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What do innovation networks really do for local development?

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What do innovation networks really do for local development?

Abstract :

We address the role of innovation networks on growth of territories in the Canadian urban system (TER WAL and BOSCHMA, 2009). We rely on an analysis of 304 urban labor market areas on the basis of patent applications filed jointly by several inventors so as to develop the networks of cooperation. An analysis of such networks on the basis of these geography areas can provide some additional explanatory on the core-periphery model, which appears between the labor market areas that innovate and those that develop economically. The working hypothesis is therefore as follows. If technological change is undeniably the macro-economic factors of growth (ROMER, 1990), the level of flow of knowledge spillover between cities and particularly the degree of centrality of each of them within the collaborative network, has a differential impact on local economic development between urban areas (GORDON and McCANN, 2000). This working hypothesis is based on the observation that innovation at the local level does not necessarily lead to economic development of territories in which it operates (SHEARMUR and BONNET, 2010).

Quel rôle réel pour les réseaux d'innovations dans le développement local ?

Résumé :

Nous nous intéresserons au rôle des réseaux d'innovation sur la croissance des territoires dans l'espace canadien (TER WAL et BOSCHMA, 2009). Nous nous appuyons sur une analyse de 304 bassins d'emplois urbains sur la base des demandes de brevets déposés en commun par plusieurs inventeurs pour établir des réseaux de coopérations. Une analyse de ce type de réseaux sur la base de ce découpage géographique permet d'apporter des éléments explicatifs additionnels sur le rapport centre-périphérie qui apparaît entre les bassins d'emplois qui innovent et ceux qui se développent économiquement. L'hypothèse de travail retenue sera donc la suivante. Si les changements technologiques sont indéniablement des facteurs macro-économiques de croissance (ROMER, 1990), le niveau de circulation de l'information innovante (knowledge spillover) entre villes et plus particulièrement le degré de centralité de chacune d'entre elles au sein du réseau de collaboration, a une incidence sur le différentiel de développement économique entre régions urbaines (GORDON et McCANN, 2000). Cette hypothèse de travail s'appuie sur le constat que l'innovation au plan local ne conduit pas nécessairement au développement économique des territoires dans lesquels elle s'inscrit (SHEARMUR et BONNET, 2010).

1 - Introduction

In this paper, we focus on the importance of information exchange in the local development of territories. These exchanges occur overwhelmingly through geographical proximity and in particular, within clusters of innovative companies. However, the mere exchange of local innovations cannot be sufficient for a sustainable development of territories. The importance of weaving links with an innovative exogenous territory is therefore crucial to its survival in the competition between territories.

But we wonder whether what some territories can not get by geographical proximity, can they get by organizational proximity, that is to say by weaving links and exchanges outside its territory? Indeed, if the innovation is territorially realized by clustered enterprises, they must continue to ensure a regular exchange of good information outside of their local cluster. The analysis of the structure of networks is still an unusual approach in economic geography (GRANOVETTER M., 1983). Nevertheless, various authors have put forward the importance of this type of analysis to understand the mechanisms of local development in the territories (TER WAL and BOSCHMA, 2009; GORDON and McCANN, 2000; DUPUY, 1993).

Thus, the central question of this work is as follows. If some areas may benefit from vicinity of innovative labor market areas to develop itself economically, for instance within metropolitan areas, do some exchanges of innovative information can induce a similar phenomenon between some distant regions and those areas. We will particularly focus on factors influencing the differential between growth and innovation in Canadian territories for the period 2001 - 2006.

The working hypothesis of this paper is as follows. The innovative territories far from major Canadian urban areas can offset their removal by more innovative exchanges and thus benefit from a local development stronger than some more central areas.

In terms of innovation policy, our work is intended to provide a detailed analysis of the territorial situation of innovation thanks of the structure of collaboration networks within 304 urban labor market areas (SINGH, 2005). To do this, we will build on the patent applications filed jointly by at least two inventors. This approach will enable us to establish nationwide innovation networks.

In Section 2, we set out the theoretical framework in which this paper come within thanks to a literature review of the various works that have been conducted so far on this topic, both by geographers and economists. In section 3 we present our data and our methodology, then in Section 4, the model we have used to provide an explanatory framework for our analysis. In Section 5, we present the results from this model.

