Finance and growth:
Local banking, credit and innovation in XIXth France

GUILLAUME BAZOT[1]

Abstract

Thanks to a new data set about patent tax in French district (Département) we examine the role of the banking system for the promotion of innovation and growth from 1881 to 1911. First, we show a positive relation between credit development and growth. Second, we prove the positive impact of local banking on innovation, and GDP per capita growth. Third, we make the link between those results studying the key role of the local banking and its utilisation of "soft" information. Finally, we reassess and give evidence of the efficiency of the local implantation's policy of the Banque de France through those new results.

The return of Schumpeterian theory through endogenous growth models opened up the way to a new set of research. Financial institutions were especially analysed as Schumpeter gave them a key role on the growth and innovation process. Indeed, through firm's selection and so called creative destructions their policy and actions influence present and future technical progress. In other word, well functioning financial system join to efficient financial institutions allow the selection of wealthiest entrepreneurs' projects.

Empirical analysis gave evidence of this positive effect through positive correlations between ex ante financial development and GDP growth (Levine & Zevros 1998). Besides, Rajan & Zingales (1998) proved that financial intermediaries play a dramatic allocation's role since well functioning financial market allows faster development in sectors with high external finance's dependence. On a microeconomic of banking way Berger & Udell (1996 & 2002), Petersen & Rajan (1995 & 2002) and Stein (2002) showed that information's management played dramatically on credit allocation's efficiency. They also established that different organisations bring different results according to the

[1] EHESS-PSE, bazot@pse.ens.fr

firms' needs. Through this outcome a contextualised management of information is the bridge from finance to growth.

The role of financial institutions related to information issues was encompassed by historian from long time as well. Gershenkron (1962) first set the key function of banks for first order backward economies catching up like Germany. He also launched a long controversial about universal banking ability to promote innovation and growth through its specific management and monitoring features (Guinnane 2001). Taking up those intuitions Calomiris (1995) compared German and US financial system for the late XIXth century. He displayed the superiority of the universal bank by its aptitude to generate long term and close connections with firms. These ones overcame informational issues and reduced "lemons" problems. It thus gave adapted financial helps at every stage of the firm life.

In other word, if associated with adapted institutions, credit development and, in a more general way, financial development is more able to promote economic growth. From this respect, the positive correlation between growth and financial development needs a better evaluation of institutions inside the black box. By comparison of different banks attributes that is what this paper attends to do.

The XIXth century French case could shed light to the role of the banking system and its consequences for the management of information to credit development on one hand and innovation and economic growth on the other. Using a pool of indicator and new data sets on the innovation's efficiency per French district (Départements) this paper gives evidence of the importance of information management through the impact of local and deposit banks on these elements.

Basically, from 1880 to the WWI the French banking system is defined by three major actors. First, local bankers acted on specific areas inside industrial districts or clusters with a large utilisation of "soft" information which is private and not transferable. Their credits took different forms and depended to the needs of their clients. They also used strong connections and relationships for their business. Second, deposit banks had a wide network of branches spread over the country and used "hard" information for their business. They drew massive deposits and limited their assets to the discount of safe bills. They made

huge profits thanks to scales' economies and diversification of risks. Third, the Banque de France had the issue's monopoly and played an important role for distribution of liquidity to local area through local bankers. One of our recent works gives evidence of its positive influence on credit development through its branch (Succursales) network.

Regard to their characteristics we assessed the influence of each banking actor on innovation, and GDP per capita growth from 1881 to 1911 per French district. We found a significant and positive effect of local banking on these variables. It proves that "soft" information utilisation join to clusters' economies was more able to promote innovation and growth in the French economic context of the late XIXth. Furthermore, because of the Banque de France sustains of local bankers on this period we reassessed its economic action on the light of those results. Eventually, because of deposit bank's expansion and their substitution to local bankers those outcomes cast the doubt about market efficiencies of the banking sector. From this respect, the double competition's feature of the banking sector (deposit and credit) is especially put in front of the argumentation.

We used a two times strategy. First, picking up King & Levine (1993) methodology we established the positive effect of credit development and local banking on GDP per capita growth. Second, we found out correlations between local banks share and figure of local bank branches per inhabitant on an indicator of innovation. By the interpretation of results, "soft" information utilisation provided more credits to the economy, increased finance of wealthier projects what improved productivity and growth through innovations. As "soft" information stems from local banking this outcome contrasts with theories about concentration efficiency (Cf. Cetorelli & Gambera 2001 for instance). In other word, in the trade off between diversification and relationship banking, the specific structure of the French economy gave advantage to the later on the former, from the point of view of economic development.

The first section of the paper presents data and variables. Section II displays empirical strategy. Section III interprets results. Section IV reassesses the Banque policy. Section V adds discussions on patents. Section VI concludes.

1. Data and variables

We used for this study a set of indicator to assess the banking structure, innovations and credit development. First, banking structure indicators look for the kind of information used in the credit process and the role of relationship on loans circulation. Through characteristics of the banking actors we are able to take into account those elements. Also, the number of local bank branches on the number of deposit bank branches (LBS) is a good proxy of the importance of relationship banking on credit's allocation. A high value of the ratio involves a high share of credit deals by local banking methods. It also catches the impact of close connections between bankers and clients. The number of local bank branches per inhabitant (LBH) and the number of deposit bank branches (DBH) per inhabitant are two additional indicators of these actors' credit tools.

Second, innovation indicator catches the amount and the productivity of innovations. We use for this purpose the tax on patent. This one has three important characteristics: it is proportional to the number of protected years (5, 10 or 15 years), the cost of additional years is proportional 500F, 1000F and 1500F and has to be paid per constant annuities (100F). The patent is null if an annuity is not paid or if the invention has not been used for production. According to this status higher is the tax higher is the patents value. Hence, rational patentees paid the tax each year as long as the expected gain of the protection was superior to 100F. Therefore the patent tax takes into account the importance and the value of present innovations. Furthermore, since the tax is spread over the patent protection's period, the amount is smooth over time and avoids some cycle's effects. The patent tax per urban population (INN) catches the effective innovation capacities since urban districts are more able to promote innovation than rural ones. It is well proved by description of patents and address of depositors since innovation was often a technician job localised on urban areas.

