanent population at the 31.12.01	28'255	63'112	51'471	43'501	126'624	312'960
Surface(Km2)	1'038.21	1'118.31	126.54	160.83	294.15	2'738.04
Population per Km2 2001	27.2	56.4	406.8	270.5	430.5	114.3
Population per Km2 1999	27.3	56	404.4	267.7	425.4	113.4
Evolution 1999-2001	-0.1	0.4	2.4	2.8	5.1	0.9

Source: Alberton and Bossi 2004, SFSO data

Appendix 14: Age structure of the population in 2000



Source: Alberton and Bossi 2004, SFSO data

[1] The resident economic population includes all the economic inhabitants of a territory. Thus, even foreign people temporarily living on the Swiss territory for working reasons (named "stagionali").

Appendix 15: Graduates in 1990 and 2000

	Percentage of population with high degree in 1990	Percentage of population with high degree in 2000	Variation of the share 1990-2000
RTV	1.4%	2.3%	+0.9%
RLVM	3.3%	4.4%	+1.0%
RMVM	3.1%	4.6%	+1.5%
Bellinzonese	2.8%	4.0%	+1.2%
Luganese	4.7%	6.7%	+2.0%
Ticino	**3.6%**	**5.1%**	**+1.5%**

Source: Alberton and Bossi 2004, SFSO data

Appendix 16: Worker inhabitants by sector in 2000

	Primary sector	Secondary sector	Tertiary sector	Total of workers inhabitants
RTV	514	3249	6022	9785
Share	5,3%	33,2%	61,5%	
RLVM	618	5657	16922	23197
Share	2,7%	24,4%	72,9%	
RMVM	329	3542	15824	19695
Share	1,7%	18,0%	80,3%	
Bellinzonese	307	3685	12616	16608
Share	1,8%	22,2%	76,0%	
Luganese	641	8153	40624	49418
Share	1,3%	16,5%	82,2%	
Ticino	**2409**	**24286**	**92008**	**118703**
Share	**2,0%**	**20,5%**	**77,5%**	

Source: Alberton and Bossi 2004, SFSO data

Appendix 17: Business density (firms each 100 inhabitants) 1998 - 2001

	Firms in 2001	Population the 31st december 2001	Business density in 1998	Business density in 2001	Variation of the share 1998 - 2001
RTV	1359	28255	5.0	4.8	-0.2
RLVM	3833	63112	6.2	6.1	-0.1
RMVM	3107	51471	5.9	6.0	0.1
Bellinzonese	2413	43501	5.5	5.5	0.0
Luganese	8494	126624	6.7	6.7	0.0
TICINO	**19206**	**312960**	**6.2**	**6.1**	**-0.1**

Source: Alberton and Bossi 2004, SFSO data

Appendix 18: Firms 1985 - 2001

	Firms in 1985	Share	Firms in 2001	Share	Percentage variation	Absolute variation	Variation of the share 1985-1998	Variation of the share 1985-2001
RTV	1358	8.2%	1359	7.1%	0	1	-0.9%	-1.2%
RLVM	3686	22.3%	3833	20.0%	0,04	147	-1.9%	-2.4%
RMVM	2758	16.7%	3107	16.2%	0,13	349	-0.8%	-0.5%
Bellinzonese	1852	11.2%	2413	12.6%	0,3	561	1.1%	1.3%
Luganese	6842	41.5%	8494	44.2%	0,24	1652	2.5%	2.7%
TICINO	**16496**		**19206**			**2710**		

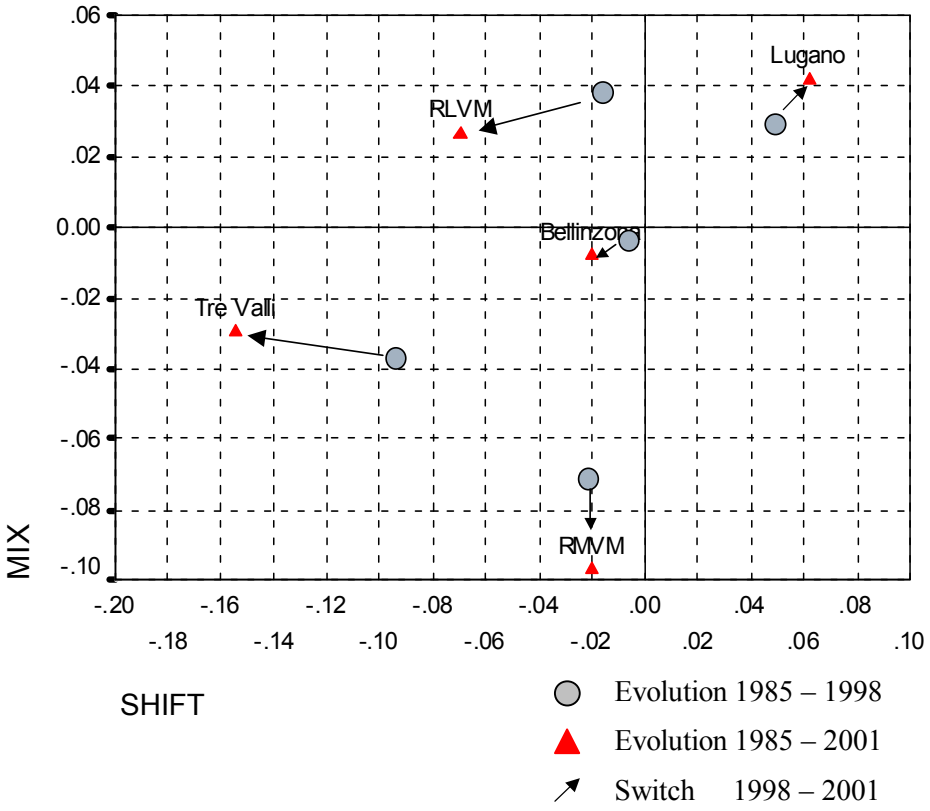
Source: Alberton and Bossi 2004, SFSO data

Appendix 19: Employees 1985 - 2001

	Employees 1985	Share	Employees 2001	Share	Percentage variation	Absolute variation	Variation of the share 1985-1998	Variation of the share 1985-2001
RTV	9637	6.5%	8608	5.4%	-10.7%	-1029	-0.8%	-1.0%
RLVM	27803	18.6%	28380	17.9%	2.1%	577	-0.6%	-0.8%
RMVM	30498	20.4%	28917	18.2%	-5.2%	-1581	-1.5%	-2.2%
Bellinzonese	20022	13.4%	21195	13.3%	5.9%	1173	0.3%	-0.1%
Luganese	61283	41.1%	71713	45.2%	17.0%	10430	3.9%	4.1%
TICINO	**149243**		**158813**			**9570**		

Source: Alberton and Bossi 2004, SFSO data

Appendix 20: Shift and Share analysis (1985-2001)



Source: Alberton and Bossi 2004, SFSO data

The graphic represents the Regional shift (SHIFT) on the horizontal axis and the Industry Mix (MIX) on the vertical axis. The regional values were calculated adapting the Shift and Share analysis (usually applied to a national system) to the cantonal level. Thus, in the computation of the shift and mix effect, Canton Ticino represents the nation with its five "sub-national" regions.

Industry Mix (MIX) identifies fast growing or slow growing economic sectors in a local area based on the cantonal growth rates for individual sectors. Thus, a local area with an above-average share of the cantonal's high-growth industries would have grown faster than a local area with an high share of low-growth economic activities.

The *Regional Shift* (SHIFT) or competitive effect is perhaps the most important component. It highlights a local area's leading and lagging sectors. Specifically, the competitive effect compares a local area's growth rate in an economic sector with the growth rate for that same sector at the cantonal level. A leading sector is one where that sectors' local area growth rate is greater than its cantonal growth rate. A lagging sector is one where the industry's local area growth rate is less than its growth rate.

Appendix 21: Regional sectoral specialisations in 2001

RTV			RLVM			Bellinese			Luganese			RMVM		
>=1 and > = Rj	>=1.5 and >=Rj	Max	>=1 and > = Rj	>=1.5 and >=Rj	Max	>=1 and > = Rj	>=1.5 and >=Rj	Max	>=1 and > = Rj	>=1.5 and >=Rj	Max	>=1 and > = Rj	>=1.5 and >=Rj	Max
Secondary sector			**Secondary sector**			**Secondary sector**			**Secondary sector**			**Secondary sector**		
29	14	23	28	26	16		15	25	33	19	21		17	27
	20			32			22		36	34			18	
	24												30	
	35												31	
	37													
Services			**Services**			**Services**			**Services**			**Services**		
50	91	62	52	55	61	71	64	75	51	65	72		60	63
80	93		70				66		74	67				
90			85				73		92					

NOGA classification
Agriculture, fishing and extraction activities (01-14)
Foodstuffs, drinks and tobacco industries (15-16)
Textile, clothes and shoes industries (17-19)
Wood, paper, petrol, plastic, chemical and other non-metallic products industries (20-26)
Metallic industries (27-28)
Machinery (29)
Electrical, medical, precision and optical instruments (30-31+33)
Television, radio and communications products (32)
Motor vehicles, transport equipment and other industrial products (34-37)
Electricity, gas, water and construction (40-45)
Trade, hotels and restaurants (50-55)
Transports and communications activities (60-64)
Computer, R&D, and business services (65-74)
Health services (85)

Appendix 22: Noga classification of economic activities

NOGA (2 digit)	Branch description in German	Branch description in French	Branch description in Italian
10	Kohle- und Torfgewinnung	Extr. houille, lignite, tourbe	Estr. carbone lignite torba
11	Gew. v. Erdöl u. Erdgas, DL	Extr. hydrocarbures, s. ann.	Estr. idrocarburi, serv. conn.
12	Gew. v. Uran- und Thoriumerzen	Extr. d'uranium et de thorium	Estr. uranio e torio
13	Erzbergbau	Extr. de minerais métalliques	Estr. min. met.
14	Gew. von Steinen und Erden	Autres industries extractives	Altre attività estrattive
15	H. Nahrungsm. und Getränken	Ind. alimentaires et boissons	Ind. alimentari e bev.
16	Tabakverarbeitung	Industrie du tabac	Industria del tabacco
17	Textilgewerbe	Industrie textile	Industria tessile
18	H. v. Bekleidung und Pelzwaren	Ind. habillement et fourrures	Conf. vestiario e pellicce
19	H. v. Lederwaren und Schuhen	Ind. du cuir, de la chaussure	Industria cuoio e calzature
20	Be- und Verarbeitung von Holz	Trav. du bois, f. art. en bois	Ind. legno e prod. in legno
21	Papier- und Kartongewerbe	Ind. du papier et du carton	Industria carta e cartone
22	Verlag, Druck, Vervielfältig.	Edition, impression, reprod.	Editoria stampa riprod.
23	Kokerei, Mineralölverarbeitung	Cokéfaction	Cokeria, raffinazione petrolio
24	Chemische Industrie	Industrie chimique	Industria chimica
25	H. Gummi- und Kunststoffwaren	F. art. caoutchouc, plastique	Fa. art. gomma e mat. plast.
26	H. sonst. nichtmet. Mineralien	F. prod. minéraux non métall.	Fa. altri prod. min. non met.
27	Erzeugung u. Bearb. v. Metall	Métallurgie	Prod. metalli
28	H. von Metallerzeugnissen	Travail des métaux	Fa. prodotti in metallo
29	Maschinenbau	F. de machines et équipements	Fa. macch. e app. mecc.
30	H. Büromasch. und EDV-Geräten	F. mach. de bur., éq. inform.	Fa. macch. ufficio e inf.
31	H. Geräten der El. Erzeugung	F. mach., app. électr. nca	Fa. macch. e app. el. nca
32	H. Geräten Radio/TV Technik	F. éq. radio-TV, communication	Fa. app. radiotelevisivi
33	H. med. und Präzisionsinstr.	F. instr. précision, horlog.	Fa. app. med. e di precisione
34	H. Automob., Anhängern u. Zub.	Industrie automobile	Fa. autov. rimorchi acc.
35	H. von sonstigen Fahrzeugen	F. autres moyens de transport	Fa. altri mezzi di trasporto
36	H. Möbeln/Schmuck/Sportgeräten	F. de meubles, ind. diverses	Fa. mobili, ind. diverse
37	Rückgewinnung und Recycling	Récup., prép. au recyclage	Recupero e riciclaggio
40	Energieversorgung	P. électricité, gaz et eau	Prod. e distr. energia e gas
41	Wasserversorgung	Captage, distribution d'eau	Raccolta e distr. acqua
45	Baugewerbe	Construction	Costruzioni
50	Handel, Reparatur Automobilen	C., rép. véhicules automobiles	Commercio e ripar. autov.
51	GH und HV	Cg et ic	Ci. e ic.
52	Detailhandel und Reparatur	Cd et rép. d'art. domestiques	Cd.; ripar. beni personali
55	Gastgewerbe	Hôtellerie et restauration	Alberghi e ristoranti
60	Landverkehr/Rohrfernleitungen	Transports terrestres	Trasp. terrestri, condotte
61	Schiffahrt	Transports par eau	Trasp. per vie d'acqua
62	Luftfahrt	Transports aériens	Trasp. aerei
63	Hilfs-/Nebentätigk. f. Verkehr	S. auxiliaires de transports	Att. ausiliarie dei trasporti
64	Nachrichtenübermittlung	Postes et télécommunications	Poste e telecomunicazioni
65	Kreditgewerbe	Intermédiation financière	Attività finanziarie
66	Versicherungsgewerbe	Assurances	Assicurazioni
67	M. Kredit/Vers. verb. Tätigk.	S. aux. fin. et d'assurance	Servizi ausiliari
70	Immobilienwesen	Activités immobilières	Attività immobiliari
71	Vermietung beweglicher Sachen	Loc. de mach. et éq. sans op.	Nol. macchinari senza oper.
72	Informatikdienste	Activités informatiques	Informatica
73	Forschung und Entwicklung	Recherche et développement	Ricerca e sviluppo
74	DL für Unternehmen	A. s. fournis aux entreprises	Altre attività professionali
75	Öff. Verw., Landesverteidigung	Adm. publ., défense, social	Pubblica amm.; difesa
80	Unterrichtswesen	Enseignement	Istruzione
85	Gesundheits- und Sozialwesen	Santé et activités sociales	Sanità e servizi sociali
90	Abfallbeseitigung/-entsorgung	Assainissement, voirie	Smaltimento rifiuti e acque
91	Interessenvertr./Vereinigungen	Activités associatives	Attività organ. associative
92	Unterhaltung, Kultur, Sport	Activ. récréatives, sportives	Att. ricreative, culturali
93	Persönliche Dienstleistungen	Services personnels	Servizi personali

Appendix 23: Main characteristics of firms by region

VARIABILE	RLVM	RMVM	RTV	DISTRIBUZIONE (RLVM)	DISTRIBUZIONE (RMVM)	DISTRIBUZIONE (RTV)
Dimensione in termini d'addetti	**10 addetti**	**12 addetti**	**8 addetti**	- l' 81% meno di 10 addetti - il 90% meno di 20 addetti - il 95% meno di 39 addetti - il 4% più di 50 addetti	- l'84% meno di 10 addetti - il 91% meno di 20 addetti - il 95% meno di 41 addetti - il 3.8% più di 50 addetti	- l'84% ha meno di 10 addetti - il 92% ha meno di 20 addetti - il 96,4% ha meno di 40 addetti - il 2,5% più di 50 addetti
Forma giuridica	**Un'impresa giuridicamente autonoma** (73%)	**Un'impresa giuridicamente autonoma** (63%)	**Un'impresa giuridicamente autonoma** (79.1%)	- Le imprese affiliate a un gruppo (27%), si dividono in: - il 64% una filiale - il 36 % una casa madre	- Le imprese affiliate a un gruppo (37%), si dividono in: - il 90% una filiale - una casa madre	
Origine	**Non sono generate da spin-off**	**Non sono generate da spin-off**	**Non sono generate da spin-off**	solo l'12% è frutto di spin-off	solo il 6% è frutto di spin-off	Solo l'8.3% è frutto di spin-off
Qualifica del personale	**Personale qualificato non accademico** (44%)	**Personale non qualificato** (35%)	**Personale qualificato non accademico** (50%)	- 27% personale non qualificato - 19% personale semi-qualificato non accademico - 6% personale accademico - 4% apprendisti	- 34% Personale qualificato non accademico - 23% personale semi-qualificato non accademico - 6% personale accademico - 2% apprendisti	- 22% personale non qualificato - 15% personale semi-qualificato non accademico - 8% apprendisti - 5% personale accademico
Provenienza del personale impiegato	**RLVM** (50%)	**Zona di frontiera** (46.5%)	**RTV** (77%)	- 29% Ticino - 16% Zona di Frontiera - 4% Svizzera - 1% Estero	- 42% RMVM - 8.6% Ticino - 1.2% Svizzera - 2% Estero	- 21% Ticino - 1% Zona di Frontiera - 0% Svizzera - 1% Estero
Personale suddiviso per funzione	**Produttive** (67%)	**Produttive** (64%)	**Produttive** (71%)	- 12% Logistiche e di distribuzione - 12% Amministrative - 9% Direttive	- 15% Logistiche e di distribuzione - 11% Amministrative - 10% Direttive	- 13% Direttive - 9 % Amministrative - 5% Logistiche e di distribuzione - 2 % R&S
Cifra d'affari mediana per addetto	**Fr. 113'333**	**Fr. 178'571**	**Fr. 147'500**	Media: 257'788	Media: 540'134	Media: 431'286
% della CA realizzata grazie alle esportazioni (media)	**20%**	**33%**	**10%**	- Il 58% non esporta! - Il 72% esporta meno della media (20%) - Il 16% realizza più del 50% della CA all'estero	- Il 41% non esporta! - Il 59% esporta meno della media (33%) - Il 38% realizza più del 50% della CA all'estero	- Il 76% non esporta! - Il 80% esporta meno della media (10%) - Il 7 % realizza più del 50% della CA all'estero
Spese media degli ultimi tre anni in Ricerca & Sviluppo		**48 %** 0 - 50'000 **20 %** 50'000 – 100'000 **7 %** 100'000 – 150'000 **1 %** 150'000 – 200'000 **24 %** 200'000 - …	**54.4 %** nessuna **21.2 %** 0 - 50'000 **9.6 %** 50'000 – 100'000 **7.2 %** 100'000 – 150'000 **2.8 %** 150'000 – 200'000 **4.8 %** 200'000 - …			
Commercializzazione	Sul mercato finale **(73%)**	Sul mercato finale **(65%)**	Sul mercato finale **(81%)**			
Genere delle forniture	**85%** Input produttivi **2%** Ricerca e Sviluppo **11%** Trasporti e logistica **2%** Finanziamenti	**53%** Input produttivi **41%** Ricerca e Sviluppo **5%** Trasporti e logistica **1%** Finanziamenti	**79.1%** Input produttivi **2.9 %** Ricerca e Sviluppo **7.9 %** Trasporti e logistica **10.1%** Finanziamenti			
Origine delle forniture	**14%** RLVM **34%** TI **38%** CH **5%** Zona di frontiera **10%** Estero	**17%** RMVM **32%** TI **30%** CH **6%** Zona di frontiera **15%** Estero	**46.3 %** RTV **27.7 %** TI **16.6 %** CH **0.9 %** Zona di frontiera **8.5 %** Estero			