2 - Conceptual Background Of The Analysis

2.1 Network, Innovation And Economic Growth

The insertion in economic networks is essential in maintaining a capacity for local innovation. The connection between innovation and growth within territories is more the result of a strategic position in networks of innovative information flow (GRANOVETTER Mark, 2005). The innovative collaborations between firms are the source of the information flow and therefore, the formation of networks both locally and regionally, and internationally. Thus, the question arises of the actual impact of the networking of innovative firms on the effects of agglomeration and on the capacity of local growth.

Innovation is a key factor of nationwide economic growth or a regional integrated level (ROMER, 1990). This link is clearly established in the macroeconomic analysis (SOLOW, 1957). However, the impact of innovation is much less obvious at a more local level and the link is less mechanical. So, the territories that produce patents are not necessarily those who locally exploit the usufruct of innovation in terms of economic growth and employment growth (SHEARMUR and BONNET, 2010). The only innovative capacity of a territory is not sufficient to produce an endogenous economic leverage, both in terms of jobs and spin-offs of local innovative companies. In the latter case, spin-offs of larger companies may give rise to some clusters and thus be the trigger for innovative local partnerships. However, the innovative agents (firms or inventors) within a cluster or in extenso a labor market area cannot miss exogenous exchanges with their surroundings geographically, otherwise it appears an endogenous innovation and therefore inefficient at the end.

Nevertheless, some intense exogenous collaborations towards peripheral territories may not produce an endogenous capacity for innovation outside the boundaries of the territory of origin. Such a form of perequation of innovative exchanges is hardly possible. However, they may allow an exchange of information beneficial to one and the other stakeholders in this collaboration. Indeed, a collaborative network remains primarily local, as the source of innovation. In this sense, it is overwhelmingly the product of its environment and its social economic background (VIRKKALA, 2007). This product is the result of local and regional factors such as agglomeration externalities but also the diversity, density and composition of its industrial fabric (WILHELMSSON, 2009).

Thus, as a solvent of the exchange of this local innovative information, the networks of exogenous collaborations contribute to the overall growth of the economy. This role as facilitator of exchange can change the relationship between organizational and geographical proximity. However, it tends to exacerbate the core-periphery ratio, and especially between strong labor market areas and weak labor market areas. It is at this stage that the morphology of relational networks becomes important in the capturing of innovative information. Thus, the central or peripheral position of a territory within a network of innovative relationship potentially allows to counteract the negative effects of a bad location for innovative players (BERGMAN and MAIER, 2009).

Thus, the more central position in a network an innovating firm is, the more the firm will be favoured by information that it will receive first. The local network and the host territory of the firm will take advantage of it. This favourable situation of a firm within a local network leads to fuel agglomeration dynamics. These positive amenities take then the form of

network externalities. These externalities are a main feature in the process of cluster development. These externalities appear when the interest of joining a network is correlated with the number of members in the network (CAPELLO et al, 1995; VICENTE, 2002).

2.2 Other Factors Of Innovative Networks

The emergence of innovation networks consists of feedback loops as we have shown, and related to agglomeration effects and positive externalities they locally provide. However, other factors connected in the theory of these latter can be put forward. The urban economies are specifically related to proximities that allow cities, and especially in services and benefits of urban life. The diversity and quality of a labor market area are more likely to create networks, in particular through the presence of research centers and university campuses.

Likewise, the effect of more turnover of workforce within dense cities allows a high capacity of exchange and therefore, more permeability between companies and research organizations, public or private. The continuity of social networks is all stronger that the population is younger and more open-minded about societal and technological developments (FLORIDA, 2002). Human capital is therefore very important in the weaving of these links which are essential for the proper flow of information at local, regional or international level. All these aspects are therefore very essential to the emergence of innovation.

Moreover, this balance between proximities implies that agents are locally in ability to communicate efficiently due to a good level of accessibility both local and international (ANDERSSON and KARLSSON, 2004). Thus, a labor market area must be in the vicinity of some transport infrastructure such as airports or motorways. The need for accessibility to infrastructures implies de facto a deep inequity between the labor market areas, that is to say labor market areas close to or included in larger metropolitan areas which profit from the benefits and those more peripheral which do not profit (PHELPS and OZAWA, 2003).