Two important points have to be added. First, the sample withdraws the district of Paris as it catches by law all foreigners' patents. It is important since this district account for 75% of the tax amount in 1881 and 88% in 1911. This

gap is especially due to foreigners deposit as it represents more than 60% of the district patents by 1881, a figure in progress with time. Thus, our sample is a composition of more than 2000 patents each year. Second, we make the hypothesis that a class of patentees present their patents to the closest office while another one present their patents to big places (Paris or Lyons for instance). This hypothesis has been studied and validated by Lamoreaux & Sokoloff (2000). We also assume this repartition stable over time. Through this specification fixe effects avoid any biases of geographical declaration.

Even if the amount of the tax can (imperfectly) take into account the patent's productivity, we finally made a qualitative analysis in order to assess patents interest by districts. First, patent where on a general way dependant of the kind of activity practiced on each district. For instance we find more "for agriculture" patent in the district of Montpellier and more industrial patent in the district of Grenoble. Second, the proportion of low value patents (patents which do not improve the firm's productivity) is randomised and did not touch specific districts. Third, the share of companies' was not actually high and smooth over time (almost 15% if we exclude foreigners and less than 10% without Paris).

Third, credit development is defined as the amount of credits per GDP[2] (DEVCRED). Credits are determined by the stamp tax (Cf. Rouleau 1914) which takes into account all kind of draft bills (Cf. Bazot 2010 for district calculation and basic results and statistics). Those bills retain all kind of credit subject to discount which is the major credit tools in XIXth France.

We used additional variables in our regressions: the average size of firms (AVSIZE) is the amount of the tax paid by enterprises by the number of firms, the part of non agricultural sector on GDP (NONAGR) the number of firms per capita (ENT per CAP), the GDP per capita (GDP per CAP) and the population density (DPOP) (Cf. Bazot 2010 for precision).

We built our data thanks to: the "Bottin du commerce et de l'industrie" for the number of local and deposit banks, Jobert (1991) for the number of firms and the amount of the tax on "patente", the "comptes définitifs des recettes de l'exercice

[2] For the calculation of GDP per French district see Bazot (2010). Note that this calculation has been compared with Toutain's calculation in Combes & al. (2008). Series are strongly correlated since the R^2 is equal to 0.98 with Paris and 0.95 without.

rendu par le ministre des finances" for the patent tax, Bazot (2010) for the amount of credits and GDP and the ined web site[3] for population. Note qualitative information about patents (address, description of patent, etc.) are available in the "bulletin des lois de la république française".

2. Empirical tests

We use a two times strategy. We first assess the impact of credit development for future GDP growth as done by King & Levine (1993). We find a robust and positive effect. Second we add tests about local and deposit banks' actions on innovation's efficiencies. We get a wide impact of local banking on real economy's variables. Thus, the pool of results gives evidence of the positive influence of financial development on growth and the specific role played by relationship and "soft" information on this result.

2.1. Credit development and Growth

Discussion on the role of financial development on one hand and credit development on the other triggered numerous works on the topics. Recent papers actually reviewed the positive effect of both credit and financial markets for growth (Cf. Levine 1999 & 2004). One empirical model particularly used was the explication of GDP per capita growth by credit development at the first year of the considered period. We take up this method in order to assess the impact of credit development for growth from 1881 to 1911. Obviously, the pool of control variables is more limited on this period; nevertheless we worked to take into account the basic catching up effect, the market size and the growth potential. We thus used three variables: GDP per capita in 1881 (GDP per CAP), the number of inhabitant in 1881 (DPOP) and the number of firms per inhabitant (ENT per CAP). Note we did not add patent variable since the patent tax per inhabitant in 1881 is highly correlated with GDP per capita at this date (R^2=0.6,

[3] www.ined.fr

see graph 1 in annexe). Explicative variables are in logarithm. Results are displayed in Table 1.

TABLE 1
Determinant of GDP per capita growth from 1881 to 1911

Independent variable	[1]	[2]	[3]
DEVCRED	0,13***	0,15***	0,14***
	[0,04]	[0,04]	[0,04]
GDP per CAP	-0,23***	-0,18**	-0,34**
	[0,078]	[0,08]	[0,15]
DPOP		-0,12*	-0,09
		[0,07]	[0,073]
ENT per CAP			0,2
			[0,16]
CONS	-0,04	0,45	0,92**
	[0,091]	[0,30]	[0,44]
R^2 within	0,12	0,18	0,2
N	84	84	84

***, **, * significant at 1%, 5% and 10% confidence
Regression tested by OLS. DEVCRED is the credit development variable (Credit/GDP) in 1881, GDP per CAP is the GDP per capita in 1881, DPOP is the population density in 1881 and ENT per CAP is the number of firms per capita in 1881. All variables explained in logarithm. The district of Paris is excluded.

We find an important, significant and stable effect of the initial credit development on GDP growth. It confirms King and Levine (1993) results on the district scale without the institutional biases inherent to cross country regressions. Furthermore, we see a strong catching up effect even if the robustness is less clear than credit development as proved by the variance of coefficient's value. For instance, if credit development double, GDP per capita would be higher by respectively 13%, 15% and 14% in 1911. At the opposite a twice richer Département would see a weaker GDP per capita growth from almost 0.3% per year.

We added local bank branches per inhabitant (LBH) and deposit bank branches per thousand of inhabitants (DBH) variables from those regressions in order to

assess the link between the banking system and the positive effect of credit development on GDP growth. Note, because some Départements had no deposit bank in 1881 we did not use neither LBS ratio for 1881 nor logarithmic estimation of DBH. Results are displayed in table 2.