(…)

VARIABILE	RLVM	RMVM	RTV
Fattori di produzione	**62%** fattore lavoro; **38%** fattore capitale	**70%** fattore lavoro; **30%** fattore capitale	**64.1%** fattore lavoro; **35.9%** fattore capitale
Grado di automazione	**L'80%** dispone di un sistema di gestione informatica integrata dell'impresa **Il 40%** dispone di una rete informatica interna (Intranet) **L'18%** dispone di una rete informatica parzialmente aperta (Extranet) **L'82%** dei PC è allacciato a Internet Possiede circa un PC ogni due addetti (**0,4 PC per addetto**) I PC sono utilizzati essenzialmente per la gestione e l'amministrazione **(57%)**, segue la produzione **(16%),** il marketing e la vendita **(15%)**, la logistica e la distribuzione **(7%)**, e la Ricerca e Sviluppo **(5%).**	**Il 67%** dispone di un sistema di gestione informatica integrata dell'impresa **Il 63%** dispone di una rete informatica interna (Intranet) **Il 32%** dispone di una rete informatica parzialmente aperta (Extranet) **L'89%** è PC allacciato a Internet Possiede circa un PC ogni due addetti (**0,39 PC per addetto**) I PC sono utilizzati essenzialmente per la gestione e l'amministrazione **(48%)**, segue la produzione **(25%),** il marketing e la vendita **(13%)**, la logistica e la distribuzione **(11%)** e la Ricerca e Sviluppo **(5%).**	**Il 23.9 %** dispone di un sistema di gestione informatica integrata dell'impresa **Il 42.9 %** dispone di una rete informatica interna (Intranet) **Il 25.2 %** dispone di una rete informatica parzialmente aperta (Extranet) **Il 72.2 %** dei PC è allacciato a Internet Possiede circa un PC ogni due addetti (**0,43 PC per addetto**) I PC sono utilizzati essenzialmente per la gestione e l'amministrazione **(54.4%),** segue la produzione **(22.4%),** il marketing e la vendita **(10.5%)**, la Ricerca e Sviluppo **(5.8%)**, e la logistica e la distribuzione **(5.6%).**
Cambiamenti previsti	**Il 15%** pensa di delocalizzare la propria produzione o parte di essa La maggior parte di questi, pensa di andare **in un'altra zona del Ticino (43%)**	**Il 20%** pensa di delocalizzare la propria produzione o parte di essa La maggior parte di questi, pensa di andare **all'Estero (40%)**	**I'8.9%** pensa di delocalizzare la propria produzione o parte di essa La maggior parte di questi, pensa di andare **in un'altra zona del Ticino (46.7%)**
Ampliamento dell'attività	**Il 51%** pensa di ampliare la propria attività Strategie in ordine di priorità: aumento del personale, introduzione di ICTs, introduzione di nuovi servizi o prodotti, operare su nuovi mercati	**Il 44%** pensa di ampliare la propria attività Strategie in ordine di priorità: introduzione di nuovi servizi o prodotti, aumento del personale, operare su nuovi mercati e introduzione di ICTs	**Il 23.9 %** pensa di ampliare la propria attività Strategie in ordine di priorità: introduzione di ICTs, adottare nuove logiche organizzative, costruzione di nuovi stabili, e operare su nuovi mercati

Source: Alberton and Bossi (2002, 2003a, 2004a)

Informatics' and communication technologies

Compared to the national situation the diffusion of ICTs among the firms of the three regions is lower (Arvanitis et al. 2004, pag. 127 and Alberton and Bossi 2002, 2003a, 2004a): in Switzerland 98% of the firms has at least one PC, while in RLVM only the 94,8%, in RMVM the 95,9% and in RTV the 91,2%. Moreover, Internet is present in 95% of the Swiss firms, while in the three Ticino's region do not overcome the 89%. By contrast, Intranet and Extranet are more diffused in Ticino's firms. In fact, in Switzerland they are respectively used by the 38% and 15% of the firms.

Appendix 24: Firms in the IRE' sample by regions and economic activities

	RTV	RMVM	RLVM	SECTOR	TOTAL
MAIN ECONOMIC ACTIVITY					
Agriculture, fishing and extraction activities (01-14)	9	8	9		26
TOTAL PRIMARY SECTOR				**26**	
Foodstuffs, drinks and tobacco industries (15-16)	6	12	9		27
Textile, clothes and shoes industries (17-19)	2	16	8		26
Wood, paper, petrol, plastic, chemical and other non-metallic products industries (20-26)	17	29	39		85
Metallic industries (27-28)	14	27	31		72
Machinery (29)	0	8	8		16
Electrical, medical, precision and optical instruments (30,31 & 33)	4	19	14		37
Television, radio and communications products (32)	1	2	2		5
Motor vehicles, transport equipment and other industrial products (34-37)	5	14	18		37
Electricity, gas, water and construction (40-45)	54	89	133		276
TOTAL SECONDARY SECTOR				**581**	
Trade, hotels and restaurants (50-55)	96	386	349		831
Transports and communications activities (60-64)	15	80	19		114
Computer, R&D, and business services (65-74)	39	177	190		406
Health services (85)	12	52	54		118
TOTAL TERTIARY SECTOR				**1469**	
TOTAL	**274**	**919**	**883**		**2076**

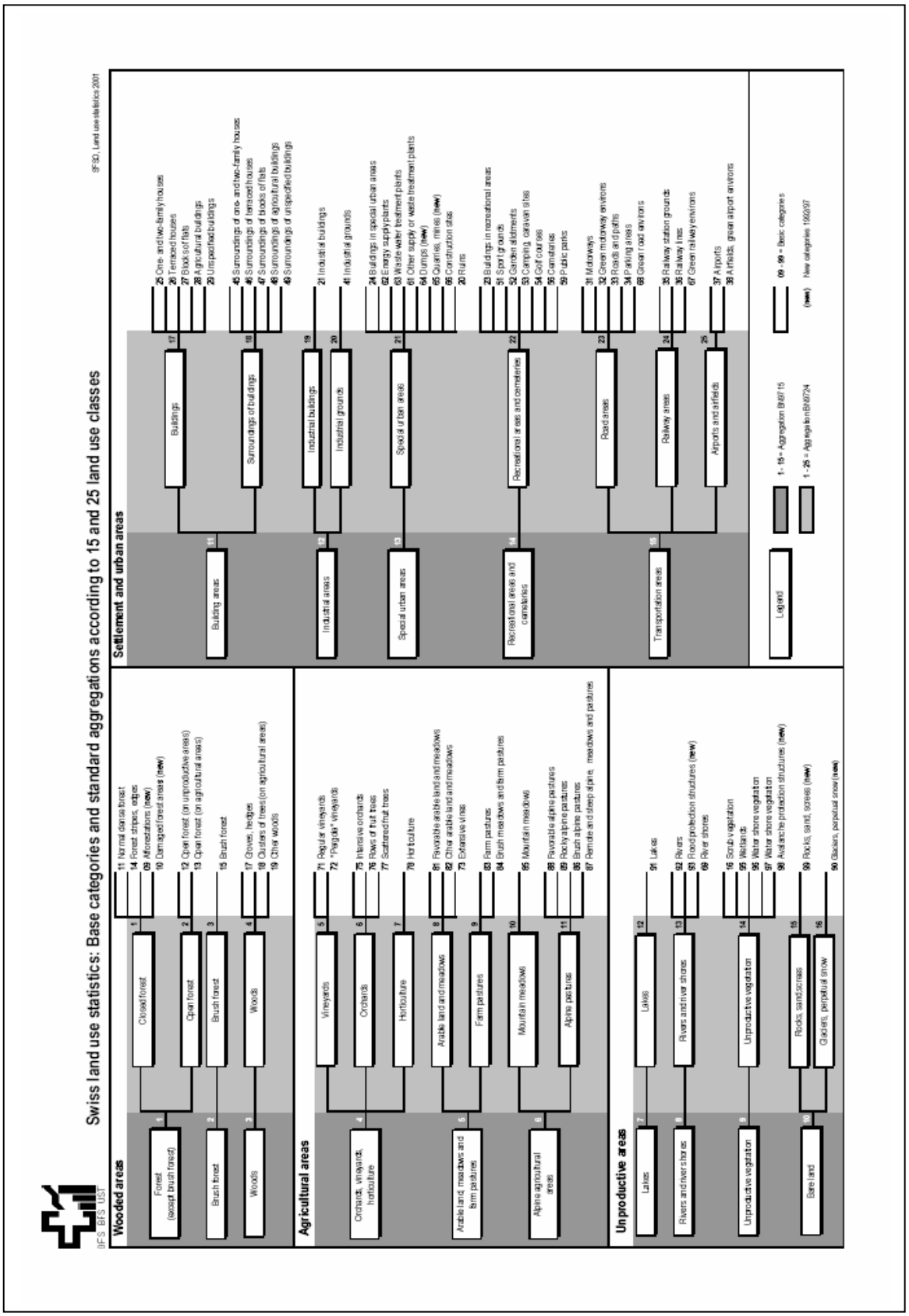
Source: IRE' surveys

Appendix 25: Firms in the KOF' sample by economic activities

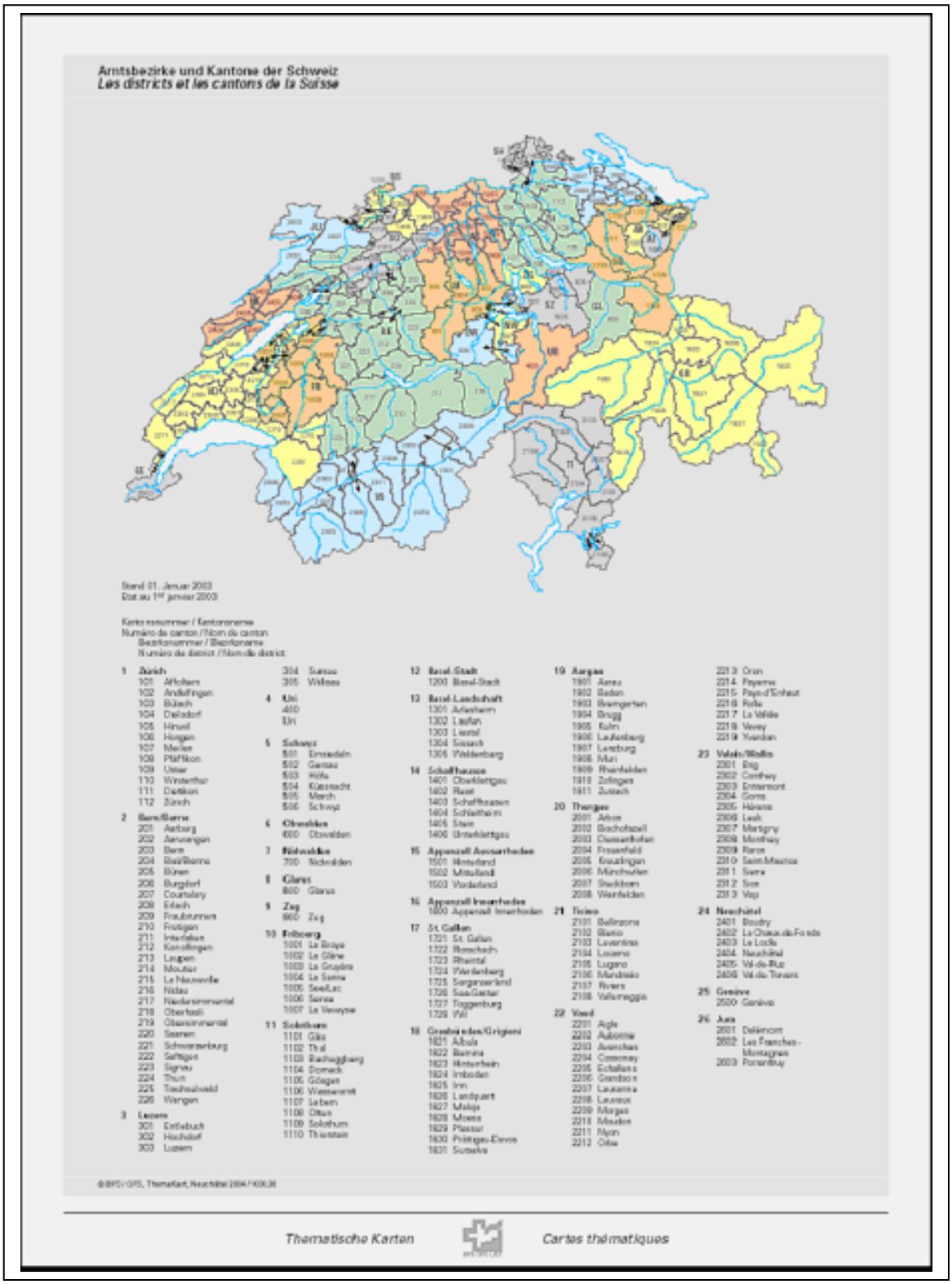
	SECTOR	TOTAL
MAIN ECONOMIC ACTIVITY		
Agriculture, fishing and extraction activities (01-14)		1
TOTAL PRIMARY SECTOR	**1**	
Foodstuffs, drinks and tobacco industries (15-16)		108
Textile, clothes and shoes industries (17-19)		59
Wood, paper, petrol, plastic, chemical and other non-metallic products industries (20-26)		394
Metallic industries (27-28)		222
Machinery (29)		221
Electrical, medical, precision and optical instruments (30-31+33)		188
Television, radio and communications products (32)		40
Motor vehicles, transport equipment and other industrial products (34-37)		80
Electricity, gas, water and construction (40-45)		269
TOTAL SECONDARY SECTOR	**1581**	
Trade, hotels and restaurants (50-55)		500
Transports and communications activities (60-64)		139
Computer, R&D, and business services (65-74)		335
Health services (85)		1
TOTAL TERTIARY SECTOR	**975**	
TOTAL		**2557**

Source: KOF' survey

Appendix 26: Settlement and urban areas definition (SFSO)



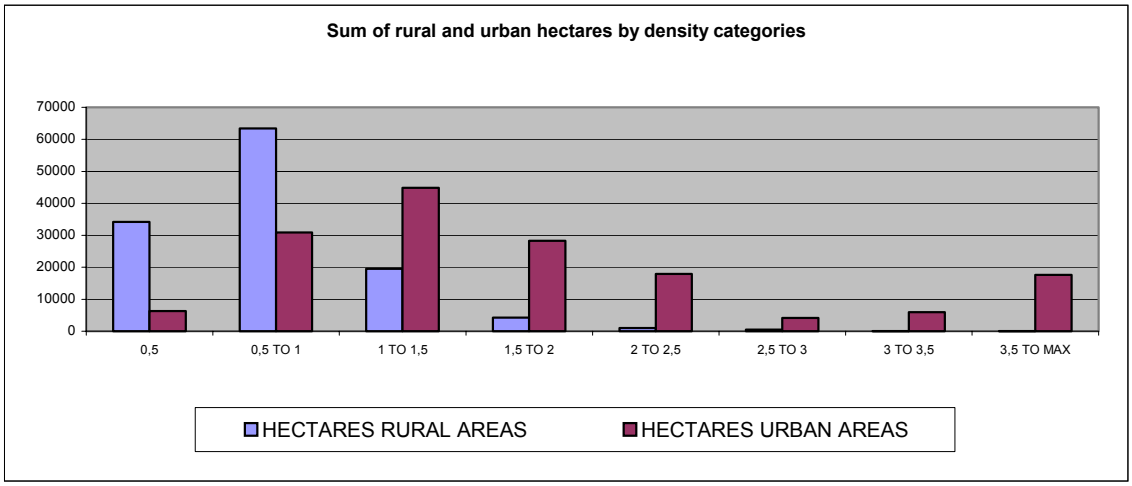
Appendix 27: Districts of Switzerland



Source: SFSO

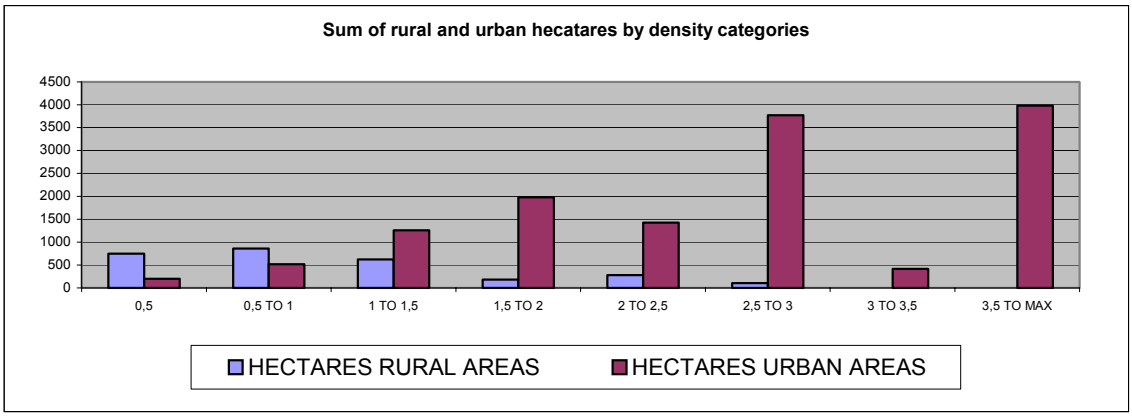
Appendix 28: Distribution of rural and urban areas by density categories in Switzerland
(after having assigned each municipality and district to a density category observing its total density)