3 - Data And Research Method

3.1 Data

To study the innovating firms of urban areas, we use the “regionalized patent register” named REGPAT of the OECD (MARAUT et al, 2008) and particularly the international patent application named PCT. The raw data, OECD REGPAT database, links the addresses of the inventors and applicants for each patent to more than 2 000 regions throughout the OECD countries and member-states signatory of the PCT treaty. Some authors have used the OECD REGPAT database to study internationalization of R&D (the transfer of foreign technology from multinationals to other firms in their home country) (CRISCUOLO, 2009).

With the database, it is possible to identify the region from which each inventor works when he applies for a patent. Indeed, our study has been established with the inventor’s addresses and not with the applicant’s addresses. This provides the innovating agents with an accurate location. Indeed no spatial interpretation of innovation is possible due to the applicant usually are the parent companies’ firms and thus, just a bailor.

The process followed for the regionalisation of patent data at low levels of scales uses the addresses of the inventor provided with the patent, either the ZIP code, or, in its absence, the town name (MARAUT et al, 2008). This database contains for each patent or patent application, the publication number, the priority year (the year when the patent was filed for the first time), information about the name, address, region code and country code of the inventors and applicants of each patent, and finally the share of the patent that corresponds to each inventor or applicant (this enables to take account of co-authorships or multi-applicants).

In this database, we only used patent applications listed at the Patent Cooperation Treaty (PCT). Instead of using data from Canadian Intellectual Property Office CIPO or the triadic patent families (DERNIS, 2007) (that is to say, patents taken at the mains patent offices, the European Patent Office (EPO), the Japan Patent Office (JPO) and the United States Patent and Trademarks Office (USPTO)), we only consider patent applications filed at the Patent Cooperation Treaty (PCT) at the international phase which have been included in the OECD REGPAT database.

The PCT system does not constitute an international patent but just an application. Indeed, then the patent application shall be granted and enforced, in each country in which an inventor seeks patent protection. But in using the patent applications PCT, we have a wider spectrum of Intellectual Property even if the PCT is not a title deed. The PCT system is managed by World Intellectual Property Organization (WIPO). Among others, this agency of the United Nations carries out a patent harmonizing between member states with the International Patent Classification (IPC) and provides the exhaustive database of patents applications PCT. The PCT applications have increasingly increased for the past 20 years (VAN ZEEBROECKA et al, 2009).

Thus, we have established networks of collaborations on the basis of patent applications filed jointly by several inventors with this data for the period 1996 - 2008. This type of approach is often suggested to analyse an innovation network (TER WAL and BOSCHMA, 2009). The matrix resulting from this database of patents allows us to set up networks based on the inventors' reference territory. It then provides an analysis of scales of innovative cooperations of this territory.

3.2 Methodology: Social Network Analysis

The method relies on the social network analysis to describe the characteristics of networks of innovative collaborations which emerge between territories. Thus, the first task of this type of network analysis is to determine the nodes, that is to say companies that have the most favourable situations for capturing this information and are located in a central position relative to their competitors in the network. The analysis of the network structure of cooperation by the formal links offers a double analysis. First, it enables to locate within a network the relay territories which are the centralities and therefore the hinges of these networks. Secondly, the morphological analysis locates spatially the relays of these networks and thus, determines a certain level of efficiency territorial. The combination of these two sets, entrepreneurial and territorial, determines the operational framework of an innovative territorial system.

The relationship between companies is dealt with as a formalization of relational networks. The nodes represent companies and links are exchanges of information between

them. The formalization of networks for innovation through patent applications in the Canadian urban system incorporates this principle. Here, it is applied nationwide except that the nodes are not directly the innovator agents but the territories on which they are located.

This method of analysis allows us to obtain a set of indicators of centrality which inform us about the state of each territory within the network overall for the study period. These indicators of centrality all relate to the characteristics of the location of a node relative to others in the matrix. We only have used one indicator of centrality. Moreover, the network indicators can be differentiated between two types (BERGMAN and MAIER, 2009).

The first measure involves the level of exchanges point to point between different areas. This indicator does not relate to the intrinsic morphology of the network but the weight of exogenous relations between each territory.

The second indicator is based on a treatment of the matrix without taking into account the mass of exchanges between territories (BARABASI and RÉKA, 2002). This indicator is called degree of Freeman's centrality. It especially allows to obtain for each labor market area its position within the matrix and compared to others. It is characterized as the number of links connecting a node in the network in only one step. Normalized, the degree of centrality is divided by the number of other nodes theoretically reachable.