TABLE 2
Determinant of GDP per Capita growth from 1881 to 1911

Independent variable	[1]	[2]	[3]
DEVCRED	0,08**	0,08**	0,09**
	[0,04]	[0,04]	[0,04]
LBH	0,12***	0,1***	0,1***
	[0,04]	[0,04]	[0,04]
DBH	5.59	5.53	
	[6.52]	[6.59]	
GDP per CAP	-0.3***	-0.4**	-0.4**
	[0.08]	[0.17]	[0.17]
ENT per CAP		3,1	3,1
		[4,6]	[4,5]
CONS	1.3***	0.82	0.81
	[0.36]	[0.57]	[0.56]
R^2	.21	.21	.21
N	84	84	84

***, **, * significant at 1%, 5% and 10% confidence
Regression tested by OLS. DEVCRED is the credit development variable (Credit/GDP) in 1881, LBH the number of local bank branches per inhabitant in1881, DBH the number of deposit bank branches per inhabitant in1881, GDP per CAP is the GDP per capita in 1881, DPOP is the population density in 1881 and ENT per CAP is the number of firms per capita in 1881. All variables except DBH explained in logarithm. The district of Paris is excluded.

Regressions display a positive effect of LBH on GDP growth while DBH is insignificant. For instance, if LBH double, GDP per capita is 10% higher in 1911. We also observe less effect of credit development here than in the precedent case. It is probably due to the influence of local bank branches on credit development.

Because of the data shape and the few number of deposit banks in 1881 we merely tested the effect of DBH substituting 1881 values by the log of the 1911's

ones. We runs tests for 1881's and 1911's LBH values. In both cases the LBH's coefficient keeps a close value (resp. 0.1 & 0.12; p-value equal resp. 0.07 & 0.005) while DBH remains insignificant. It confirms the positive correlation between local banking and growth. Moreover, the existence of a positive correlation between DBH variation and LBH in 1881 proves that deposit banks expansion followed business level instead of business growth (see graph 4 in annex). Therefore, local banks brought business about while deposit banks followed. Nevertheless, because of endogenous bias this test is not actually academic though informative.

Instead of DBH and LBH we could test the LBS ratio for 1911 (Cf. map 1 in annexe). We put this ratio out of order for 1881 however its 1911's value is more accurate. Indeed, the figure of deposit bank branches is sufficiently high now to predict the importance of relationship banking per Département. The spectre of endogenous bias is not present as GDP growth could impact on both figure of local and deposit bank branches. We should nonetheless stay prudent since inertia makes up values. For instance, because of its business size a Département with a high number of local bank branches in 1881 could keep an artificially high value of LBS even if the information used was not "soft".

We also created a new variable called SOFT which is the variation from 1881 to 1911 of the number local bank branches per inhabitant by the variation of deposit bank branches per inhabitant[4] (Cf. map 2 in annexe). This ratio avoids the inertia issue but is not useful outside a variation regression. As the variation of deposit bank branches per capita is always positive on the period we can interpret the ratio as follow. A positive value of the ratio shows no substitution between local and deposit banks. Also, higher is SOFT higher is local banking needed. If the ratio is inferior to zero deposit banks take up local banks business what prove a substitution. Here, hard information is needed as SOFT is low.

Note that LBS and SOFT are correlated by a U relation (as proved by the graph 1 in Annexe). Therefore, the shape of this curve and the comparison between the map 1 and the map 2 gives evidence of the link between LBS and SOFT but shows also that some district with a high number of local banks can be

[4] Note the number of inhabitant is important in the ratio since it rub off the effect due to the district business size.

associated to hard information. Furthermore, on a general way, map 2 puts in front the importance of relationship banking on industrial district ("Isère", "Nord", "Rhone" and "Loire" for instance) while map 1 proves that local banking belong to both agricultural and industrial district. From this perspective local banking is not a backward way of firm's financing, it is rather the opposite. Eventually, industry needed tough relation with bankers for their business. It probably comes from the large variety of their needs and the flexibility that local banks gave to them. Indeed, because of the low number of intermediaries inside the bank, extraordinary decisions could be made easily without large cost.

We run regressions with SOFT as an IV of LBS1910. Results are displayed in table 3.

TABLE 3
Determinant of GDP per Capita growth from 1881 to 1911

Independent variable	[1]	[2]	[3]
DEVCRED	.13**	.14***	.13***
	[.04]	[.04]	[.04]
LBS1910	.04**	.04*	.04*
	[.02]	[.02]	[.02]
GDP per CAP	-.19**	-.16**	-.29*
	[.08]	[.08]	[.16]
DPOP		-.06	-.05
		[.06]	[.06]
ENT per CAP			.16
			[.17]
CONS	-.11	.16	.54
	[.10]	[.27]	[.45]
R^2	.15	.18	.20
N	84	84	84

***, **, * significant at 1%, 5% and 10% confidence
IV Regression with SOFT as instrument of LBS1910. DEVCRED is the credit development variable (Credit/GDP) in 1881, LBS the number of local bank branches per deposit bank branches in 1911, GDP per CAP is the GDP per capita in 1881, DPOP is the population density in 1881 and ENT per CAP is the number of firms per capita in 1881. All variables except LBS explained in logarithm. The district of Paris is excluded.

Results are significant at 5% if DPOP and ENT per CAP are not included. Once control variables inside LBS1910 is significant at 10% (p-value respectively equal to .054 and .070) coefficient figure remains stable while controls are not significant, what proves the importance of the first test. Also if LBS double GDP growth increases by .13% per year. In other hand, DEVCRED keep the value of .13 anyway.

As econometric shows, finance and banking institutions matter for economic growth. Nevertheless, those specifications faced the lack of connection with real economic parameter, and then a large black box still remains. We thus looked for a bridge from finance to growth through innovation exploration.

2.2. Local banking and innovation

Since we know the importance of local banking for local GDP growth and the correlation of LBH with the credit development variable we have to make both and meets. Therefore, important questions remain about key elements of those correlations. We thus look for assessing the influence of local banking and credit development on innovation efficiency as a way to picking up additional information about the kind of mechanisms in game.