Municipalities



Source: SFSO data and personal elaboration

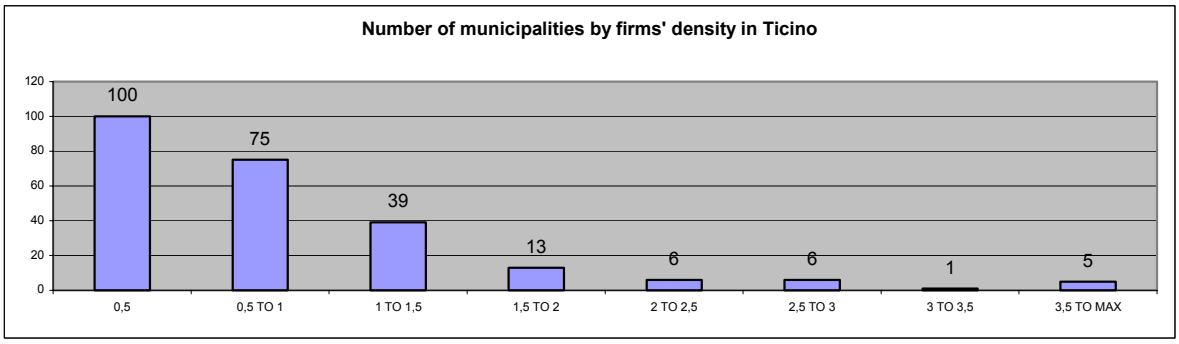
Districts



Source: SFSO data and personal elaboration

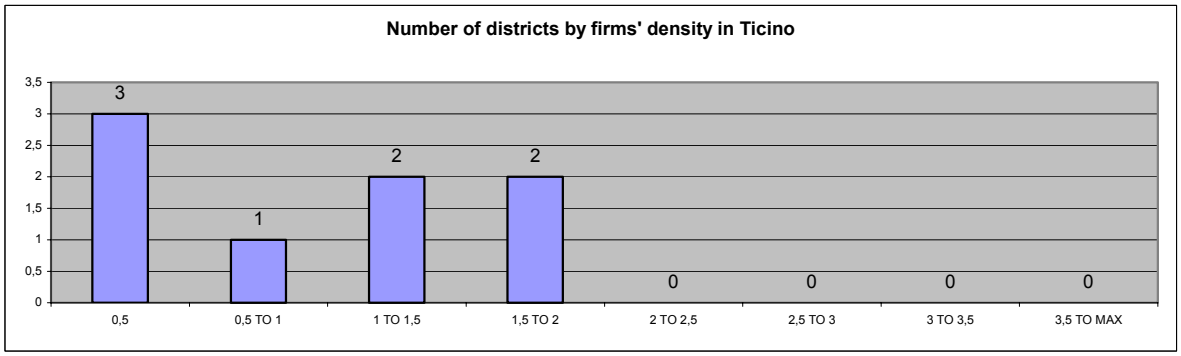
Appendix 29: Distribution of municipalities and districts by density in Ticino

Municipalities



Source: SFSO data and personal elaboration

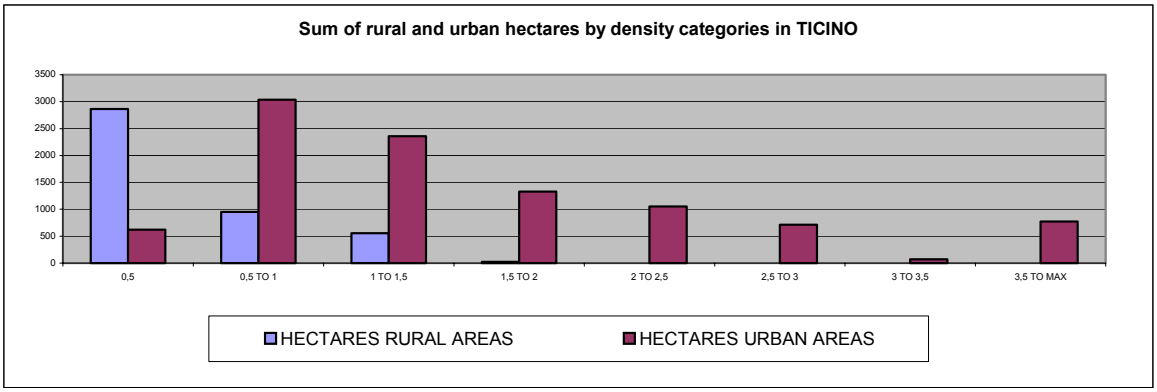
Districts



Source: SFSO data and personal elaboration

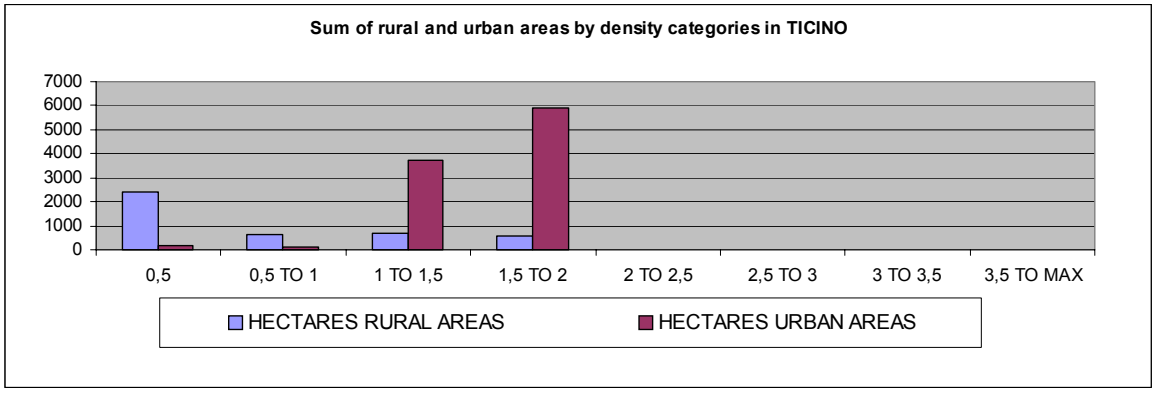
Appendix 30: Distribution of rural and urban areas by density categories in TICINO (after having assigned each municipality and district to a density category observing its total density)

Municipalities



Source: SFSO data and personal elaboration

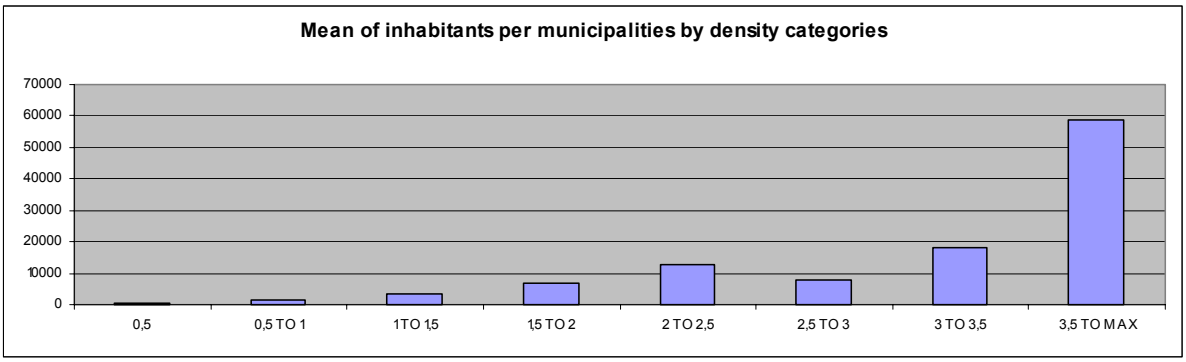
Districts



Source: SFSO data and personal elaboration

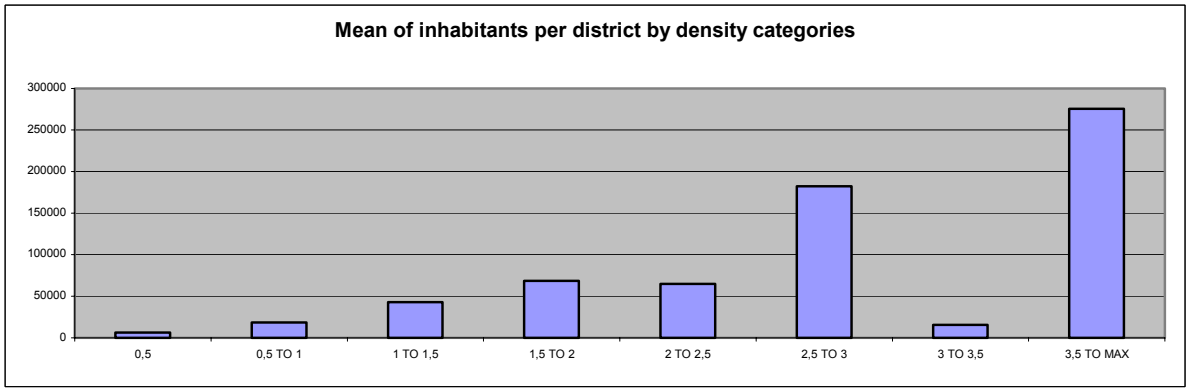
Appendix 31: Inhabitants per municipality and per district by density categories

Municipalities



Source: SFSO data and personal elaboration

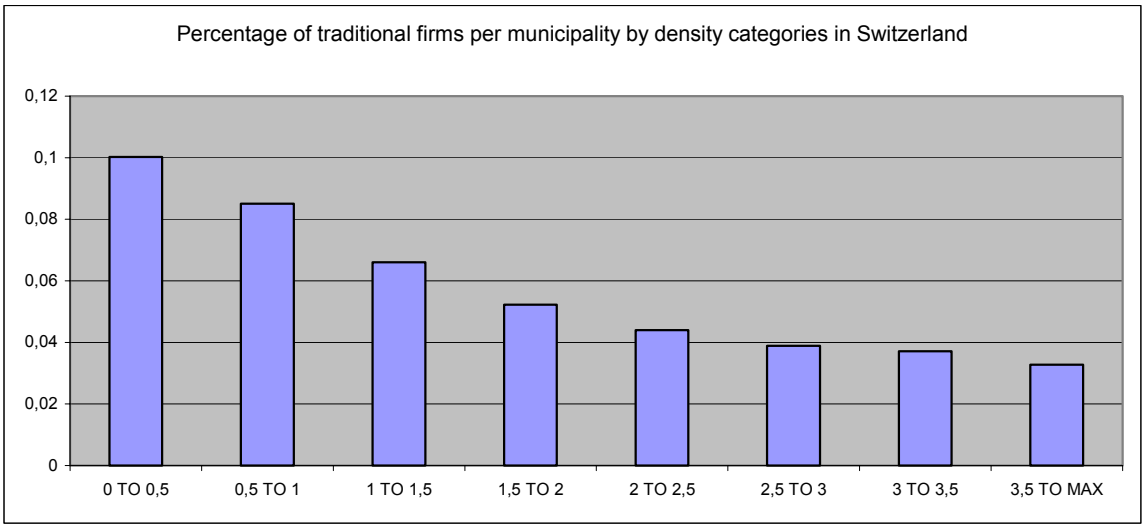
Districts



Source: SFSO data and personal elaboration

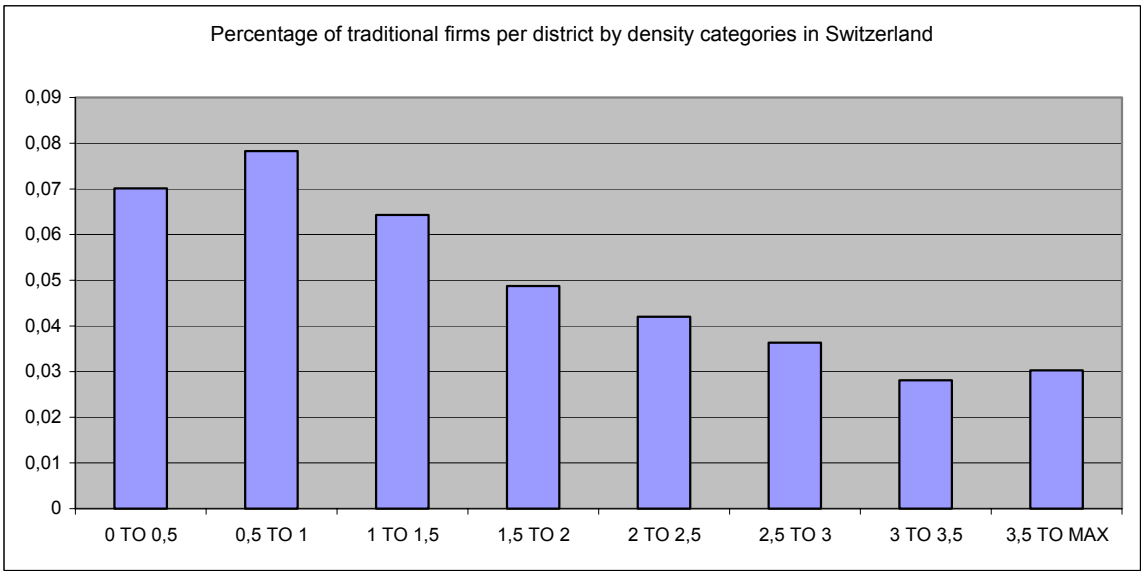
Appendix 32: Traditional firms by firms' density categories

Municipalities



Source: SFSO data and personal elaboration

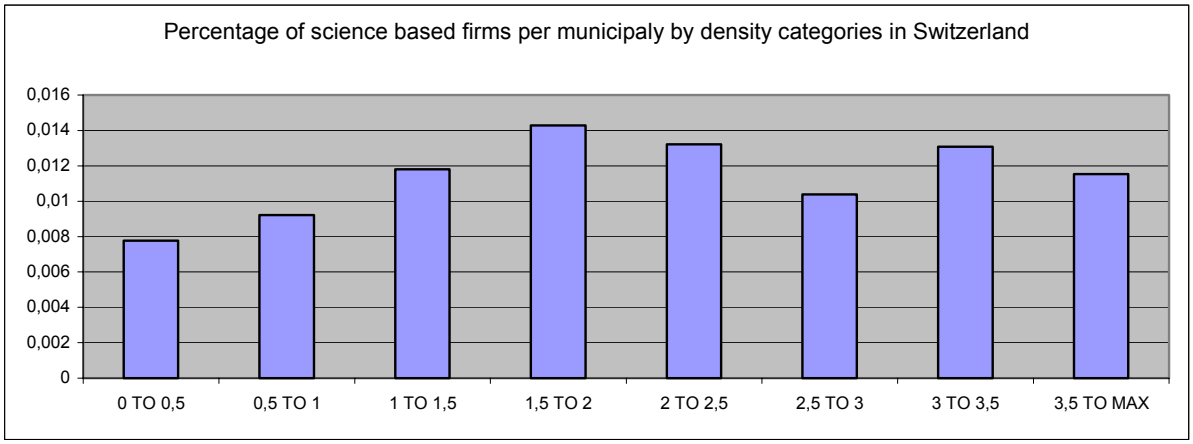
Districts



Source: SFSO data and personal elaboration

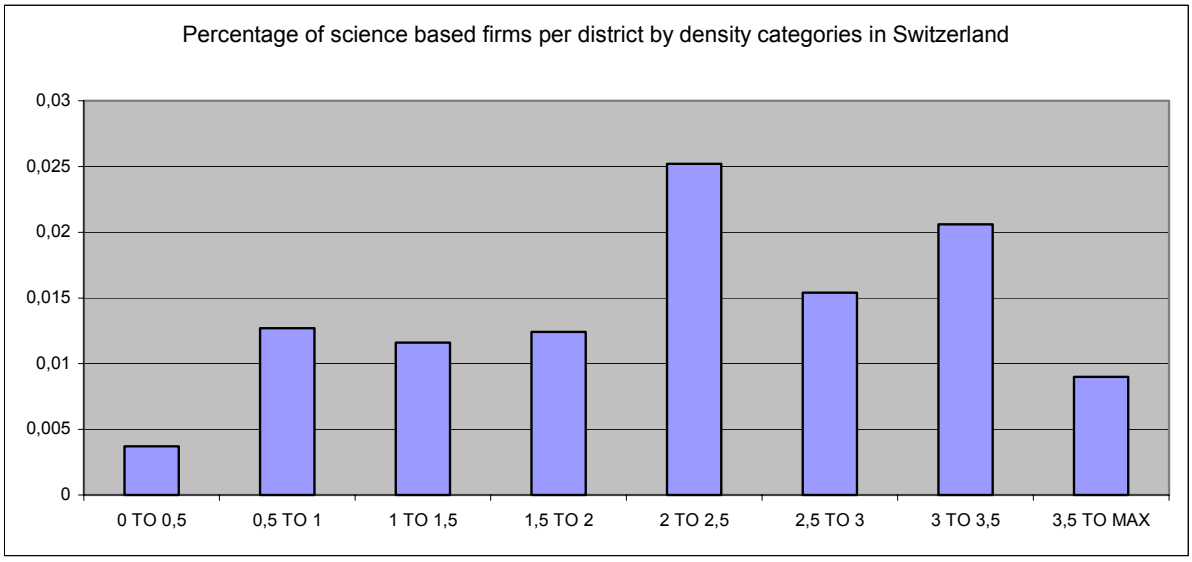
Appendix 33: Science based firms by firm's density categories

Municipalities



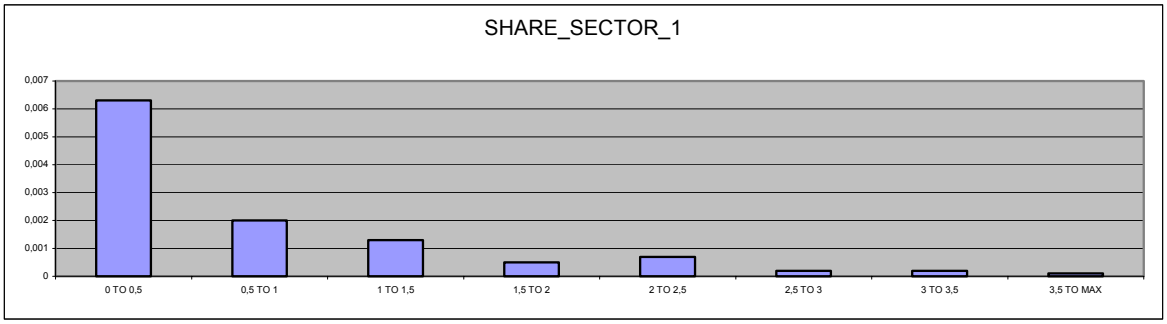
Source: SFSO data and personal elaboration