4 - Model

In order to determine whether the level of cooperation exogenous (E) and the degree of centrality (F) to a territory may explain differences in economic development (Employment growth and wage growth) between territories, we construct a statistical model. Moreover, we suggest controlling through a set of both regional factors and national factors.

Following the work of Polèse and Shearmur (2007), we introduce in our model the following factors that control the level of the industrial structure by building a model summarizing the different sectors within these territories studies.

The following model is apprehended through a multiple linear regression by the method of Ordinary least-squares (OLS):

$$G = A + \gamma_1 F + \gamma_2 E + \gamma_3 R + \gamma_4 C + \gamma_5 S + \gamma_6 Q + \gamma_7 \log(P) + \gamma_8 L + \varepsilon$$

Where A is the constant and, G measures the local economic development (Employment growth and wage growth)

The control variables are, R (dummy variables) as provincial territory, C (dummy variables) as cluster of industrial structure, S as variable of industrial specialisation, Q as share of graduates in the population, P as logarithm of population and, L which represents the residues of the potential access to the local market from the following regression:

$$\log(N) = A + \gamma \log(M)$$

Where A is the constant and, N which is an indicator of potential access to the national market in 2001 and, M which is an indicator of potential access to the local market in 2001.

The details of the dummy variables (C) are showed in appendix 1.

5 - Results

Local employment (Table 1) is subject to a low correlation with the efficiency of local innovation networks. This link becomes null with the growth of local revenues (Table 2).

The territories of remoted provinces of the economic core of Canada show a more obvious correlation, first with the local employment (Table 1, A, B) then secondly, to some extent with the growth of local wage (Table 2, A, B). However, the introduction in the model of variables related to the industrial structure (Table 1 and 2, C) and structural factors of territories (Table 1 and 2, E), shows an adjusted R² improved only partially. The adjusted R² is not increased in the case of the addition of variables of structural factors in the growth model of local wage (Table 2, E). The adjusted R² is much better with the introduction of regional variables (Table 1 and 2, C, F). Furthermore, it appears that the growth of local employment is more strongly correlated with the regional situation of each territory than the growth of local wage. Also, this is true for all model variables, suggesting that the link between growth and innovation network, although relatively small, is more strongly associated with growth of local employment with wage growth. In addition, this link is even clearer because of the greater involvement of certain sectors to grow local industries (CL6 and CL7) that are both highly providers of patents and collective patents outside the territory of reference.

The influence of the variables of structural factors on the economic growth is quite different between the employment growth (Table 1, E) and the wage growth (Table 2, E). Indeed, employment growth does not appear to correlate with the population of the territories, which suggests that agglomeration economies have only an indirect impact on employment. Also, it should be noted that, given the local industrial structure, these controls are only a moderate explanatory power in this model on employment growth (Table 1, F). To the two variables of innovation networks, the first, the centrality of the territories, has little influence on the level of employment growth. Conversely, the second, the level of cooperation innovative exogenous is relatively correlated with employment growth.

For growth of the wage, the situation is different for the local structural variables. The level of graduates in the population, the specialization of local activity and the population size have a more pronounced share in the level of local wage (Table 2, F). For variables of innovation networks, their influence on the growth model of local wage is much less pronounced than on the employment growth. In any case, the centrality of territories in the Canadian nationwide innovation network does not directly effect, neither on the level of employment growth, nor the level of wage growth. In general, our model provides a stronger explanatory power for local employment growth than for local wage growth.

The results provide geographic differences more obvious when we perform a dichotomous analysis between central and peripheral territories. So, while the explanatory ratio is more favorable to the center in the context of the wage growth (Table 2, G), this ratio

is reversed in favor of the periphery in the context of local employment growth (Table 1, H). The central regions do not have better growth potential in terms of wage due to their central position in the Canadian innovation network; their ability to connect to other territories appears slightly more beneficial to theirs. This should be compared with those of peripheral territories. They derive maximum benefit from their central position in the innovation network and more in their exogenous innovative linkages (Table 2, H). This shows that that links can maintain a local capacity for innovation but do not bring an evident wage growth. Conversely, for the employment growth, the share of innovative external links is a larger positive factor for peripheral territories than it is for the central areas (Table 1, G and H). Moreover, in the two cases, peripheral and central, the centrality within the national innovation network has little correlation with local employment growth.