Whatever we specified our models it is difficult to test the effect of DEVCRED on innovation. One explanation is the impact of fixe effects and control variables. One good proof is the evolution of the coefficient value and its significance according to the model specification (see table 6 in annexe). Results prove that DEVCRED suffer from both of those parameters. Besides, coefficients' sign change according to the kind of individual effect we use. However, as robustness is weaker with the *within* estimator we can support the idea that fixe effects hide the actual role of DEVCRED. As a proof, when individual effects are withdrawn, DEVCRED became positive and significant even with control variables. Therefore, credit development probably had steady effects on innovation but they remain hard to specify because of their correlation with wealth and level of development. It is thus more useful to looking for effects generated by the banking structure.

In order to catch the role of local banking and more specifically the importance of connections between banks and their clients, we tested the influence of the number of local bank branches per deposit bank branches (LBS) ratio on INN. This one is a good proxy of local banking domination on a given area. Of course it does not catch size effect of the banking system that the reason why we add estimations with LBH variables below.

Since there is no direct risk of endogenous biases between LBS and dependent variables we can run panel *within* regression with temporal dummies. We added control variable with a ten years' lag in order to catch several soundless effects but we avoided to put variable which have in their calculation an element of the denominator of INN. Results are displayed in table 4.

TABLE 4
Determinant of innovation from 1881 to 1911

Independent variable	[1]	[2]	[3]
LBS	.43***	.45**	.45**
	[0.16]	[0.21]	[0.22]
NONAGR t-10	-47	-66	-88*
	[42]	[64]	[45]
AVSIZE t-10	-.59	-1.8	
	[1.96]	[1.22]	
CONST	56***	80***	78***
	[13]	[27]	[28]
temporal dummies	no	yes	yes
R^2 within	0.19	0.19	0.19
N	296	296	296

***, **, * significant at 1%, 5% and 10% confidence
Regression tested by panel *within* regressions with temporal dummies. The dependant variable is INN (the patent tax divided by urban population per thousand of inhabitant). [1] is the basic regression without temporal dummies, [2] and [3] add temporal dummies. LBS is the number of local bank branches divided by the number of deposit bank branches, AVSIZE is the average size of firms and NONAGR is the non agricultural production dived by GDP. The district of Paris is excluded. All variables except LBS are 10 years' lagged.

We find a significant impact of the LBS ratio which is stable whatever the specified model. It thus proves the importance of "soft" information utilisation for innovation. On each case if the LBS increase by one unit the proxy of research efficiency increases by almost 2% on average. Also, a district which gets three times more local bank branches than deposit bank branches will have a higher research potential by 5% than a district with the same number of both types. Note we ran regressions adding control variables like GDP per CAP or ENT per CAP, results remain the same. Tests with random effects change neither coefficient nor standard errors. Furthermore, because of few numbers of years in our panel we used *bootstrapping* regressions to assess convergence of the LBS coefficient. The standard errors' variance of thirty *bootstrapping* tests is feeble either with fifty or one hundred replications what proves the accuracy of the LBS coefficient.

As mentioned before the lack of size effects of the LBS variable could be a problem. For instance, *ceteris paribus*, a district with 8 local banks and 1 deposit bank will get a high LBS value while a district with 20 local banks and 30 deposit banks will get a low one. That the reason why we ran new regressions with the LBH variable. In order to interpret results we ran regressions with the number of bank branches per inhabitant (NBH) as a variable as well. Results are displayed in table 5.

Results confirm the importance of local banking rather than banks alone since the significance is only established for LBH. Furthermore the coefficient is stable whatever the specified model what gives evidence of the robustness of results even if [2] has a p-value of 0.054. In other hand if the number of local bank branches double on an average district, INN increase by 26%. We also ran regressions adding control variables like GDP per CAP or ENT per CAP, results remain the same. Tests with random effects change neither coefficient nor standard errors. *Bootstrapping* standard error brings no significant variations for LBH as well.

TABLE 5
Determinant of innovation from 1881 to 1911

Independent variable	[1]	[2]	[3]	[4]	[5]	[6]
LBH	.14** [.068]	.13* [.067]	.14** [.067]			
NBH				.084 [.064]	.094 [.062]	.11* [.062]
NONAGR t-10	-111*** [3,48]	-31 [62]	56 [40]	-120*** [36]	-31 [63]	58 [40]
AVSIZE t-10	-.067 [1.72]	-2.0 [2.1]		-.22 [1.72]	-2.1 [2.1]	
CONST	81*** [11]	52** [22]	50** [25]	90*** [10]	55** [21]	51** [25]
temporal dummies	no	yes	Yes	no	yes	yes
R^2 within	0.16	0.19	0.18	0.16	0.18	0.18
N	336	336	336	336	336	336

***, **, * significant at 1%, 5% and 10% confidence

Within regressions with temporal dummies. The dependant variable is INN: the patent tax divided by the urban population in thousand of inhabitant. LBH is the number of local bank branches per capita, NBH is the number of bank branches per capita. LBH and NBH are expressed in million of inhabitant. NONAGR is the non agricultural production dived by GDP and AVSIZE is the firm's average size. The district of Paris is excluded.

Note *within* regressions were the perfect tools for these tests. It helps to catch the dynamic effect of the banking system's evolution over different districts what is an important element we point out through the role of the deposit bank expansion from 1890 to the WWI. Therefore, according to innovation capacities of each district the model proves that local banking helps to finance innovation.

3. Interpretation of results

How the French financial system influenced the economy? The empirical results suggest an important role played by local banking through their major characteristics. Hence, that is by the action of "soft" information utilisation that effects should appear. Analysis of local banking in XIXth France and theories about relationship banking will thus help us to draw some mechanisms and dressed economic interpretation.