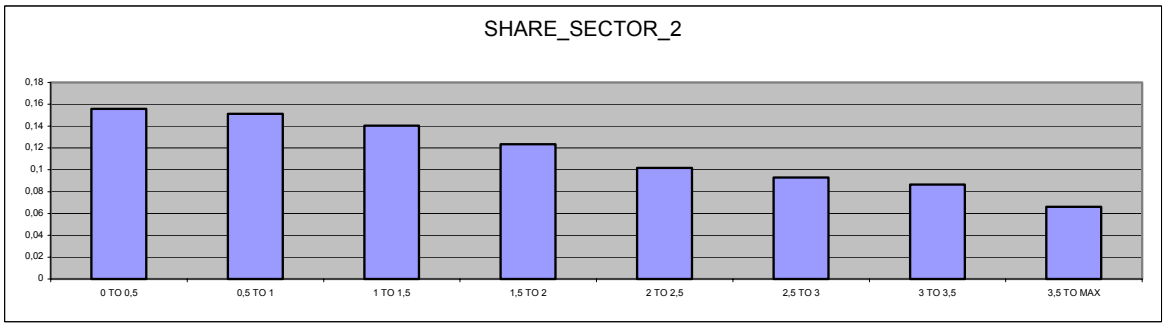
Districts

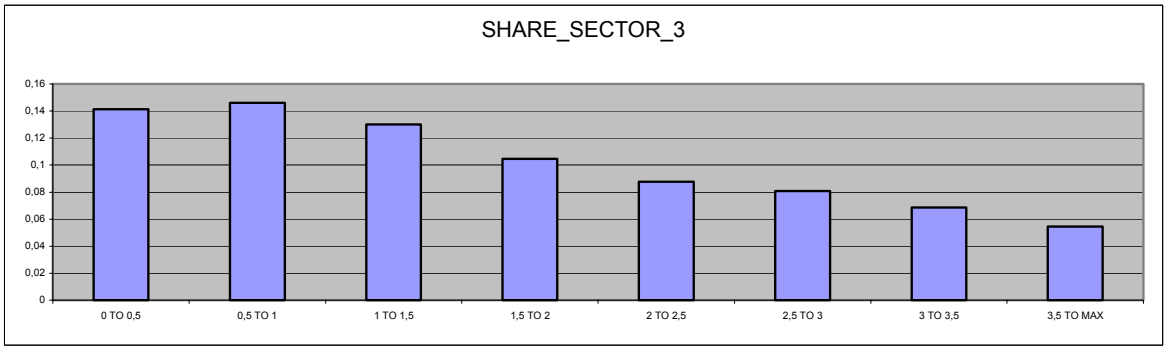


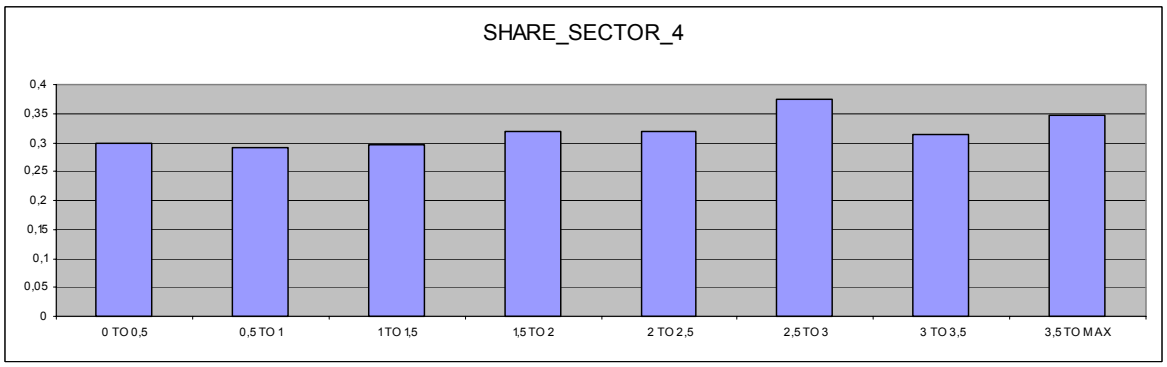
Source: SFSO data and personal elaboration

Appendix 34: Economic sectoral concentration per municipality by density categories

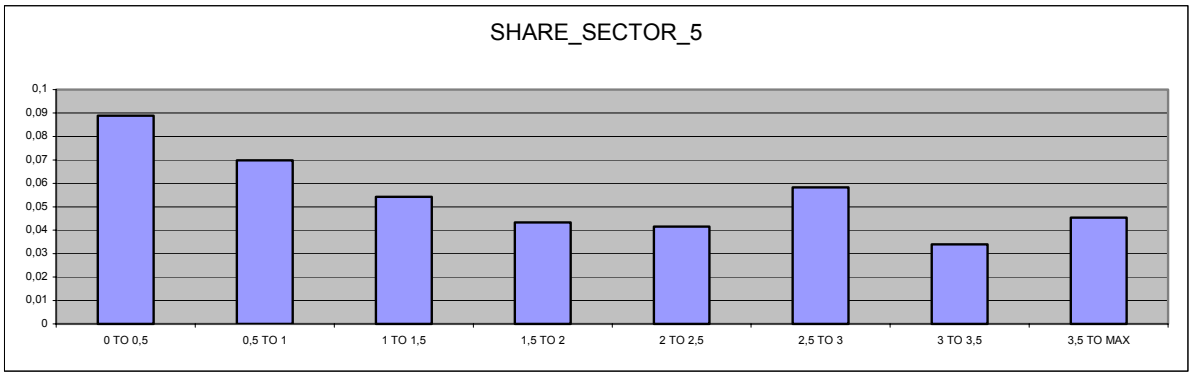


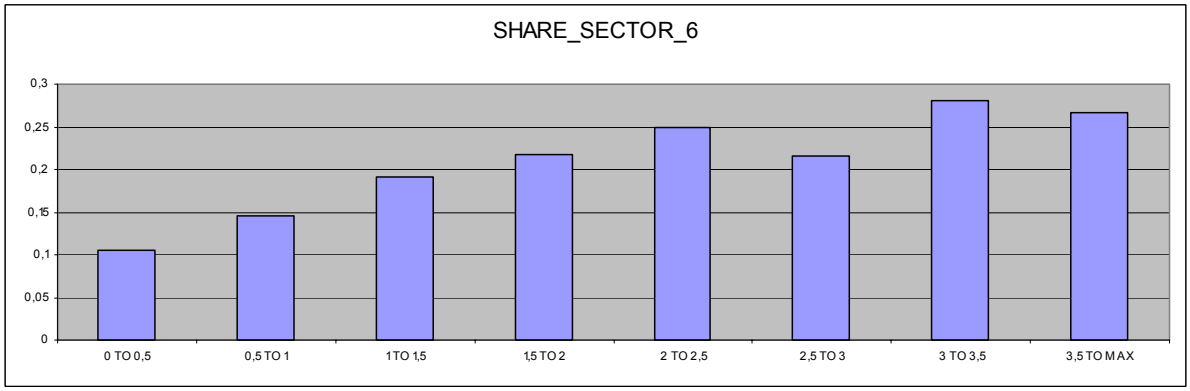


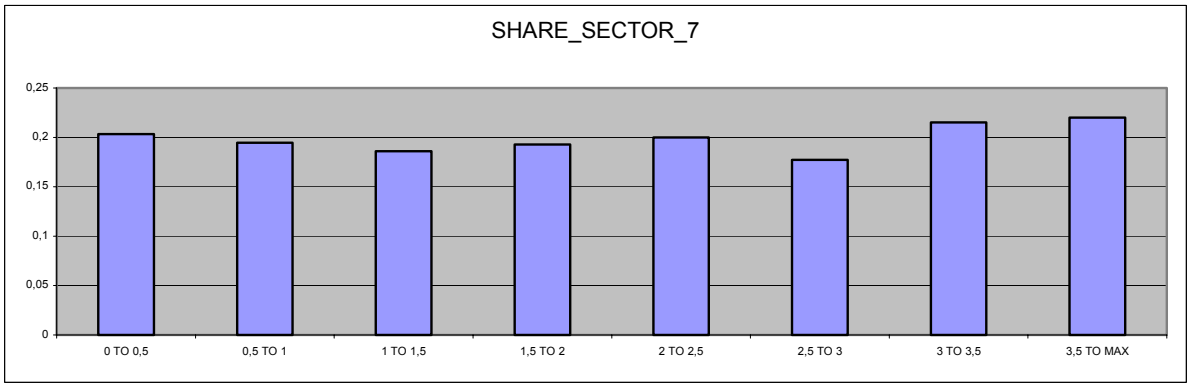




(…)

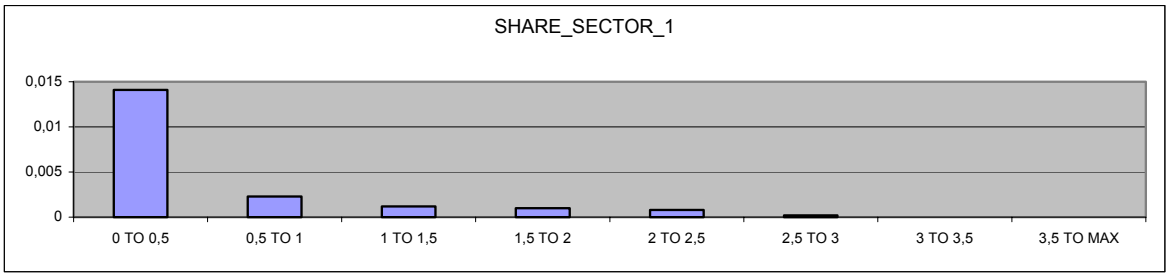


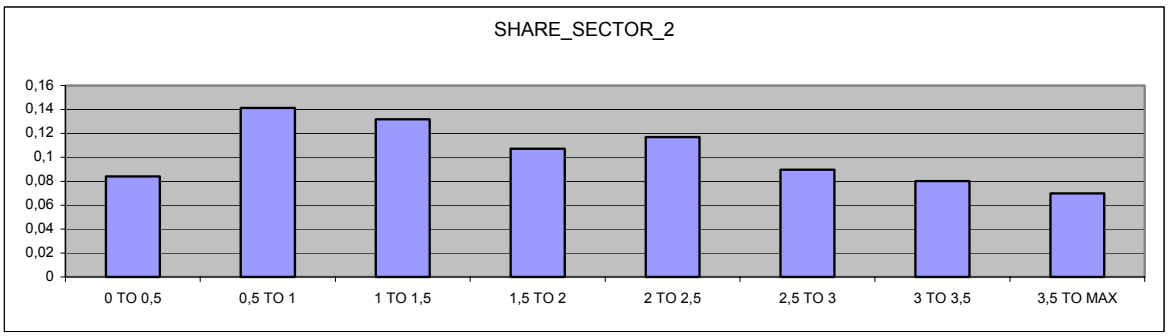


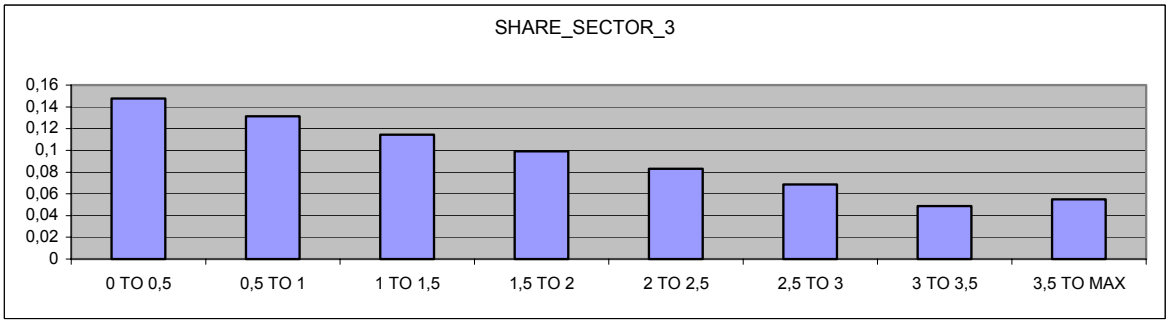


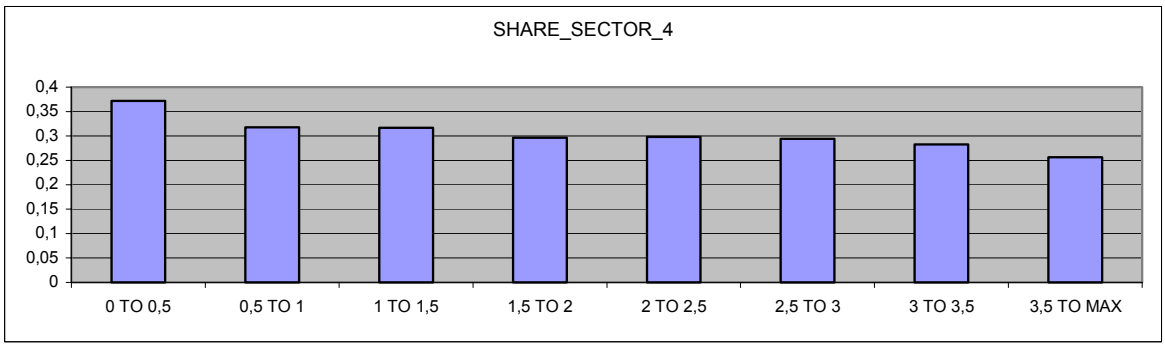
Source: SFSO data and personal elaboration

Appendix 35: Economic sectoral concentration per district by density categories









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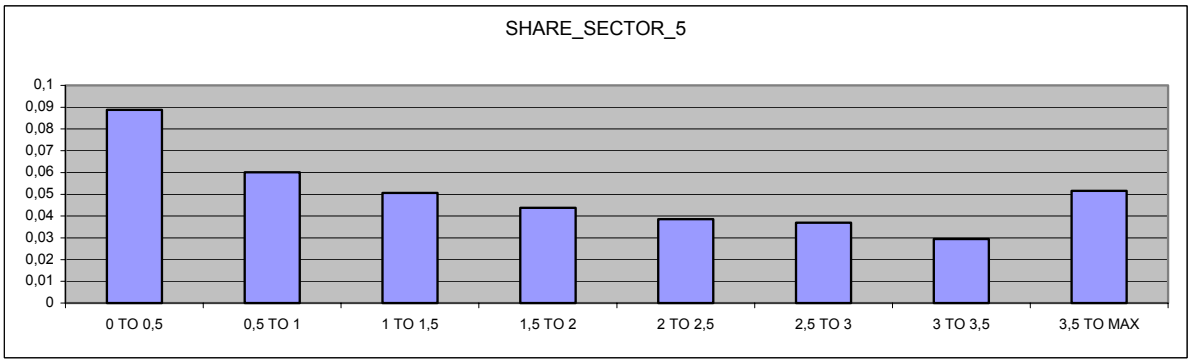
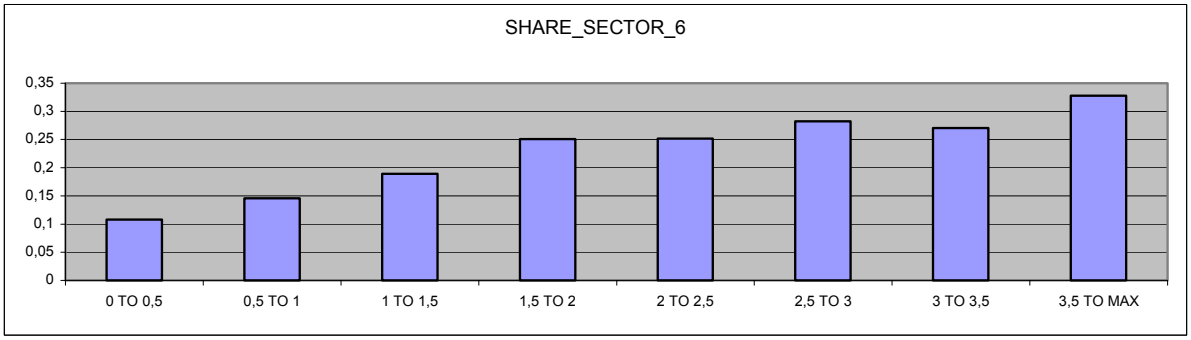
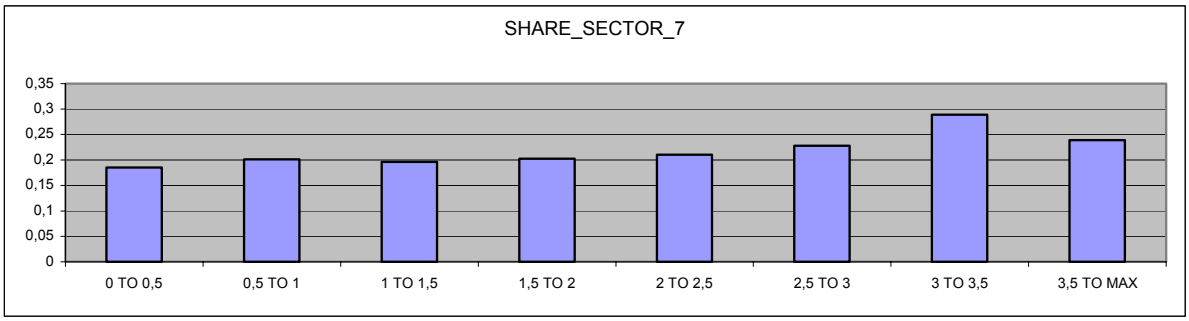


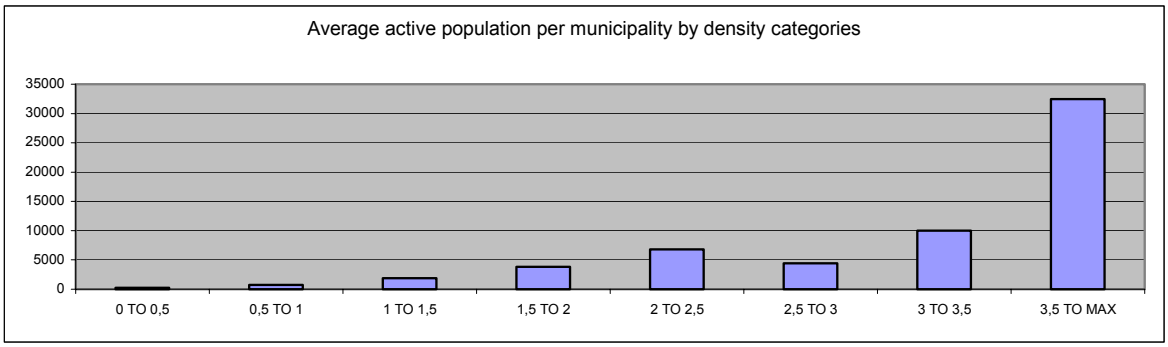




Source: SFSO data and personal elaboration

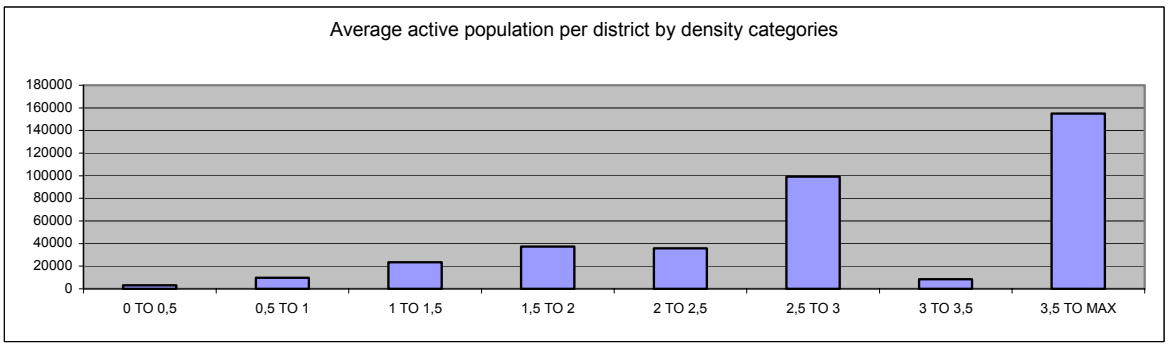
Appendix 36: Average active population per municipality and district by density category