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Appendix 1 : Industrial Cluster Profiles

Clusname_SAct	CL10	CL12	CL5	CL6	CL7	rang	description
_06lag1	1,18	4,82	1,92	1,77	0,86	1	Primary
_06lag2	1,61	1,09	1,20	0,93	1,10	2	Construction
_06lag3	0,89	0,68	1,70	1,79	0,92	3	First and second transformation manuf.
_06lag4	0,91	0,28	1,60	0,68	1,11	4	Medium tech manuf.
_06lag5	0,30	0,04	0,58	0,31	1,41	5	High-tech manuf.
_06lag6	0,61	0,74	0,89	0,61	0,97	6	Wholesale and warehousing
_06lag7	1,09	0,81	0,92	1,11	1,01	7	Retail and personal services
_06lag8	0,86	1,09	1,26	1,00	0,96	8	Transport
_06lag9	0,74	0,64	1,05	0,78	0,82	9	Support services for transport
_06lag10	0,61	0,35	0,45	0,49	0,94	10	Information and cultural industries
_06lag11	0,58	0,57	0,59	0,60	0,79	11	Finance
_06lag12	0,49	0,49	0,71	0,56	1,07	12	Insurance
_06lag13	1,20	0,54	0,59	0,62	0,95	13	Real estate and rental services
_06lag14	0,89	0,52	0,64	0,54	0,90	14	non scientific KIBS
_06lag15	0,60	0,37	0,41	0,40	0,95	15	scientific and technical KIBS
_06lag16	1,06	0,53	0,80	0,76	1,01	16	management support
_06lag17	0,90	0,89	0,79	1,05	1,03	17	education
_06lag18	0,99	0,88	0,91	1,22	1,01	18	health and social services
_06lag19	1,66	0,63	0,85	0,72	1,05	19	arts, leisure and performance
_06lag20	1,44	0,78	0,87	1,07	0,96	20	restaurants and hotels
_06lag21	1,06	1,50	1,35	1,33	1,01	21	repair services
_06lag22	0,95	0,66	0,81	0,95	0,98	22	religious services and other organizations
_06lag23	0,81	0,73	0,80	0,97	1,18	23	public administration

class1	CL10	CL12	CL5	CL6	CL7	Total	
AM1					4	4	major metropolitan areas (over 1M)
AM2					4	4	smaller metropolitan regions (under 1M)
AC1	1		4	4	6	15	central cities, 100K+
AC2	3		4	2	2	11	central cities 50-100K
AC3	1		4	7	2	14	central cities 25-50K
AC4	15		18	6	12	51	central cities up to 25K
AP1	2			5	6	13	peripheral cities, 100K+
AP2	3	2	2	4	2	13	peripheral cities 50-100K
AP3	3	2	1	13	1	20	peripheral cities 25-50K
AP4	3	1	3	17	1	25	peripheral cities up to 25K
RC	11	6	27	12	4	60	
RP	8	21	8	34	2	73	
990 Whitehorse					1	1	
Total	50	32	71	104	47	304	

Centr_Periph	CL10	CL12	CL5	CL6	CL7	Total
C	29	4	52	25	35	145
P	21	28	19	79	11	158