3.1. Local banks characteristics

By 1881 France accounted more than 2000 bank branches which almost of 1600 were due to local private banks. These one were often created by traders who found new opportunities of business through the discount of trade papers. They are also, well include in the commercial landscape and had strong information, connexions and knowledge of the local business (Plessis 2001). They took different social forms but larger ones were either joint stock companies or partnerships often constituted by local peoples and local funds. They were therefore insiders of industrial districts and clusters.

Belonging to local business local banks had higher aptitude to allocate funds to riskier clients since their knowledge reduced information asymmetry and allowed to figure out the actual value of the venture (Berger & Udell 1996). Hence, thanks to "soft" information they had facilities to seize opportunities of new valuable projects and avoided anti selection process. Furthermore, connections with other actors of the cluster gave them a coercive power through

reputation cost and prevented moral hazard. In other hand their small size allowed to adapt loans to their clients' needs what made them able to face unusual situations. They also had accurate knowledge of firms and lent to the most profitable and promising ones. Local banks could thus generated selections between many firms from their activities' area.

Bank's credit in XIXth France took the form of bills. These bills were either drafted by sellers or by banks if they directly provided credit to their clients through open account. Bills due by a client could be discounted to banks if the sellers needed liquidities for its activities. Once in the banking track each bill could be rediscounted to the Banque de France or one of its Succursales[5] if the bill, the discounted bank, the seller and the client were well perceived by it[6]. Therefore, many bills were not discountable to the Banque; also banks manage their portfolios to get a sufficient mass of liquid papers. One part of their credit went to riskier long time projects and the other to trade bills easily discounted to the Succursale. If banks could not rediscount their bills they had to keep reserves in vault what reduced their credits to the economy. Banks make thus trades off between long time high productive credit and short run liquid ones.

Thus, through their illiquid loans and private knowledge local banks were more able to promote new business and innovation. Firms were indeed often credit constraint because of the informational gap of banks. Basically, deposit banks did not provide loans to many firms because of their lack of "soft" information. Their concern about hazard moral and their used of quantitative "hard" information prevent them to the accumulation of clusters' knowledge. Archives of the Banque provide example of such exclusion of deposit banks of the local common business. For instance when the Banque chose to set up a new Succursale in the city of Cherbourg inspectors noted the error of the Société Générale to set up a branch and its inability to make business with local firms as proved by the feeble volume of its provided funds.

[5] Note the Banque was reluctant to accept papers directly drafted by a bank since those ones were often long time immobilisation and increased risks.

[6] The Banque used a notation system in order to evaluate bankers and asked for three times signed bills even if credit could be provided by banks on an accommodating way (Nishimura 1995).

It also proves that while local banks lent to firms through calculation of their value on the long run, deposit banks lent as a function of their ability to repay on the short run. Therefore, as they distinguished firms value local banks where more able to promote innovation.

3.2. Mechanisms: from information to innovation

How could we use theoretical knowledge to relate results with local banks characteristics? In other word, what mechanisms explain the link between local banking and innovation?

Such issue is well attested theoretically by Stein (2002) and empirically by Berger & al. (2005). Small companies include in a cluster have more chance to be financed by a local banker since that one faced less information costs. It is due to information's transfer costs from the point where the information is collected to the point where the decision is made. Inside the bank, higher is the number of connections higher has the information to be "hard" and easily transferable. In other word, more the need of "soft" information for the transaction more efficient the decentralised structure is.

We encompass two aspects of the causality. First, innovation existed before the credit relation but the firm needed funds for the project. In this case local banking helps to financing investment and improved firms' capacities and productivity. Second, local bankers selected firms through their projects and bring funds to promising one. It thus triggered innovation since expected returns of firms is a function of their abilities to innovate. Here, local banking financed research what generated innovation and patents. We also check alternatively both features of the phenomena[7].

[7] According to Sokoloff (1988) this dichotomy is encompass by the debate on "the role of the demand factor" for innovation throughout industrial revolution. The demand effect theory was triggered by Landes by his works of 1966. From his point of view innovation was triggered by opportunities what increased research on specific areas. Hence, because of implicit demand, firms spent money where it could be profitable to innovate. At the opposite Monkyr relayed by Crafts put down innovation to contingence what impact on the productive system and demand of both firms and customers. From the first vision, projects were selected by their profitability also banks could play a fundamental role by the allocation of funds. From the second side, innovations were already made and banks were urged to finance investment.

3.2.1. Investment credits

This first section brings the deeper issue of endogenous bias. Is it because firms were innovative that local banks were numerous compare to deposit ones? It's a hypothesis indirectly tested by Lamoreaux & Sokoloff (2001) as they put in front the central role of local infrastructure for patent deposit. Nevertheless there is here no bridge from the incentive to deposit patents and local banking density. Hence, the question is: does innovation gave advantage to local banking? If yes, innovation should increased local bank's profit by improving rents due to "soft" information. From this respect, local banks should get advantages by providing fund to innovative firms. Also, as deposit banks provided safe and short run funds these advantages should come from investments financing. It is therefore well caught by the positive effect of local banking on GDP growth. Anyway, such endogenous effect should be involved by what we want to show: the positive impact of "soft" information and relationship banking on technical development and firm's productivity.

3.2.2. Innovation credits

The second aspect displays an indirect link between "soft" information credit and innovation through the ability of local banking to select most profitable projects. From this point of view selection of firms could be made by short run credit as well. Since information is costly to pool, banks might choose to invest time on firms' relationship as a function of their growth capacities. Hence, new products and innovative industries must be privileged for investigation. By providing credits to these enterprises they finally gave chance to their future development and innovations. That is one of the basic features of universal banking as argued by Gershenkron.

Looking to bank characteristics "soft" information helped to provide funds to unsafe but valuable firms. It also means that firms were not apt to get funds on the direct market as a consequence of their small size. An easy way to test this hypothesis is the establishment of a negative correlation between average size of firms and the LBS ratio (Cf. Graph 2 and regressions in table 7 in annexe).