Municipalities



Source: SFSO data and personal elaboration

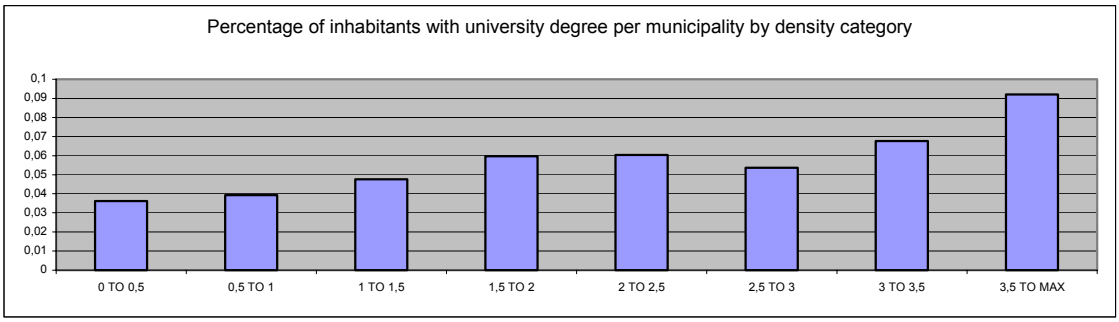
Districts

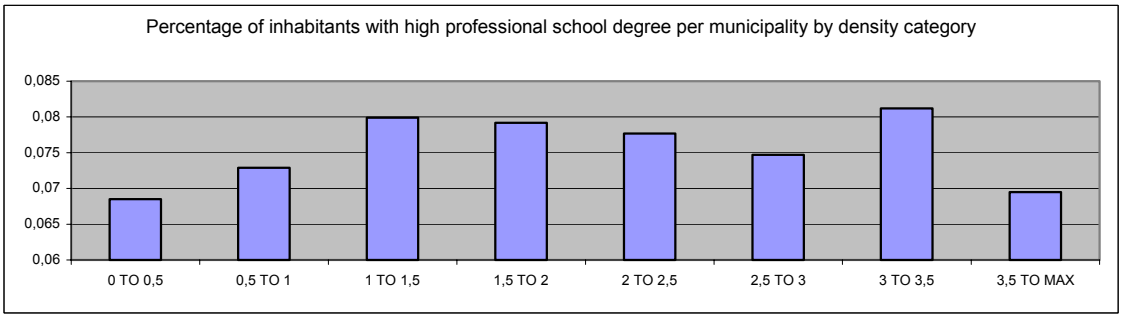


Source: SFSO data and personal elaboration

Appendix 37: Inhabitants with university[2] or high professional school degrees[3] by density categories

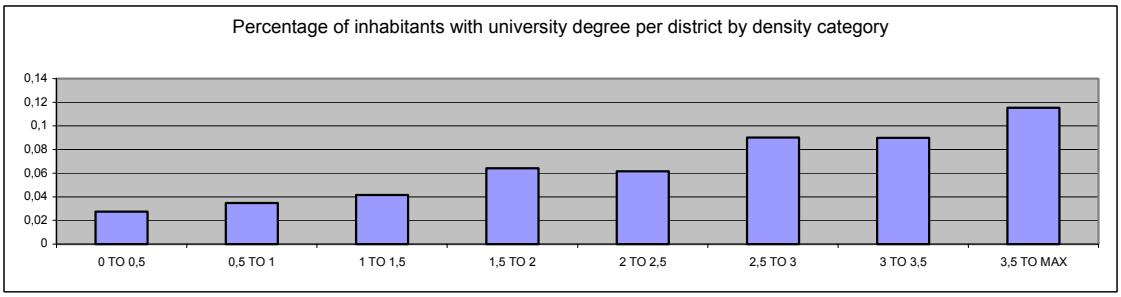
Municipalities

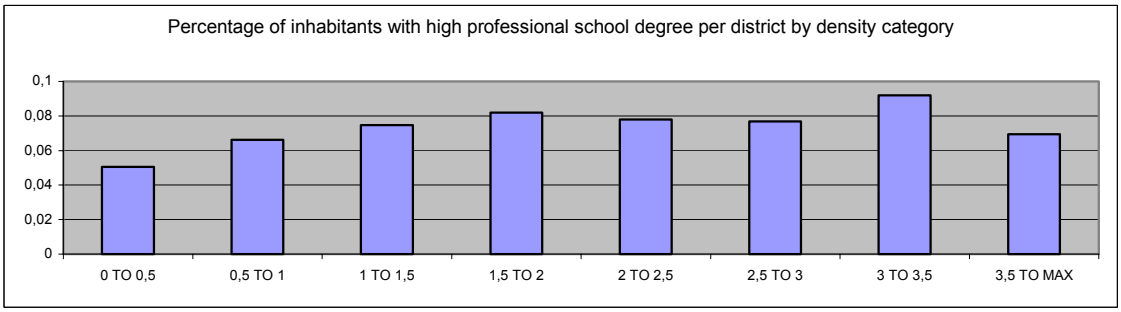




Source: SFSO data and personal elaboration

Districts





Source: SFSO data and personal elaboration

[2] Categories 33 and 34 according to SFSO classification
[3] Categories 31 and 32 according to SFSO classification

Appendix 38: Share of national firms present in KOF sample by density categories

Municipalities

	Firms in KOF' sample	Firms 2001 in Switzerland	Share of firms in KOF sample
0 TO 0,5	90	14827	0,6%
0,5 TO 1	455	69957	0,7%
1 TO 1,5	564	79338	0,7%
1,5 TO 2	395	56029	0,7%
2 TO 2,5	288	41287	0,7%
2,5 TO 3	91	12720	0,7%
3 TO 3,5	158	19730	0,8%
3,5 TO MAX	513	88952	0,6%
Total	2554	382840	0,7%

Source: SFSO data, KOF survey 2002 and personal elaboration

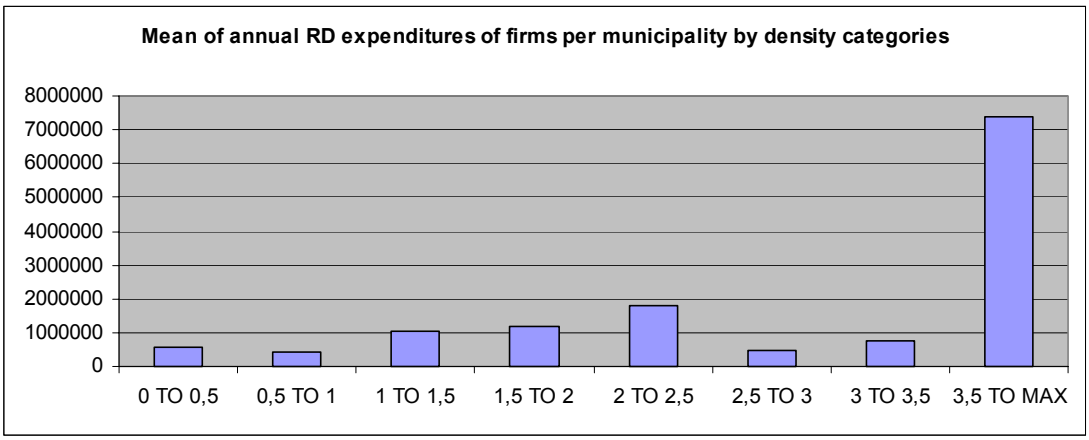
Districts

	Firms in KOF' sample	Firms 2001 in Switzerland	Share of firms in KOF sample
0 TO 0,5	7	1755	0,4%
0,5 TO 1	481	81631	0,6%
1 TO 1,5	671	114178	0,6%
1,5 TO 2	418	62025	0,7%
2 TO 2,5	157	22005	0,7%
2,5 TO 3	324	62718	0,5%
3 TO 3,5	23	1458	1,6%
3,5 TO MAX	473	37070	1,3%
Total	2554	382840	0,7%

Source: SFSO data, KOF survey 2002 and personal elaboration

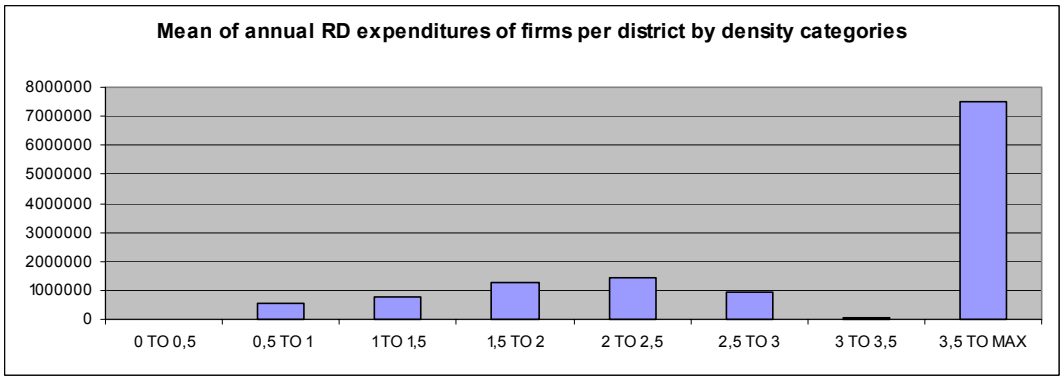
Appendix 39: Annual R&D expenditures by density categories (KOF sample 2002)

Municipalities



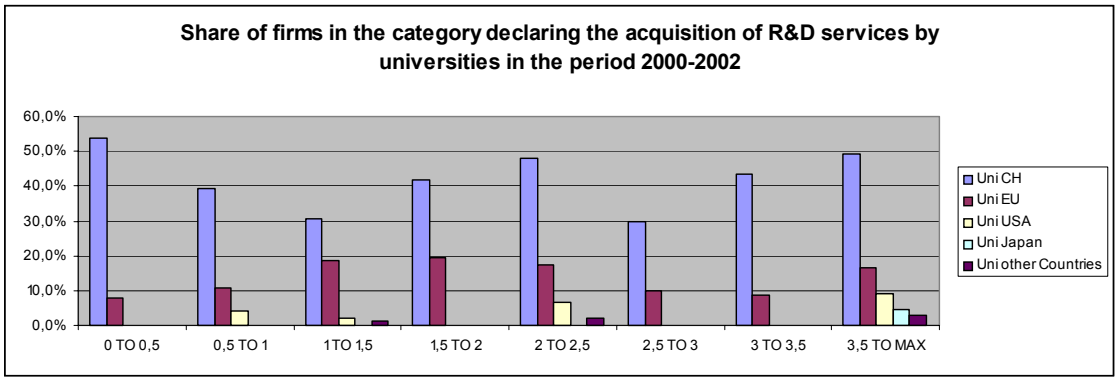
Source: SFSO data, KOF survey 2002 and personal elaboration

Districts

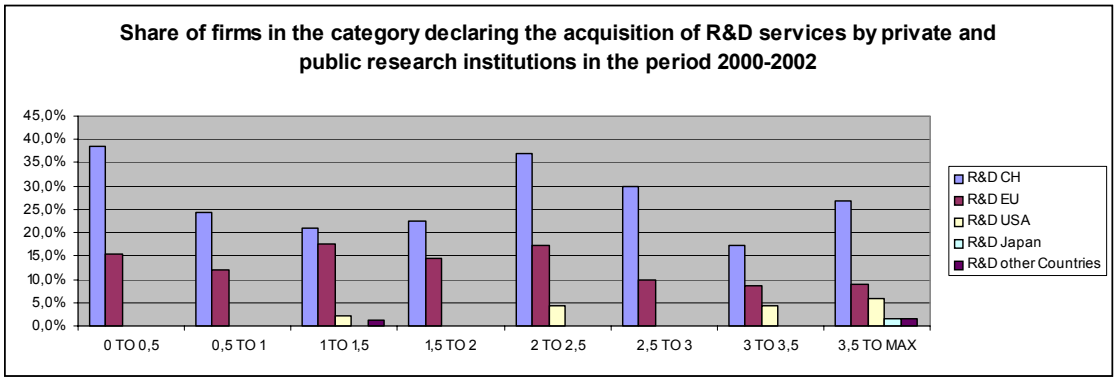


Source: SFSO data, KOF survey 2002 and personal elaboration

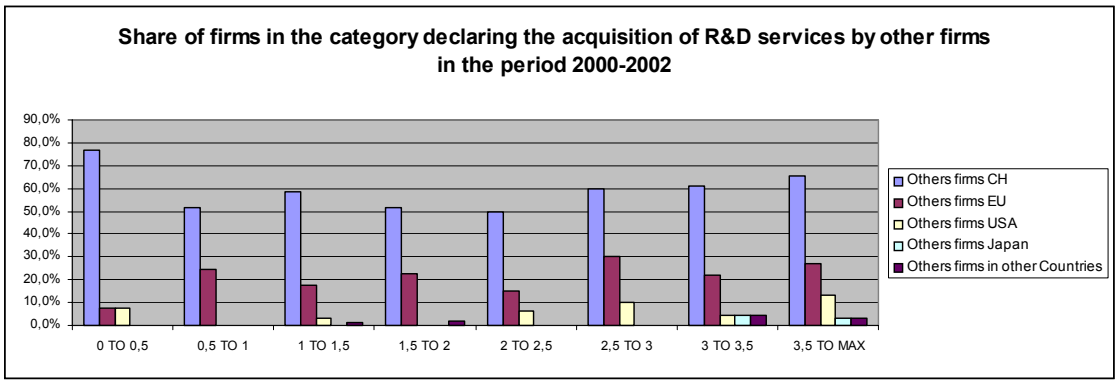
Appendix 40: Localisation of R&D partners by density categories (at the municipality level[4])



Source: SFSO data, KOF survey 2002 and personal elaboration



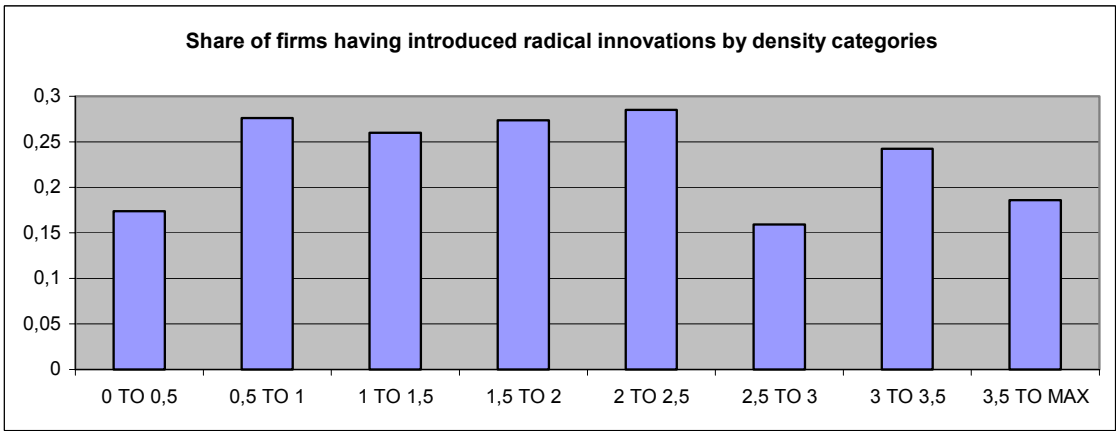
Source: SFSO data, KOF survey 2002 and personal elaboration



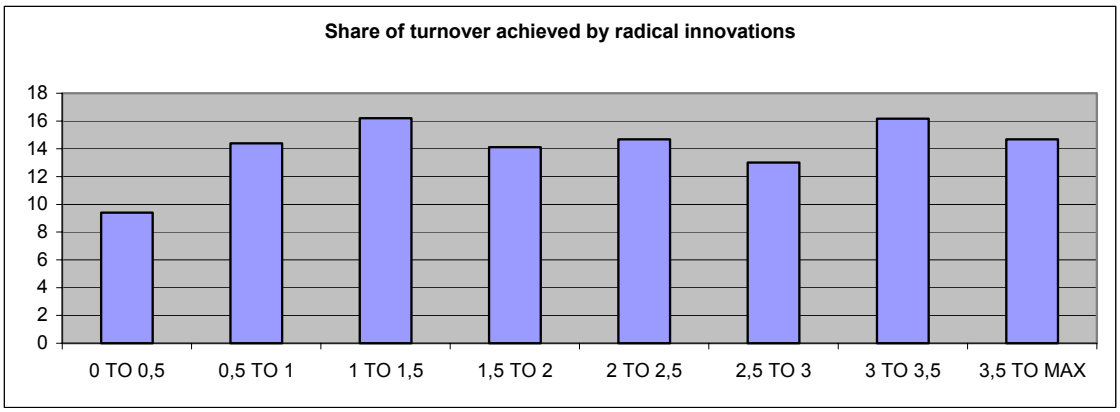
Source: SFSO data, KOF survey 2002 and personal elaboration

[4] At the district level the sample some category has too few observations to obtain reliable results.