Table 1: Employment Growth Model

	A	B	C	D	E	F	Central G	Peripheral H
Intercept	3,51	9,37	1,11	7,13	1,79	2,63	1,88	-0,2
	0,0005	<.0001	0,2673	<.0001	0,0751	0,0091	0,0632	0,8407
F	-1,58	-0,64	-0,81	-0,3	-0,53	-0,34	-0,37	-1,1
	0,1148	0,5253	0,4201	0,7641	0,5935	0,7341	0,7099	0,2757
E	2,6	4,04	1,62	3,22	0,37	1,84	0,38	1,51
	0,0099	<.0001	0,1067	0,0015	0,7094	0,0673	0,7014	0,1337
AT		2,71		-3,1		-3,07	X	-1,64
		0,0072		0,0022		0,0024	X	0,1034
QC		4,24		-4,47		-2,46	-3,09	1,34
		<.0001		<.0001		0,0147	0,0025	0,1828
ON		-9,29		-10,84		-5,86	-5,56	-1,34
		<.0001		<.0001		<.0001	<.0001	0,1819
PR		-2,18		-7,04		-7,1	-3,33	-4,52
		0,0303		<.0001		<.0001	0,0012	<.0001
AL		-1,56		-5,75		-5,43	-2,39	-3,55
		0,1203		<.0001		<.0001	0,0184	0,0006
BC		7,11		3,1		3,07	3,09	1,64
		<.0001		0,0022		0,0024	0,0025	0,1034
CL10			1,42	0,03		-0,72	0,7	0,77
			0,1581	0,9796		0,4746	0,4866	0,4453
CL12			0,47	0,74		-0,48	-0,18	0,52
			0,6369	0,4592		0,6311	0,8547	0,606
CL5			1	0,48		-0,29	1,06	1,06
			0,3176	0,6288		0,7745	0,2927	0,2915
CL6			4,11	2,93		0,97	1,36	1,38
			<.0001	0,0038		0,3329	0,178	0,1717
CL7			-1,42	-0,03		0,72	-0,7	-0,77
			0,1581	0,9796		0,4746	0,4866	0,4453
S					-7,17	-3,05	0,63	-4,03
					<.0001	0,0026	0,531	0,0001
Q					2,19	-0,79	-1,39	-0,45
					0,0295	0,4309	0,168	0,6531
P					-2,27	-0,56	0,67	0,72
					0,0243	0,5739	0,5012	0,4755
L					0,35	-0,94	-1,92	1,17
					0,7232	0,3483	0,0571	0,2448
Adj R-Sq	0,0448	0,4398	0,1237	0,464	0,2322	0,4829	0,3632	0,3993
N	243	243	243	243	243	243	131	112
VIF Max	1,11754	2,3753	2,42762	2,57821	2,36514	6,46377	3,19538	5,83925

Table 2: Wage Growth Model

	A	B	C	D	E	F	Central G	Peripheral H
Intercept	19,54 <.0001	15,6 <.0001	16,99 <.0001	13,19 <.0001	-0,14 0,8923	1,05 0,2947	0,83 0,409	0,03 0,975
F	-0,7 0,4877	-0,77 0,4431	-1,35 0,1768	-1,39 0,1658	-2,06 0,0405	-1,55 0,123	-0,82 0,4117	0,28 0,7812
E	0,5206	0,8112	0,3367	0,3769	0,1158	0,3912	0,6926	0,3419
AT		-0,6 0,547		-0,26 0,7966		-0,34 0,7354	X X	-0,17 0,8641
QC		-1,49 0,1377		-0,58 0,5619		-1,37 0,1727	-0,15 0,8844	-0,48 0,6336
ON		-0,63 0,5296		-0,45 0,6541		-0,82 0,4126	-0,25 0,8046	0,87 0,3882
PR		0,58 0,5622		0,89 0,3739		1,35 0,1777	2,1 0,0381	0,53 0,5988
AL		6,52 <.0001		5,73 <.0001		5,4 <.0001	4,2 <.0001	3,11 0,0025
BC		0,6 0,547		0,26 0,7966		0,34 0,7354	0,15 0,8844	0,17 0,8641
CL10			-0,11 0,9157	-0,1 0,9205		0,9 0,3665	0,36 0,718	1,28 0,2031
CL12			2,25 0,0257	-0,77 0,4421		0,36 0,7216	0,23 0,816	0,79 0,4287
CL5			-3,09 0,0022	-2,76 0,0063		-0,92 0,36	-0,64 0,5229	0,18 0,8599
CL6			-2,76 0,0061	-2,46 0,0146		-0,89 0,3731	-1,19 0,2361	0,12 0,905
CL7			0,11 0,9157	0,1 0,9205		-0,9 0,3665	-0,36 0,718	-1,28 0,2031
S					-0,88 0,3819	0,86 0,3909	1,17 0,2458	-0,51 0,608
Q					3,1 0,0022	2,76 0,0063	2,09 0,0392	1,34 0,1846
P					1,48 0,14	0,41 0,6858	-0,21 0,8319	0,81 0,4206
L					0,92 0,3568	-1,13 0,2595	-1,23 0,221	-0,09 0,9257
Adj R-Sq	0	0,2248	0,1219	0,2572	0,0513	0,2758	0,2886	0,2285
N	243	243	243	243	243	243	131	112
VIF Max	1,11754	2,3753	2,42762	2,63517	2,36514	6,46377	3,19538	5,83925