The basic *within* regression with temporal dummies give those results (*Within* $R^2 = 0.66$):

$$\underset{\substack{(0.08) \\ (0.0096)}}{AVSIZE = 8.0 - 0.019LBS.}$$

The average size of firms is really slightly negatively correlated with the LBS ratio (p-value = 0.057). If LBS double, the average size of firms decreases on average by 0.3%. This feeble effect comes probably from the small number of very big companies and the needs of the industry for local and relationship banking. According to what was said above, this outcome shows the importance of medium enterprises in the innovative process. It also gives evidences of the decentralised French productive system and the importance of both clusters and "soft" information treatment[8] for development.

3.2.3. Synthesis

Basically, both aspects of the interpretations lead to the same effect of local banking on economic growth through mechanisms described by Stein (2002). Nevertheless it is possible to join both elements by the innovation grapes' concept. Even if the first loan is an investment credit, through learning by doing process it helps to future innovations and patent's publications.

Thanks to local knowledge and connections local bankers could chose projects and finance firms which were the most promising one. Money was either used for investments or indirectly for innovation through firm's selection. Also, both causalities are presents with a same loan since investment financing follows a selection process by the bank as well.

Therefore, local banking helped to finance development and long term projects through advantages of relationship. It is probably due to the role of medium enterprises in the growth process of this French economy. In other hand, their incapacity to be financing on the direct market and their special and unusual needs provide an obvious advantage to local banks. Nevertheless, why some local

[8] Another interpretation could be joining. Because of higher competition on not concentrated sectors there is both incentive to innovate in order to keep market's share and incentive to patent since it represent a major hope for ultimate success (Griliches 1990). There is thus a risk of patent overvaluation and a spectre of decreasing returns with the firm letting out. Nevertheless those effects should be weak in the XIXth French context.

banks disappeared while the deposit bank's network spreads up since the later was *a-priori* less efficient than the former. One possible explanation stem from the double function of banking: collecting deposit and providing funds. Even if deposit banks were less able to generate investment on wealthy projects their size gave them an incomparable advantages on collecting deposits. It thus reduced their costs and made them more competitive on the safe credit market. Nevertheless, local banks needed both deposits and "safe" credit to get efficient balance sheet's structure. As a result, some of them could bankrupt or shut off as their business were not enough protected by their informational rent[9]. From this respect, throughout the period some local business could suffer by the lack of riskier credits which helped firms to invest and grow up. This phenomenon and its consequences on economic growth are also well caught by the table 3 above.

This explanation proves that bank features as describe by microeconomic of banking can lead to market inefficiencies. It also let a space to regulation and public action. In the case we are studying for it is the job done by the Banque de France through its local branches (Succursales).

4. The Banque de France Policy

In a precedent paper (Bazot 2010) I showed the positive effect of local Succursale's implantations on credit development. The basic argument was the strength of the link between Succursales and local bankers on credits' distribution. Because of historical circumstances the Banque acted with local banks what improved bills' liquidities and helped bankers to struggle against deposit banks. It also reduced bankers' constraints and improves their lending capacities. Therefore, the pool of econometric tests ended to prove the positive impact of the Banque's policy upon credit development by those mechanisms.

However, one particular remaining issue of the paper was the effect of such a policy on economic development. Indeed, by the hypothesis that wide industries

[9] Bazot (2010) gives evidence of this effect in a model of credit where a bank had to choose the composition of its portfolio according to its level of information rent and the cost of external funds. From this model the case we are speaking about correspond to a bank belonging to a porous cluster.

improve productivity[10], it could prevent the appearance of the "rational" firm by the lack of creative destruction mechanisms. We have now some arguments which prove that it is false.

First, we saw that local banking and "soft" information utilisation are particularly used on industrial district (see graph 1 and 2). It therefore proves that deposit banks neither facilitate rationalisation nor investment. Second, we know from table 1, 2 and 3 that credit development plays positively on GDP growth even if a part is attributable to banks. Since we have already proved that Succursale's density increases credit development we could extrapolate to growth. Nevertheless, the lack of accurate mechanisms makes it a feeble argument. Third, positive results about local banking upon innovations are more precise. As, there are historical evidences about Succursales' position on the local banks' sustain (see Lescure 2003 and Gonjo 2003 for instance) it gives strong arguments about the legitimacy of the Banque policy, at least on the middle run.

On the long run arguments about the brake put on the firm's rationalisation remains. However one important result of this paper is the innovative power of the SME's park. It thus shows that a productive system composed by bigger but less numerous enterprises should not triggered higher GDP growth in the XIXth French structure since "soft" information utilisation is an important factor of innovation's financing. As proved by our tests above (table 4), Départements with larger companies did not increase the innovation's production[11].

5. Discussion on patents

Two important points have to be discussed now. First do patents measure the innovation and can we consider that our estimations and regressions avoided resultant biases. Second, do our ratios are good enough to take into account development's differential and structural's elements of the numerous districts.

[10] Especially through transaction costs mechanisms, see Williamson 1981 for instance.

[11] Note table 4 results do not change if we withdraw the NONAGR variable. Furthermore keep in memory that the AVSIZE variable has a lagged of ten years. We also ran a 2SLS regression with the lag of AVSIZE as IV, results remain the same.

5.1. Patent as an indicator of innovation

As long discussed by Griliches (1990), patent is a good but imperfect proxy of innovation as an output estimator. Several reasons are dressed: enterprises can be reluctant to patent all theirs discoveries, administrative factors involve fluctuations in the number of granted patents, invention's quality is not figure out, minimal standards of novelty change over time, patents are volatile with GDP and, over all, patents do not retain process' innovations what is an important sources of growth if transaction costs are wide.

Also, on an econometric way if we note P as patent and I as innovation, the model we assumed is: $I = aP + e$ where e has to be as small as possible. Hence, is e small enough? As said above the role of process' innovations is an important element. Also, P only gauges technical innovation. Once retain this fact the new model became $I' = bP + e'$ where I' is all but process innovation and e' error term due to this new specification. We thus have to think about other biases with e' instead of e.