Appendix 41: Radical innovations by density categories (at the municipality level[5])



Source: SFSO data, KOF survey 2002 and personal elaboration

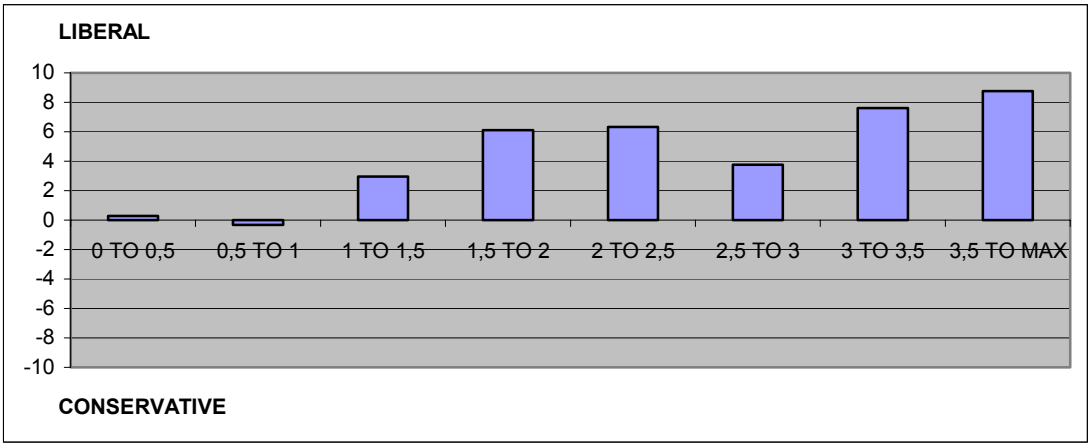


Source: SFSO data, KOF survey 2002 and personal elaboration

[5] At the district level the sample some category has too few observations to obtain reliable results

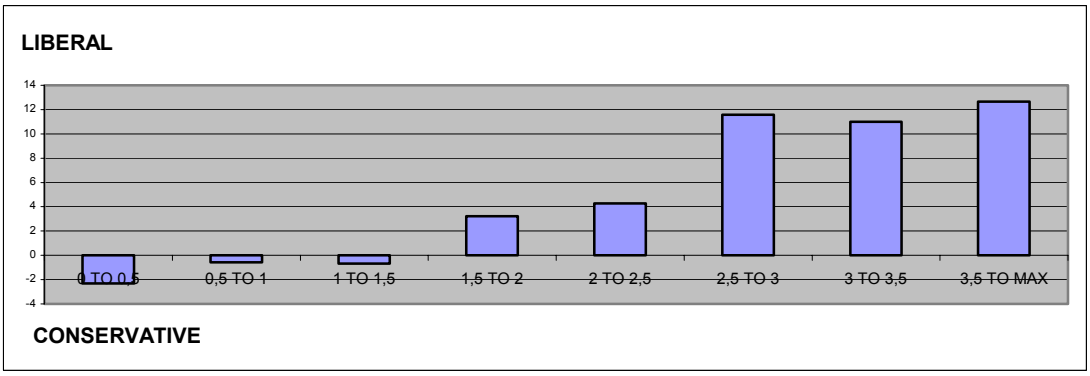
Appendix 42: Political positioning

Municipalities



Source: Hermann and Leuthold (2003), personal elaboration

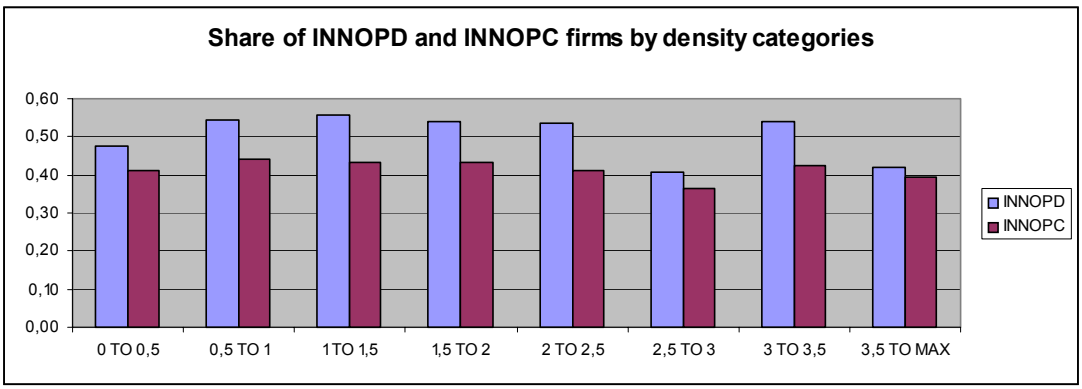
Districts



Source: Hermann and Leuthold (2003), personal elaboration

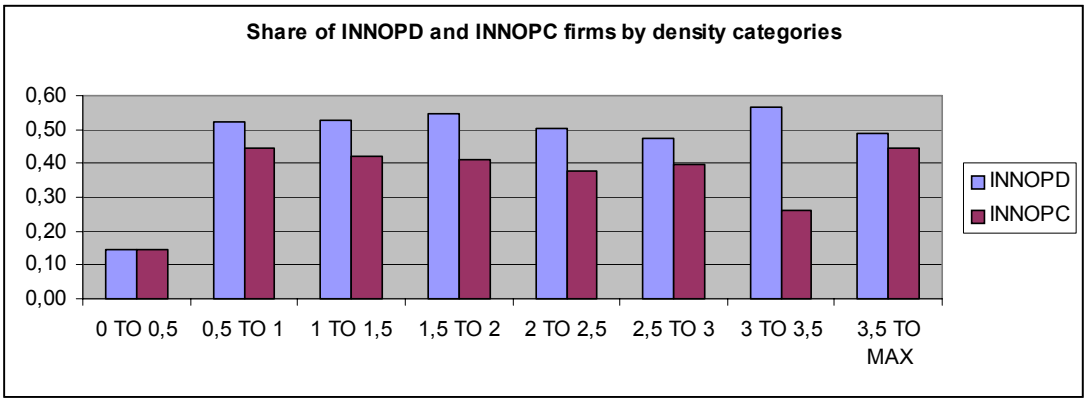
Appendix 43: Product and Process innovations in firms of Switzerland by density categories (KOF sample)

Municipalities



Source: SFSO data, KOF survey 2002 and personal elaboration

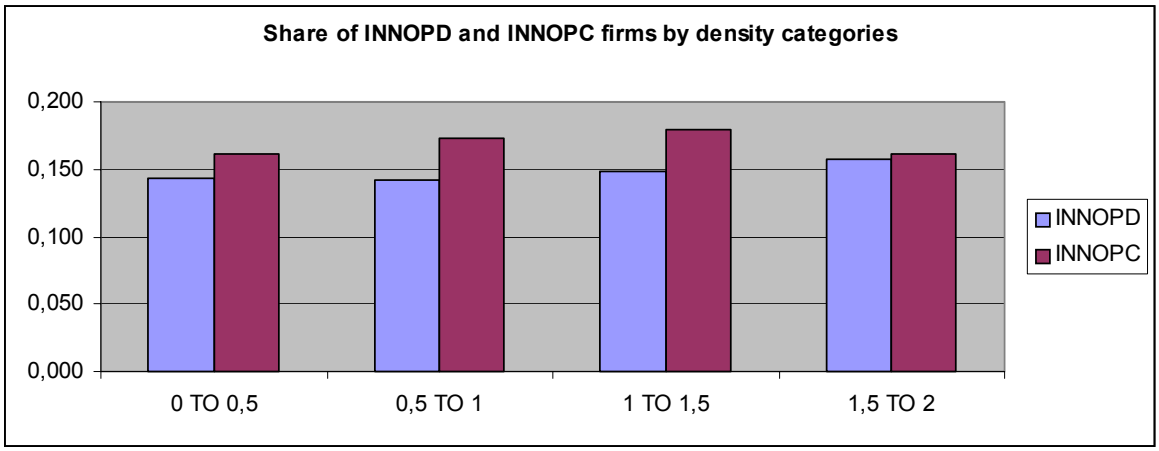
Districts



Source: SFSO data, KOF survey 2002 and personal elaboration

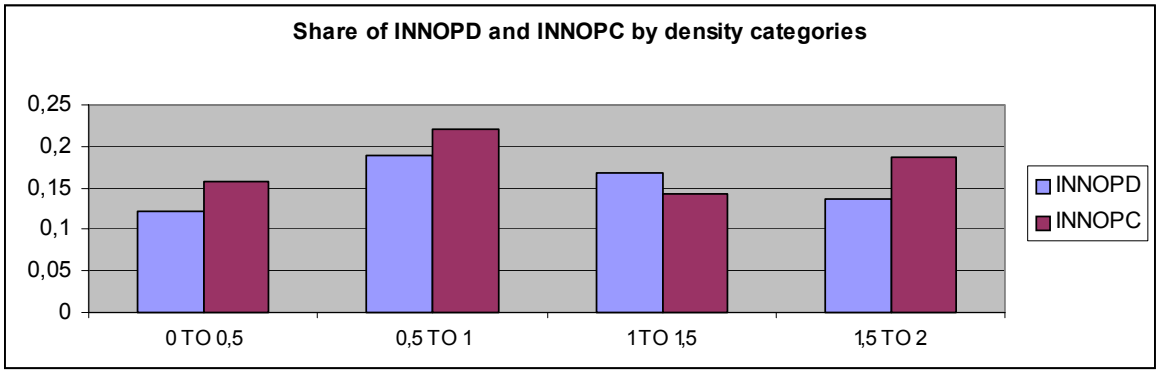
Appendix 44: Product and Process innovations in firms of Ticino's regions by density categories (IRE sample)

Municipalities



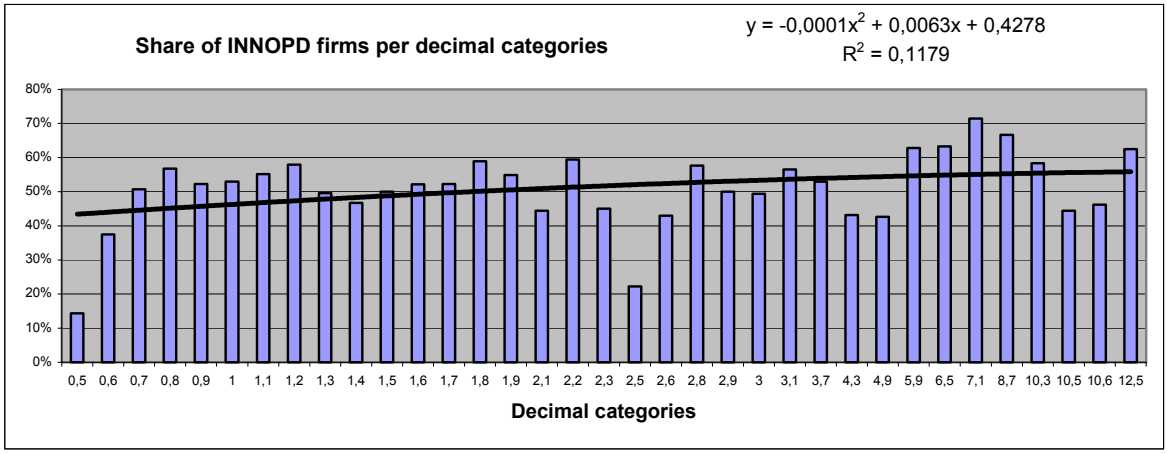
Source: SFSO data, IRE surveys and personal elaboration

Districts

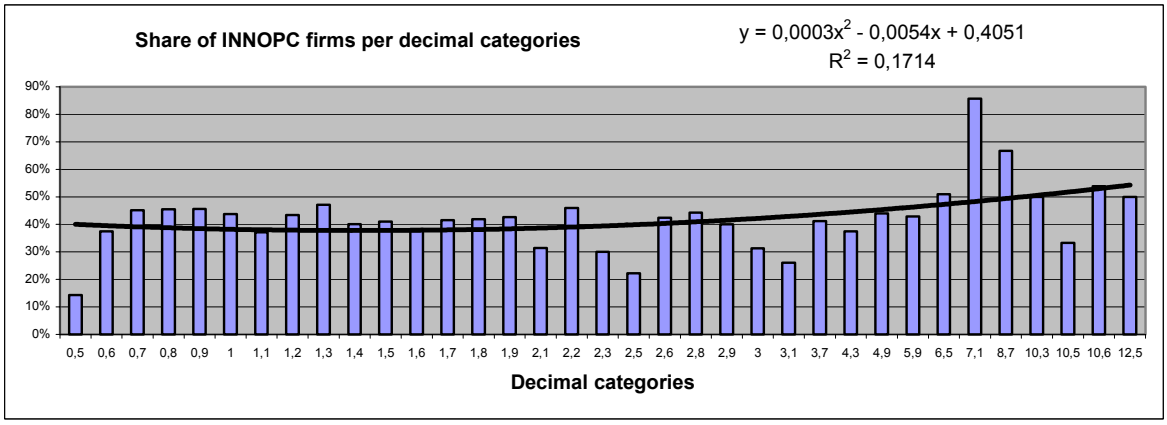


Source: SFSO data, IRE surveys and personal elaboration

Appendix 45: Share of firms having launched product (INNOPD) or process (INNOPC) innovations per districts by decimal density categories



Source: SFSO data, KOF survey 2002 and personal elaboration



Source: SFSO data, KOF survey 2002 and personal elaboration

Appendix 46: The explanatory variables

KOF	IRE	VARIABLE NAME	
		KOF	IRE
SIZE			
LN (employees number)	LN (employees number)	**Firm' size**	
Academic employees (%)	Academic employees (%)	**% Academic employees**	
CORPORATE GOVERNANCE AND FINANCIAL STRUCTURE			
Independent firms without significant financial sharing of others firms (DUMMY VARIABLE)	Independent firms without significant financial sharing of others firms (DUMMY VARIABLE)	**Autonomous firm**	
TECHNOLOGICAL OPPORTUNITIES			
Activity of the firm. NOGA 2digit classification : 15 – 37 (DUMMY VARIABLE)	Activity of the firm. NOGA 2digit classification : 15 – 37 (DUMMY VARIABLE)	**Manufacturing (Sector_2)**	
Activity of the firm. NOGA 2digit classification : 40 – 45 « energy and building » (DUMMY VARIABLE)	Activity of the firm. NOGA 2digit classification : 40 – 45 « energy and building » (DUMMY VARIABLE)	**Energy sector (Sector_3)**	
Activity of the firm. NOGA 2digit classification : 50 – 55 « trade and hotels » (DUMMY VARIABLE)	Activity of the firm. NOGA 2digit classification : 50 – 55 « trade and hotels » (DUMMY VARIABLE)	**Trade sector (Sector_4)**	
Activity of the firm. NOGA 2digit classification : 60 – 64 « transports and communication » (DUMMY VARIABLE)	Activity of the firm. NOGA 2digit classification : 60 – 64 « transports and communication » (DUMMY VARIABLE)	**Transports sector (Sector_5)**	
Activity of the firm. NOGA 2digit classification : 65 – 74 « services to businesses » (DUMMY VARIABLE)	Activity of the firm. NOGA 2digit classification : 65 – 74 « services to businesses » (DUMMY VARIABLE)	**Services to businesses (Sector_6)**	
COMPETITION			
Number of local competitors (only if LOCKMARK = 1, otherwise missing value)	Number of local competitors (in the same region)	**Local competitors**	
MARKET DEMAND			
Main market = local market (less than 50km of distance) (DUMMY VARIABLE)	Main market = local market (if local market share > other markets = 1; else = 0) (DUMMY VARIABLE)	**Local market**	
Share of turnover achieved on foreign markets	Share of turnover achieved on foreign markets	**% Export**	
SOURCES OF KNOWLEDGE / NETWORKS			
Importance of customers as external source of knowledge for innovation activities.	Importance of customers as external source of knowledge for innovation activities.	**Customers' knowledge**	
Importance of material and input suppliers as external source of knowledge for innovation activities.	Importance of suppliers as external source of knowledge for innovation activities.	**Input suppliers' knowledge**	**Suppliers' knowledge**
Importance of software suppliers as external source of knowledge for innovation activities		**Software suppliers' knowledge**	
Importance of equipments suppliers as external source of knowledge for innovation activities		**Equipments suppliers' knowledge**	
Importance of competitors as external source of knowledge for innovation activities	Importance of competitors as external source of knowledge for innovation activities	**Competitors' knowledge**	
Importance of firms of the same sector (partners) as external source of knowledge for innovation activities	Importance of firms of the same sector (partners) as external source of knowledge for innovation activities	**Partners' knowledge**	
Importance of university or technical high schools as external source of knowledge for innovation activities	Mean of the scores given to the following external source of knowledge for innovation activities: University of Lugano, University of applied sciences of Lugano, university and polytechnics, other research institutions and Local, Ticino's, Swiss, border region's and foreign consulting firms	**Universities' knowledge**	**Educational institutions and Consultants' knowledge**
Importance of other research institutions as external source of knowledge for innovation activities		**R&D institutes' knowledge**	
Importance of consulting firms as external source of knowledge for innovation activities		**Consultants' knowledge**	

(…)

PROXIMITY (GEOGRAPHICAL, CULTURAL, ECONOMICAL, POLITICAL)		
Municipality level		
Municipality's political positioning: mean of both positive or negative left & right, 0 if one positive and one negative. Source: Hermann & Leuthold, 2003	Municipality's political positioning: mean of both positive or negative left & right, 0 if one positive and one negative. Source: Hermann & Leuthold, 2003	**Right & liberal municipality**
Share of inhabitants in the municipality with a university, high school or "Fachhochschule" degree (classified 33 and 34 by SFSO)	Share of inhabitants in the municipality with a university, high school or "Fachhochschule" degree (classified 33 and 34 by SFSO)	**% Municipality pop. with university degree**
Share of inhabitants in the municipality with an high professional school degree (classified 31 and 32 by SFSO)	Share of inhabitants in the municipality with an high professional school degree (classified 31 and 32 by SFSO)	**% Municipality pop. with high professional school degree**
Natural log of the number of foreign commuters working in the municipality	Natural log of the number of foreign commuters working in the municipality	**Municipality trans-border workers**
Share of firms in the municipality being classified as Science Based by the Pavitt taxonomy (1984): NOGA 244, 300,321, 322, 323, 331, 332, 333, 334, 335, 353	Share of firms in the municipality being classified as Science Based by the Pavitt taxonomy (1984): NOGA 244, 300,321, 322, 323, 331, 332, 333, 334, 335, 353	**Share of Science based firms in the municipality**
Share of firms in the municipality being classified as Traditional by the Pavitt taxonomy (1984): NOGA 151, 152, 153, 154, 155, 156, 157, 158, 159, 171, 172, 173, 174, 175, 176, 177, 181, 182, 183, 191, 192, 193, 201, 202, 203, 204, 205, 262, 263, 281, 282, 286, 287, 315, 361, 361, 362, 363, 364, 365, 366, 371, 372, 401, 402, 403, 410	Share of firms in the municipality being classified as Traditional by the Pavitt taxonomy (1984): NOGA 151, 152, 153, 154, 155, 156, 157, 158, 159, 171, 172, 173, 174, 175, 176, 177, 181, 182, 183, 191, 192, 193, 201, 202, 203, 204, 205, 262, 263, 281, 282, 286, 287, 315, 361, 361, 362, 363, 364, 365, 366, 371, 372, 401, 402, 403, 410	**Share of traditional firms in the municipality**
Share of firms of the same sector (see definition of SECTOR variables) and municipality	Share of firms of the same sector (see definition of SECTOR variables) and municipality	**% Municipality firms of the same sector**
District level		
District's political positioning (mean of RIGHTLIBERAL_MUN scores in the district): Source: Hermann & Leuthold, 2003	District's political positioning (mean of RIGHTLIBERAL_MUN scores in the district): Source: Hermann & Leuthold, 2003	**Right & liberal district**
Share of inhabitants in the municipality with a university, high school or "Fachhochschule" degree (classified 33 and 34 by SFSO)	Share of inhabitants in the municipality with a university, high school or "Fachhochschule" degree (classified 33 and 34 by SFSO)	**% District pop. with university degree**
Share of inhabitants in the municipality with an high professional education degree (classified 31 and 32 by SFSO)	Share of inhabitants in the district with an high professional education degree (classified 31 and 32 by SFSO)	**% District pop. with high professional school degree**
Natural log of the number of foreign commuters working in the municipality	Natural log of the number of foreign commuters working in the district	**District trans-border workers**
Share of firms in the district being classified as Science Based by the Pavitt taxonomy (1984): NOGA 244, 300,321, 322, 323, 331, 332, 333, 334, 335, 353	Share of firms in the district being classified as Science Based by the Pavitt taxonomy (1984): NOGA 244, 300,321, 322, 323, 331, 332, 333, 334, 335, 353	**Share of Science based firms in the district**
Share of firms in the district being classified as Traditional by the Pavitt taxonomy (1984): NOGA 151, 152, 153, 154, 155, 156, 157, 158, 159, 171, 172, 173, 174, 175, 176, 177, 181, 182, 183, 191, 192, 193, 201, 202, 203, 204, 205, 262, 263, 281, 282, 286, 287, 315, 361, 361, 362, 363, 364, 365, 366, 371, 372, 401, 402, 403, 410	Share of firms in the district being classified as Traditional by the Pavitt taxonomy (1984): NOGA 151, 152, 153, 154, 155, 156, 157, 158, 159, 171, 172, 173, 174, 175, 176, 177, 181, 182, 183, 191, 192, 193, 201, 202, 203, 204, 205, 262, 263, 281, 282, 286, 287, 315, 361, 361, 362, 363, 364, 365, 366, 371, 372, 401, 402, 403, 410	**Share of traditional firms in the district**
Share of firms of the same sector (see definition of SECTOR variables) and district	Share of firms of the same sector (see definition of SECTOR variables) and district	**% District firms of the same sector**
PERIPHERY'S INDICATORS		
Number of firms by hectare of settlement and urban area in the municipality	Number of firms by hectare of settlement and urban area in the municipality	**Firms' density in the municipality**
Number of firms by hectare of settlement and urban area in the district	Number of firms by hectare of settlement and urban area in the district	**Firms' density in the district**
SFSO		
SFSO definition of Urban and Rural areas (DUMMY VARIABLE)	SFSO definition of Urban and Rural areas (DUMMY VARIABLE)	**URBAN**

Appendix 47: Descriptive statistics of the explanatory variables (KOF sample)

Internal characteristics	N	Minimum	Maximum	Mean	Std. Deviation
Firm' size	2556	0,00	10,72	3,9	1,4
% Academic employees	2462	0,00	100,00	4,9	11,8
Autonomous firm	2524	0,00	1,00	0,6	0,5
Energy sector (Sector_3)	2556	0,00	1,00	0,1	0,3
Trade sector (Sector_4)	2556	0,00	1,00	0,2	0,4
Transport sector (Sector_5)	2556	0,00	1,00	0,1	0,3
Services for businesses (Sector_6)	2556	0,00	1,00	0,1	0,3
Market					
Local competitors	2469	0,00	5,00	1,4	1,7
Local market	2539	0,00	1,00	0,5	0,5
% Export	2400	0,00	100,00	21,2	32,6
Network					
Customers' knowledge	2294	1,00	5,00	3,3	1,2
Input suppliers' knowledge	2294	1,00	5,00	3,2	1,2
Software suppliers' knowledge	2294	1,00	5,00	2,5	1,2
Equipments suppliers' knowledge	2294	1,00	5,00	2,6	1,2
Competitors' knowledge	2294	1,00	5,00	3,0	1,1
Partners' knowledge	2294	1,00	5,00	2,1	1,4
Universities' knowledge	2294	1,00	5,00	2,2	1,2
R&D institutes' knowledge	2294	1,00	5,00	1,9	1,1
Consultants' knowledge	2294	1,00	5,00	2,0	1,0
Proximity					
Municipality level					
Right & liberal municipality	2506	-14	24	3,12	4,85
% Municipality pop. with university degree	2554	0,00	0,21	0,1	0,0
Municipality trans-border workers	1856	0,00	10,28	4,6	2,8
% Municipality firms of the same sector	2553	0,00	0,58	0,2	0,1
District level					
Right & liberal district	2532	-11,34	14,37	2,59	5,10
% District pop. with university degree	2554	0,02	0,14	0,1	0,0
District trans-border workers	2092	0,00	10,31	5,6	2,9
% District firms of the same sector	2553	0,03	0,43	0,2	0,1
Periphery indicators					
Firms' density in the municipality	2554	0,00	8,84	2,3	1,7
Firms' density in the district	2554	0,40	12,42	2,3	2,0
SFSO					
URBAN	2556	0	1	0,76	0,43

Source: SFSO data, KOF survey 2002 and personal elaboration

Appendix 48: Descriptive statistics of the explanatory variables (IRE sample)

Internal characteristics	N	Minimum	Maximum	Mean	Std. Deviation
Firm' size	2040	-2,30	6,81	1,30	1,20
% Academic employees	1941	0,00	1,00	0,10	0,24
Autonomous firm	2028	0,00	1,00	0,89	0,31
Energy sector (Sector_3)	2050	0,00	1,00	0,13	0,34
Trade sector (Sector_4)	2050	0,00	1,00	0,41	0,49
Transport sector (Sector_5)	2050	0,00	1,00	0,06	0,23
Services for businesses (Sector_6)	2050	0,00	1,00	0,26	0,44
Market					
Local competitors	1642	1,00	5,00	3,17	1,38
Local market	2050	0,00	1,00	0,44	0,50
% Export	1694	0,00	100,00	15,54	31,60
Network					
Customers' knowledge	1756	0,00	11,00	8,53	3,18
Suppliers' knowledge	1739	0,00	11,00	7,10	3,98
Competitors' knowledge	1664	0,00	11,00	6,34	4,43
Partners' knowledge	1687	0,00	11,00	6,91	4,18
Educational institutions and consultants' knowledge	1419	0,00	11,00	6,15	4,22
Proximity					
Municipality level					
Right & liberal municipality	2037	-25,50	8,50	-3,50	5,15
% Municipality pop. with university degree	2045	0,00	0,13	0,05	0,02
Municipality trans-border workers	1857	0,00	8,12	5,67	2,02
% Municipality firms of the same sector	2043	0,00	1,00	0,25	0,14
District level					
Right & liberal district	2037	-11,34	-4,46	-8,01	1,41
% District pop. with university degree	2045	0,02	0,08	0,05	0,01
District trans-border workers	1890	2,48	9,49	8,39	1,69
% District firms of the same sector	2042	0,04	0,41	0,23	0,13
Periphery indicators					
Firms' density in the municipality	2045	0,00	4,21	1,75	1,18
Firms' density in the district	2045	0,39	1,89	1,29	0,37
SFSO					
URBAN	2050	0,00	1,00	0,80	0,40

Source: SFSO data, IRE surveys and personal elaboration

Appendix 49: Appropriability variables

KOF	IRE	VARIABLE NAME	
Description	**Description**	**KOF**	**IRE**
R&D expenditures (in Switzerland in the last three years)	**Not available**	**R&D expenditures**	
Number of patents 2000-2002	**Not available**	**Patents**	
Not available	Share of pc used for R&D		**Personal computers used for R&D activities**

Appendix 50: Distribution of firms by decimal categories in CH and in KOF sample

Number of firms per hectare in the municipality	Firms in CH	Firms in KOF sample	Share of firms in the category CH	Share of firms in the category KOF	Difference (CH – KOF)
0,1	38	4	0%	0%	0%
0,2	301	3	0%	0%	0%
0,3	1318	8	0%	0%	0%
0,4	4604	30	1%	1%	0%
0,5	7461	39	2%	2%	0%
0,6	11255	61	3%	2%	1%
0,7	12289	64	3%	3%	1%
0,8	15748	96	4%	4%	0%
0,9	16963	105	4%	4%	0%
1	12373	109	3%	4%	-1%
1,1	17884	142	5%	6%	-1%
1,2	15878	108	4%	4%	0%
1,3	15104	106	4%	4%	0%
1,4	17285	126	5%	5%	0%
1,5	15021	102	4%	4%	0%
1,6	12210	83	3%	3%	0%
1,7	12653	80	3%	3%	0%
1,8	12368	89	3%	3%	0%
1,9	11850	90	3%	4%	0%
2	7180	56	2%	2%	0%
2,1	14228	90	4%	4%	0%
2,2	10463	70	3%	3%	0%
2,3	7457	47	2%	2%	0%
2,4	5786	52	2%	2%	-1%
2,5	3716	32	1%	1%	0%
2,6	2376	21	1%	1%	0%
2,7	5317	39	1%	2%	0%
2,8	2248	11	1%	0%	0%
2,9	1265	10	0%	0%	0%
3	1483	10	0%	0%	0%
3,1	1602	7	0%	0%	0%
3,2	2911	31	1%	1%	0%
3,3	8287	71	2%	3%	-1%
3,4	5508	32	1%	1%	0%
3,5	1458	17	0%	1%	0%
3,7	365		0%	0%	0%
3,8	2221	15	1%	1%	0%
3,9	2275	14	1%	1%	0%
4	2244	16	1%	1%	0%
4,1	9470	52	2%	2%	0%
4,2	8313	33	2%	1%	1%
4,3	817	6	0%	0%	0%
4,6	4328	28	1%	1%	0%
4,9	26038	176	7%	7%	0%
5,1	10350	68	3%	3%	0%
5,2	1084	10	0%	0%	0%
5,4	274		0%	0%	0%
6,5	3295	17	1%	1%	0%
7,8	3479	19	1%	1%	0%
7,9	1666	13	0%	1%	0%
8,9	12733	46	3%	2%	2%
TOTAL FIRMS	382840	2554			

Source: SFSO data, KOF survey 2002 and personal elaboration

Appendix 51: Estimation of innovation in Switzerland – Municipality level (PART 1)

	INNO				INNO RURAL				INNO URBAN			
R square (Nagelkerke)	0,23				0,42				0,22			
N	1423				238				1185			
	B	S.E.	Sig.	Probability	B	S.E.	Sig.	Probability	B	S.E.	Sig.	Probability
Firm' size	0,286 ****	0,051	0	*5,7%*	0,711 ****	0,182	0	16,6%	0,238 ****	0,055	0	5,0%
% Academic employees	0,013 **	0,006	0,02	*0,3%*	0,026	0,016	0,11	0,6%	0,013 **	0,006	0,037	0,3%
Autonomous firm	0,064	0,15	0,672		0,064	0,46	0,89		0,073	0,162	0,652	
Energy sector (Sector_3)	-1,233 ****	0,212	0	*-24,8%*	-2,906 ****	0,868	0,001	-67,9%	-1,058 ****	0,227	0	-22,2%
Trade sector (Sector_4)	-1,144 ****	0,311	0	*-23,0%*	-0,647	0,842	0,442		-1,12 ***	0,359	0,002	-23,5%
Transports sector (Sector_5)	-0,728 ***	0,255	0,004	*-14,6%*	0,231	0,774	0,766		-0,817 ***	0,273	0,003	-17,2%
Services to businesses (Sector_6)	-0,321	0,227	0,158		0,131	0,866	0,88		-0,351	0,238	0,14	
Local competitors	-0,096 *	0,058	0,097	*-1,9%*	-0,121	0,187	0,517		-0,114 *	0,062	0,065	-2,4%
Local market	-0,114	0,222	0,608		0,087	0,685	0,899		-0,1	0,241	0,679	
% Export	0,007 **	0,003	0,011	*0,1%*	0,011	0,008	0,136		0,006 **	0,003	0,028	0,1%
Customers' knowledge	0,019	0,055	0,731		0,284	0,185	0,125		-0,016	0,059	0,784	
Input suppliers' knowledge	0,059	0,061	0,327		0,14	0,186	0,451		0,043	0,065	0,509	
Software suppliers' knowledge	0,084	0,059	0,157		-0,01	0,173	0,954		0,107 *	0,064	0,094	2,2%
Equipments suppliers' knowledge	-0,079	0,062	0,205		0,035	0,184	0,849		-0,088	0,068	0,195	
Competitors' knowledge	-0,082	0,06	0,175		-0,247	0,201	0,219		-0,063	0,064	0,325	
Partners' knowledge	-0,064	0,053	0,228		-0,034	0,157	0,829		-0,065	0,058	0,263	
Universities' knowledge	0,169 **	0,074	0,023	*3,4%*	0,067	0,245	0,784		0,175 **	0,079	0,026	3,7%
R&D institutes' knowledge	-0,133	0,083	0,11		-0,299	0,284	0,291		-0,119	0,088	0,177	
Consultants' knowledge	-0,005	0,07	0,948		0,031	0,213	0,885		-0,005	0,075	0,949	
Right & liberal municipality	0,023 *	0,014	0,1		-0,037	0,042	0,387		0,035 **	0,016	0,027	0,7%
% Municipality pop. with university degree	0,492	2,352	0,834		-5,35	15,109	0,723		0,344	2,443	0,888	
Municipality trans-border workers	-0,063 **	0,027	0,019	*-1,3%*	0,104	0,094	0,269		-0,07 **	0,03	0,018	-1,5%
% Municipality firms of the same sector	1,405	1,35	0,298		2,714	3,361	0,419		1,321	1,573	0,401	
Firms' density in the municipality	0,029	0,057	0,614		0,314	0,396	0,427		0,05	0,059	0,399	
Constant	-0,268	0,444	0,546		-2,959 **	1,406	0,035	-69,1%	-0,084	0,496	0,865	

Source: SFSO data, KOF survey 2002 and personal elaboration

Appendix 51: Estimation of innovation in Switzerland – Municipality level (PART 2)

	INNOPD				INNOPC			
R square (Nagelkerke)	0,26				0,17			
N	1423				1423			
	B	S.E.	Sig.	Probability	B	S.E.	Sig.	Probability
Firm' size	0,194 ****	0,05	0	4,5%	0,289 ****	0,049	0	7,2%
% Academic employees	0,011 **	0,005	0,033	0,3%	0,008	0,005	0,12	
Autonomous firm	0,049	0,148	0,739		0,119	0,143	0,404	
Energy sector (Sector_3)	-1,402 ****	0,231	0	-32,3%	-0,843 ****	0,223	0	-21,1%
Trade sector (Sector_4)	-1,062 ****	0,309	0,001	-24,4%	-1,037 ****	0,303	0,001	-25,9%
Transports sector (Sector_5)	-0,687 ***	0,259	0,008	-15,8%	-0,665 **	0,26	0,01	-16,6%
Services to businesses (Sector_6)	-0,344	0,225	0,126		0,249	0,22	0,258	
Local competitors	-0,126 **	0,06	0,037	-2,9%	-0,043	0,06	0,48	
Local market	-0,01	0,223	0,964		-0,381 *	0,223	0,087	-9,5%
% Export	0,009 ****	0,002	0	0,2%	0,002	0,002	0,312	
Customers' knowledge	0,109 **	0,054	0,044	2,5%	-0,023	0,052	0,657	
Input suppliers' knowledge	0,122 **	0,06	0,044	2,8%	0,003	0,059	0,96	
Software suppliers' knowledge	-0,027	0,058	0,648		0,219 ****	0,057	0	5,5%
Equipments suppliers' knowledge	-0,105 *	0,062	0,088	-2,4%	0,076	0,059	0,197	
Competitors' knowledge	-0,056	0,059	0,339		-0,024	0,056	0,665	
Partners' knowledge	0,042	0,052	0,424		-0,091 *	0,05	0,07	-2,3%
Universities' knowledge	0,062	0,071	0,382		0,046	0,067	0,494	
R&D institutes' knowledge	0,024	0,08	0,759		-0,056	0,075	0,45	
Consultants' knowledge	-0,083	0,068	0,224		0,003	0,065	0,962	
Right & liberal municipality	0,022	0,013	0,103		0,014	0,013	0,28	
% Municipality pop. with university degree	0,753	2,36	0,75		-0,088	2,258	0,969	
Municipality trans-border workers	-0,051 *	0,027	0,055	-1,2%	-0,042 *	0,025	0,099	-1,0%
% Municipality firms of the same sector	1,628	1,328	0,22		1,882	1,271	0,139	
Firms' density in the municipality	-0,012	0,058	0,831		0,043	0,055	0,438	
Constant	-0,746 *	0,44	0,09	-17,2%	-1,693 ****	0,43	0	-42,3%

Source: SFSO data, KOF survey 2002 and personal elaboration

Appendix 51: Estimation of innovation in Switzerland – District level (PART 3)