Fixed effects on panel regressions reduced many biases like the shift of novelty's standards, enterprises reluctance and volatilities. It is particularly due to the *within* estimator which is calculated by average differences on time and Départements. Furthermore, our choice to use the amount of the tax instead of the number of granted patent for data reduces some fluctuations' effects. Obviously even with econometric and data tools some biases remains but we have to admit their small roles. Concerning the quality of patents our calculation with the patent tax helps to solve the problem again as it takes into account the expected return of the patent. Anyway, our qualitative observation of patent gives no evidence of heterogeneity across district.

5.2. Départements differences

Another issue is the structure's difference of each Département. Propensity to patent is different regarding to sectors of activities or degrees of development. For instance, an agricultural Département will get less innovations and will less

patents them. Several reasons explain this fact. First, competition improves propensity to patent (Griliches 1990) since future success depend on it. Second, sectors are more or less innovative *per se*. Therefore, do our pool of proxies and estimator goods enough to mitigate these elements? First, as said above *within* regressions prevent biases due to stable temporal effects like sector differences or patents attractive regions. Second, INN takes into account urban facilities on innovation. Third, control variables like firm's average size and the share of non agricultural production catch some of these differences as well.

Of course, biases are not all caught by our techniques. Nevertheless, patents remain goods indicators of technical innovations in our model because of both econometric specifications and proxy of innovation.

6. Conclusion

The first result of the paper is the importance of credit development for economic growth. From this specification we tried to give more details about mechanisms in game through the analysis of banking institutions and innovations. We showed that local banks by the utilisation of close connections with firms and important local knowledge were more able to finance innovation and promoting growth. Through either selection of projects or investment credit local banking was strongly correlates with innovation efficiency.

Further features could be dressed from those empirical results. First, clusters and industrial districts were more able to promote growth on this decentralised economic structure through their aptitude to allocate capitals efficiently. Second, the positive role of universal banking could be more generally included into banks ability to generate connections with other economic actors and financing their future researches, innovations and investments.

In other hand, this paper gives also evidence of possible inefficiency of the banking market. This conclusion stem from the special feature of this market which affect both deposit and credit business side. From this respect, even if local banks were more able to finance innovation, investment and growth

through their aptitude on the credit side they were less able to compete on the deposit side. It especially comes from to the flexibility/rationalisation trades off. This one generated larger costs to deposit banks on the provision of riskier or unusual credit but entailed optimisation of their deposit's management. Also, some local banks could suffer from the lack and the cost of liquidities what pushed them to shut off.

Finally those conclusions and hypothesis could be more than a curiosity. Works about organisations (Williamson 1981) showed that transaction costs' reductions due to information and communication's technologies incite to diminish the firm size by allocating a wide part of the production to specialized SMEs. Furthermore, Krugman and Venables (1995) introduced congestion costs into models of economic geography what raise sectors' diversification inside regions as empirically showed by Imbs & Wacziarg (2003). Both sectors diversification and firm's decentralisation should generate SMEs' multiplication and clusters in the future what involves an adapted banking system. Therefore, the way those firms will improves their production's capacities and reduce their costs is an important issue. Perhaps "soft" information and local banking activities would perform some financial solutions.

Bibliography

Aghion, P., Howitt, P., *Endogenous Growth Theory*, Cambridge MA, MIT Press, 1998

Bazot, G., "credit constraint in XIXth France: the role of the geographical access to the Banque of France", PSE-WP, 2010.

Berger, A. N., Miller, N. H., Petersen, M. A., Rajan, R. G., Stein, J. C., "Does function follow organizational form? Evidence from the lending practices of large and small banks", *Journal of Financial Economics*, Elsevier, vol. 76(2), pages 237-269, May 2005.

Berger, A. N., Udell, G. F., “universal banking and the future of small business lending”, In Saunders A., Walter, I., *Financial System Design: the Case for Universal Banking*, Burr Ridge, IL: Irwin Publishing, 1996

Berger, A. N., Udell, G. F., “Small business credit availability and relationship lending: the importance of bank organisational structure”, *Economic Journal*, vol. 112, 2002

Calomiris, C. W., “The costs of rejecting universal banking: American finance in the German mirror, 1870-1914”, in Lamoreaux & Raff, *Coordination and Information*, 1995

Cetorelli, N., Gambera, M., “Banking market structure, financial dependence, and growth: international evidence from industry data”, *Journal of Finance*, vol. 106, N°2, 2001

Combes, P., Lafourcade, M., Thisse, J., Toutain, J., "The rise and fall of spatial inequalities in France: A long-run perspective", PSE Working Papers, 2008

Gershenkron, A., “Economic bakwardness in historical perspective”, Cambridge Mass. *Harvard University Press*, 1962

Gonjo, Y., « La Banque de France et la décentralisation du crédit (1880-1914) », *in* Feiertag, O. and Margairaz M., « introduction des Pratiques et politiques des banques d’émission en Europe (XVII-XXèmes siècles) », Paris, Albin Michel, 2003

Griliches, Z., “patent statistics as economic indicators: a survey”, *Journal of Economic Literature*, Vol. 28, N°4, 1990

Guinnane, T. W., "Delegated Monitors, Large and Small: Germany's Banking System, 1800-1914," *Journal of Economic Literature*, vol. 40, N°1, 2002

Imbs, J., Wacziarg, R., "Stages of diversification", *American Economic Review*, vol. 93, N°1, 2003

Jobert, P., « Les entreprises aux XIXe et XXe siècles », Paris, Presses de l'E.N.S., 1991

King, R. Levine, R., "Finance and growth, Schumpeter might be right", *Quarterly Journal of Economics*, August, Vol. 108, pp717-738, 1993

Krugman, P., Venables, A., "globalization and the inequality of nations", *Quarterly Journal of Economics,* Vol. 110, N°4, 1995