	INNO				INNO RURAL				INNO URBAN			
R square (Nagelkerke)	0,21				0,34				0,21			
N	1639				321				1318			
	B	S.E.	Sig.	Probability	B	S.E.	Sig.	Probability	B	S.E.	Sig.	Probability
Firm' size	0,262 ****	0,048	0	4,9%	0,548 ****	0,147	0	13,3%	0,225 ****	0,052	0	3,8%
% Academic employees	0,016 ***	0,006	0,004	0,3%	0,024	0,015	0,109		0,015 **	0,006	0,012	0,3%
Autonomous firm	-0,02	0,142	0,892		-0,197	0,379	0,604		0,007	0,157	0,967	
Energy sector (Sector_3)	-1,13 ****	0,193	0	-21,3%	-1,889 ****	0,561	0,001	-45,9%	-1,019 ****	0,212	0	-17,3%
Trade sector (Sector_4)	-1,01 ****	0,311	0,001	-19,0%	0,91	0,9	0,312		-1,438 ****	0,372	0	-24,4%
Transports sector (Sector_5)	-0,64 ***	0,241	0,008	-12,0%	0,084	0,656	0,898		-0,757 ***	0,266	0,004	-12,8%
Services to businesses (Sector_6)	-0,52 *	0,308	0,089	-9,8%	0,262	0,67	0,696		-0,948 **	0,373	0,011	-16,1%
Local competitors	-0,07	0,053	0,199		-0,013	0,154	0,935		-0,083	0,058	0,151	
Local market	-0,2	0,205	0,323		-0,264	0,543	0,627		-0,222	0,228	0,328	
% Export	0,006 **	0,002	0,022	0,1%	0,009	0,006	0,154		0,005 *	0,003	0,086	0,1%
Customers' knowledge	0,05	0,051	0,327		0,367 **	0,151	0,015	8,9%	-0,002	0,056	0,976	
Input suppliers' knowledge	0,042	0,056	0,45		0,167	0,149	0,261		0,022	0,062	0,72	
Software suppliers' knowledge	0,106 *	0,055	0,055	2,0%	0,123	0,146	0,399		0,128 **	0,061	0,035	2,2%
Equipments suppliers' knowledge	-0,1 *	0,058	0,08	-1,9%	-0,114	0,142	0,42		-0,116 *	0,065	0,073	-2,0%
Competitors' knowledge	-0,09	0,056	0,122		-0,317 **	0,161	0,049	-7,7%	-0,057	0,061	0,355	
Partners' knowledge	-0,06	0,05	0,25		-0,122	0,126	0,334		-0,047	0,055	0,395	
Universities' knowledge	0,161 **	0,069	0,019	3,0%	0,176	0,207	0,395		0,158 **	0,074	0,033	2,7%
R&D institutes' knowledge	-0,15 *	0,078	0,055	-2,8%	-0,379 *	0,226	0,093	-9,2%	-0,109	0,085	0,198	
Consultants' knowledge	0,001	0,065	0,986		0,038	0,177	0,831		-0,001	0,071	0,994	
Right & liberal district	0,008	0,011	0,489		0,059	0,039	0,128		0,007	0,012	0,587	
% District pop. with university degree	-0,3	2,093	0,885		-27,99 **	11,436	0,014	-680,1%	1,682	2,272	0,459	
District trans-border workers	-0,06 ***	0,022	0,007	-1,1%	0,141 **	0,07	0,045	3,4%	-0,079 ***	0,024	0,001	-1,3%
% District firms of the same sector	0,944	1,441	0,513		-4,61	4,303	0,284		2,771	1,723	0,108	
Firms' density in the district	-0,01	0,035	0,79		-0,035	0,09	0,696		-0,008	0,038	0,841	
Constant	0,17	0,417	0,683		-0,321	1,178	0,785		0,198	0,479	0,679	

Source: SFSO data, KOF survey 2002 and personal elaboration

Appendix 51: Estimation of innovation in Switzerland – District level (PART 4)

	INNOPD				INNOPC			
R square (Nagelkerke)	0,25				0,15			
N	1639				1639			
	B	S.E.	Sig.	Probability	B	S.E.	Sig.	Probability
Firm' size	0,167 ****	0,047	0	3,9%	0,247 ****	0,045	0	6,1%
% Academic employees	0,012 **	0,005	0,016	0,3%	0,011 **	0,005	0,019	0,3%
Autonomous firm	0,005	0,139	0,974		0,035	0,134	0,793	
Energy sector (Sector_3)	-1,423 ****	0,213	0	-33,2%	-0,735 ****	0,199	0	-18,1%
Trade sector (Sector_4)	-0,789 ***	0,303	0,009	-18,4%	-1,065 ****	0,302	0	-26,2%
Transports sector (Sector_5)	-0,692 ***	0,241	0,004	-16,2%	-0,45 *	0,24	0,061	-11,1%
Services to businesses (Sector_6)	-0,503 *	0,302	0,096	-11,7%	-0,297	0,293	0,312	
Local competitors	-0,117 **	0,055	0,035	-2,7%	-0,039	0,055	0,477	
Local market	-0,098	0,204	0,631		-0,36 *	0,202	0,075	-8,8%
% Export	0,007 ***	0,002	0,002	0,2%	0	0,002	0,878	
Customers' knowledge	0,129 **	0,051	0,011	3,0%	0,006	0,049	0,907	
Input suppliers' knowledge	0,118 **	0,056	0,034	2,8%	-0,028	0,054	0,599	
Software suppliers' knowledge	-0,004	0,054	0,939		0,218 ****	0,052	0	5,4%
Equipments suppliers' knowledge	-0,12 **	0,057	0,035	-2,8%	0,054	0,054	0,32	
Competitors' knowledge	-0,052	0,055	0,346		-0,02	0,052	0,695	
Partners' knowledge	0,044	0,049	0,365		-0,085 **	0,047	0,07	-2,1%
Universities' knowledge	0,079	0,066	0,231		0,067	0,062	0,274	
R&D institutes' knowledge	-0,004	0,075	0,96		-0,072	0,07	0,302	
Consultants' knowledge	-0,057	0,063	0,365		0,027	0,06	0,652	
Right & liberal district	0,017	0,011	0,128		0,002	0,011	0,828	
% District pop. with university degree	-1,488	2,061	0,47		0,844	1,994	0,672	
District trans-border workers	-0,041 *	0,021	0,054	-1,0%	-0,047 *	0,02	0,022	-1,2%
% District firms of the same sector	0,377	1,397	0,787		1,973	1,369	0,15	
Firms' density in the district	-0,004	0,033	0,912		-0,012	0,031	0,7	
Constant	-0,359	0,409	0,38		-1,274 ***	0,4	0,001	-31,3%

Source: SFSO data, KOF survey 2002 and personal elaboration

Appendix 52: Estimation of innovation in Ticino's regions – Municipality level (PART 1)

	INNO				INNOPD				INNOPC			
R square (Nagelkerke)	0,29				0,21				0,27			
N	783				782				781			
	B	S.E.	Sig.	Probability	B	S.E.	Sig.	Probability	B	S.E.	Sig.	Probability
Firm' size	0,717 ****	0,088	0	17,5%	0,453 ****	0,09	0	11,1%	0,739 ****	0,094	0	18,0%
% Academic employees	0,796 **	0,372	0,033	19,4%	0,984 **	0,4	0,014	24,1%	0,93 **	0,421	0,027	22,7%
Autonomous firm	-0,193	0,287	0,5		-0,42	0,302	0,165		-0,021	0,309	0,945	
Energy sector (Sector_3)	-1,479 ****	0,375	0	-36,1%	-1,135 ***	0,437	0,009	-27,8%	-1,649 ****	0,41	0	-40,2%
Trade sector (Sector_4)	-0,533	0,491	0,278		-0,746	0,554	0,178		0,081	0,536	0,879	
Transports sector (Sector_5)	-0,248	0,428	0,562		0,114	0,471	0,808		-0,26	0,439	0,553	
Services to businesses (Sector_6)	0,124	0,297	0,677		0,092	0,328	0,78		-0,226	0,319	0,479	
Local competitors	-0,302 ****	0,072	0	-7,4%	-0,302 ****	0,081	0	-7,4%	-0,176 **	0,079	0,025	-4,3%
Local market	-0,423 **	0,203	0,037	-10,3%	-0,214	0,231	0,354		-0,333	0,222	0,135	
% Export	-0,007 **	0,003	0,041	-0,2%	-0,002	0,004	0,57		-0,009 **	0,004	0,024	-0,2%
Customers' knowledge	0,03	0,031	0,33		0,063 *	0,036	0,079	1,5%	0,016	0,034	0,628	
Suppliers' knowledge	-0,004	0,027	0,874		0,017	0,031	0,578		-0,019	0,03	0,53	
Competitors' knowledge	-0,059 **	0,026	0,022	-1,4%	-0,096 ***	0,03	0,001	-2,3%	-0,026	0,028	0,364	
Partners' knowledge	0,015	0,025	0,554		-0,012	0,028	0,662		0,02	0,028	0,482	
Edu. Instit. & Consultants' knowled.	-0,044 *	0,025	0,076	-1,1%	-0,017	0,028	0,54		-0,045 *	0,027	0,097	-1,1%
Right & liberal municipality	0,003	0,029	0,928		0,044	0,031	0,166		-0,037	0,031	0,241	
% Municipality pop. with university degree	1,467	7,055	0,835		-7,738	8,047	0,336		6,249	7,766	0,421	
Municipality trans-border workers	0,03	0,057	0,598		0,018	0,062	0,777		0,079	0,061	0,197	
% Municipality firms of the same sector	-0,23	1,483	0,876		1,885	1,654	0,254		-2,922 *	1,66	0,078	-71,3%
Firms' density in the municipality	0,01	0,11	0,926		-0,123	0,124	0,323		0,041	0,119	0,733	
Constant	-0,363	0,843	0,667		-0,367	0,91	0,687		-1,636 *	0,924	0,077	-39,9%

Source: SFSO data, IRE surveys and personal elaboration

Appendix 52: Estimation of innovation in Ticino's regions – District level (PART 2)

	INNO				INNOPD				INNOPC			
R square (Nagelkerke)	0,31				0,2				0,28			
N	876				875				874			
	B	S.E.	Sig.	Probability	B	S.E.	Sig.	Probability	B	S.E.	Sig.	Probability
Firm' size	0,745 ****	0,084	0	18,6%	0,461 ****	0,085	0	9,3%	0,753 ****	0,089	0	18,2%
% Academic employees	0,895 **	0,353	0,011	22,3%	1,102 ***	0,376	0,003	22,2%	0,971 **	0,405	0,016	23,4%
Autonomous firm	-0,261	0,271	0,337		-0,534 *	0,284	0,06	-10,7%	-0,11	0,293	0,709	
Energy sector (Sector_3)	-1,562 ****	0,341	0	-39,0%	-1,306 ***	0,411	0,001	-26,3%	-1,611 ****	0,367	0	-38,9%
Trade sector (Sector_4)	-1,76 *	1,049	0,093	-43,9%	-0,65	1,195	0,586		-1,873	1,19	0,115	
Transports sector (Sector_5)	-0,245	0,399	0,54		-0,252	0,45	0,576		-0,038	0,41	0,927	
Services to businesses (Sector_6)	-0,243	0,348	0,484		0,058	0,392	0,883		-0,773 **	0,393	0,049	-5,3%
Local competitors	-0,283 ****	0,067	0	-7,1%	-0,247 ***	0,076	0,001	-5,0%	-0,219 ***	0,074	0,003	-8,1%
Local market	-0,424 **	0,191	0,026	-10,6%	-0,154	0,218	0,479		-0,336	0,21	0,11	
% Export	-0,008 **	0,003	0,022	-0,2%	-0,002	0,004	0,649		-0,01 ***	0,004	0,006	0,6%
Customers' knowledge	0,038	0,03	0,204		0,063 *	0,035	0,07	1,3%	0,023	0,033	0,486	
Suppliers' knowledge	-0,003	0,026	0,921		0,026	0,029	0,375		-0,019	0,029	0,507	
Competitors' knowledge	-0,062 **	0,025	0,014	-1,5%	-0,099 ***	0,029	0,001	-2,0%	-0,023	0,028	0,411	
Partners' knowledge	0,017	0,025	0,495		-0,01	0,027	0,71		0,015	0,027	0,581	
Edu. Instit. & Consultants' knowled.	-0,059 **	0,025	0,016	-1,5%	-0,014	0,028	0,619		-0,06 **	0,027	0,03	-1,4%
Right & liberal district	0,053	0,063	0,398		0,077	0,071	0,28		0,001	0,07	0,983	
% District firms of the same sector	3,527	3,522	0,317		1,04	4,014	0,796		3,611	4,005	0,367	
Firms' density in the district	0,147	0,241	0,542		0,303	0,275	0,27		0,269	0,263	0,306	
Constant	-0,181	0,793	0,819		-0,797	0,881	0,366		-1,423	0,902	0,115	

Source: SFSO data, IRE surveys and personal elaboration

Appendix 53: Estimation of innovation in the Ticino's regions (at the district level) with the two omitted spatial variables

	INNO		INNOPD		INNOPC	
R square (Nagelkerke)	0,29		0,2		0,25	
N	807		806		805	
Firm' size	+	****	+	****	+	****
% Academic employees	+	**	+	***	+	**
Autonomous firm						
Energy sector (Sector_3)	-	****	-	***	-	****
Trade sector (Sector_4)	-	**			-	***
Transports sector (Sector_5)						
Services to businesses (Sector_6)						
Local competitors	-	****	-	****	-	**
Local market	-	*				
% Export	-	*			-	**
Customers' knowledge			+	*		
Suppliers' knowledge						
Competitors' knowledge	-	**	-	***		
Partners' knowledge						
Edu. Instit. & Consultants' knowled.	-	*			-	*
% District pop. with university degree						
District trans-border workers						
Constant			-	**		

Source: SFSO data, IRE surveys and personal elaboration

Appendix 54: Innovation in Swiss low density areas

	INNO RURAL	1ST QUARTILE		1ST + 2nd QUARTILE	
R square (Nagelkerke)	0,34	0,35		0,25	
N	321	367		827	
	B	B	Sig.	B	Sig.
Firm' size	0,548****	0,463****	0	0,284****	0
% Academic employees	0,024	0,025	0,142	0,014	0,102
Autonomous firm	-0,197	-0,121	0,72	-0,073	0,726
Energy sector (Sector_3)	-1,889****	-1,467***	0,002	-1,47****	0
Trade sector (Sector_4)	0,91	-0,397	0,617	-1,117**	0,036
Transport sector (Sector_5)	0,084	-0,249	0,676	-0,958**	0,01
Services for businesses (Sector_6)	0,262	0,245	0,684	-0,456	0,251
Local competitors	-0,013	0,033	0,803	-0,127	0,127
Local market	-0,264	-0,66	0,169	0,097	0,748
% Export	0,009	0,006	0,279	0,007**	0,049
Customers' knowledge	0,367**	0,361***	0,004	0,166**	0,036
Input suppliers' knowledge	0,167	0,247*	0,062	0,058	0,482
Software suppliers' knowledge	0,123	0,11	0,412	0,117	0,166
Equipments suppliers' knowledge	-0,114	-0,151	0,267	-0,139	0,104
Competitors' knowledge	-0,317**	-0,38***	0,007	-0,087	0,298
Partners' knowledge	-0,122	0,054	0,636	-0,062	0,384
Universities' knowledge	0,176	0,154	0,371	0,142	0,177
R&D institutes' knowledge	-0,379*	-0,272	0,142	-0,16	0,174
Consultants' knowledge	0,038	-0,027	0,858	-0,083	0,385
Right & liberal district	0,059	0,067**	0,04	0,033*	0,059
% District pop. with university degree	-27,99**	-15,905**	0,028	-9,311*	0,059
District trans-border workers	0,141**	0,116**	0,048	0,029	0,427
% District firms of the same sector	-4,61	2,001	0,561	0,912	0,707
Firms' density in the district	-0,035	-1,407	0,144	-0,149	0,646
Constant	-0,321	-0,338	0,796	0,039	0,957

Source: SFSO data, KOF survey 2002 and personal elaboration

Appendix 55: Innovation in Swiss high density areas

	INNO URBAN	2nd + 3rd + 4th QUARTILE		3rd + 4th QUARTILE	
R square (Nagelkerke)	0,21	0,21		0,22	
N	1318	1272		812	
	B	B	Sig.	B	Sig.
Firm' size	0,225****	0,236****	0	0,243****	0
% Academic employees	0,015**	0,015**	0,012	0,021***	0,007
Autonomous firm	0,007	0,001	0,994	0,071	0,727
Energy sector (Sector_3)	-1,019****	-1,142****	0	-0,831***	0,002
Trade sector (Sector_4)	-1,438****	-1,103***	0,004	-0,65	0,234
Transport sector (Sector_5)	-0,757***	-0,709***	0,009	-0,314	0,351
Services for businesses (Sector_6)	-0,948**	-0,613	0,114	-0,315	0,595
Local competitors	-0,083	-0,092	0,124	-0,058	0,418
Local market	-0,222	-0,116	0,619	-0,356	0,226
% Export	0,005*	0,005**	0,049	0,004	0,292
Customers' knowledge	-0,002	-0,018	0,756	-0,023	0,745
Input suppliers' knowledge	0,022	0,002	0,981	0,017	0,834
Software suppliers' knowledge	0,128**	0,117*	0,059	0,079	0,29
Equipments suppliers' knowledge	-0,116*	-0,091	0,164	-0,058	0,48
Competitors' knowledge	-0,057	-0,027	0,66	-0,103	0,187
Partners' knowledge	-0,047	-0,079	0,165	-0,049	0,494
Universities' knowledge	0,158**	0,162**	0,035	0,18*	0,055
R&D institutes' knowledge	-0,109	-0,136	0,122	-0,125	0,246
Consultants' knowledge	-0,001	0,001	0,992	0,06	0,504
Right & liberal district	0,007	0	0,976	-0,012	0,478
% District pop. with university degree	1,682	1,101	0,634	0,654	0,831
District trans-border workers	-0,079***	-0,09****	0	-0,121****	0
% District firms of the same sector	2,771	0,895	0,622	-0,251	0,925
Firms' density in the district	-0,008	-0,018	0,618	-0,024	0,538
Constant	0,198	0,578	0,232	0,823	0,217

Source: SFSO data, KOF survey 2002 and personal elaboration

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Ordinanza del 22 maggio 2002 concernente l’introduzione graduale della libera circolazione delle persone tra la Confederazione Svizzera e la Comunità europea e i suoi Stati membri nonché gli Stati membri dell’Associazione europea di libero scambio (Ordinanza sull’introduzione della libera circolazione delle persone, OLCP).

Ordinanza del 6 ottobre 1986 che limita l’effettivo degli stranieri (OLS)

ABBREVIATIONS

ARE	Federal Office for Spatial Development
BAK	BAK Basel Economics
CHF	Swiss francs
CIS	Community Innovation Survey
EIS	The European Innovation Scoreboard
EPO	European Patent Office
ETH	Eidgenössische Technische Hochschule
GDP	Gross Domestic Product
GVA	Gross Value Added
ICTs	Information and communication technologies
IRE	Istituto di ricerche economiche
Istat	Istituto nazionale di statistica (Italy)
KOF	Konjunkturforschungsstelle
MAR	Marshall – Arrow – Romer externalities
NEG	New Economic Geography
PPP	Purchasing power parity
R&D	Research and development
RLVM	Locarnese and Vallemaggia's Region
RMVM	Mendrisiotto and Valle di Muggio's Region
RTV	Tre Valli's Region
Seco	State Secretariat for Economic Affairs
SFSO	Swiss Federal Statistical Office
TPP	Technological product and process
USD	United States Dollars
USPTO	United States Patent and Trademark Office
USTAT	Ufficio di statistica del Canton Ticino
VCO	Verbano-Cusio-Ossola