Lamoreaux, N., "Regional financial institutions", *in* Cottrell, P. and Reis, J., "Finance and the making of the modern capitalist world, 1750-1931, 1998

Lamoreaux, N. and Sokoloff, K. L., "the geography of invention in the American glass industry 1870-1925", *Journal of Economic History*, vol.60, N°3, 2000

Lescure M., « La formation d'un système de crédit en France et le rôle de la banque d'émission : approche comparée », *in* Feiertag, O. and Margairaz M., « introduction des Pratiques et politiques des banques d'émission en Europe (XVII-XXèmes siècles) », Paris, Albin Michel, 2003

Levine, R., "finance and growth, theory and evidence", NBER WP 10766, 2004

Levine, R., Zevros, S., "Stock markets, banks and economic growth", *The American Economic Review*, June 1998

Nishimura, “the French provincial banks, the Banque de France, and Bill Finance, 1890-1913”, *Economic History Review*, vol. 48, N°3, 1995

Petersen, M. A., Rajan, R. G., "The Effect of Credit Market Competition on Lending Relationships," *The Quarterly Journal of Economics*, MIT Press, vol. 110(2), pp 407-43, May 1995

Petersen, M. A., Rajan, R. G., “Does distance still matter? The information revolution in small business lending”, *Journal of Finance*, vol. 57, 2002

Plessis, A., “La révolution de l’escompte dans la France du XIXe siècle”, *Revue d’Histoire du XIXe Siècle*, N°23, 2001

Rajan, R., Zingales, L., “Financial dependence and growth”, *The American Economic Review*, June 1998

Rouleau, G., « les règlements par effets de commerce en France et l’étranger », Paris, Société statistique de Paris, 1914

Sokoloff, K. L. “Inventive activity in early industrial America”, *Journal of Economic History*, Vol. 48, N°4, 1988

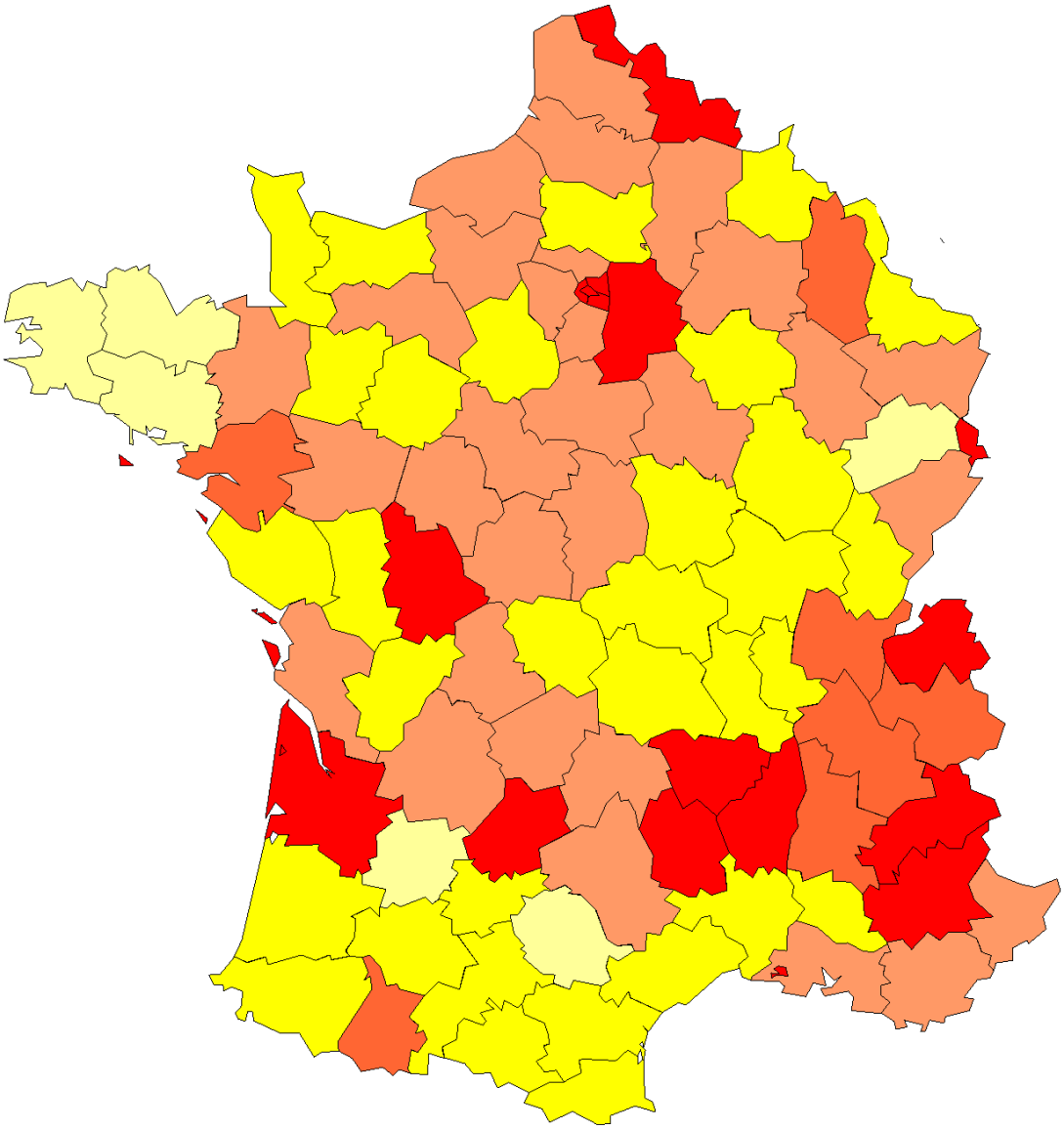
Stein J. C., “Information production and capital allocation: decentralised vs. hierarchical firms”, *Journal of Finance*, vol. 57, 2002

Williamson O. E., “The Modern Corporation: Origins, Evolution, Attributes”, *Journal of Economic Literature*, vol. 19, 1981

Annexe A: Maps

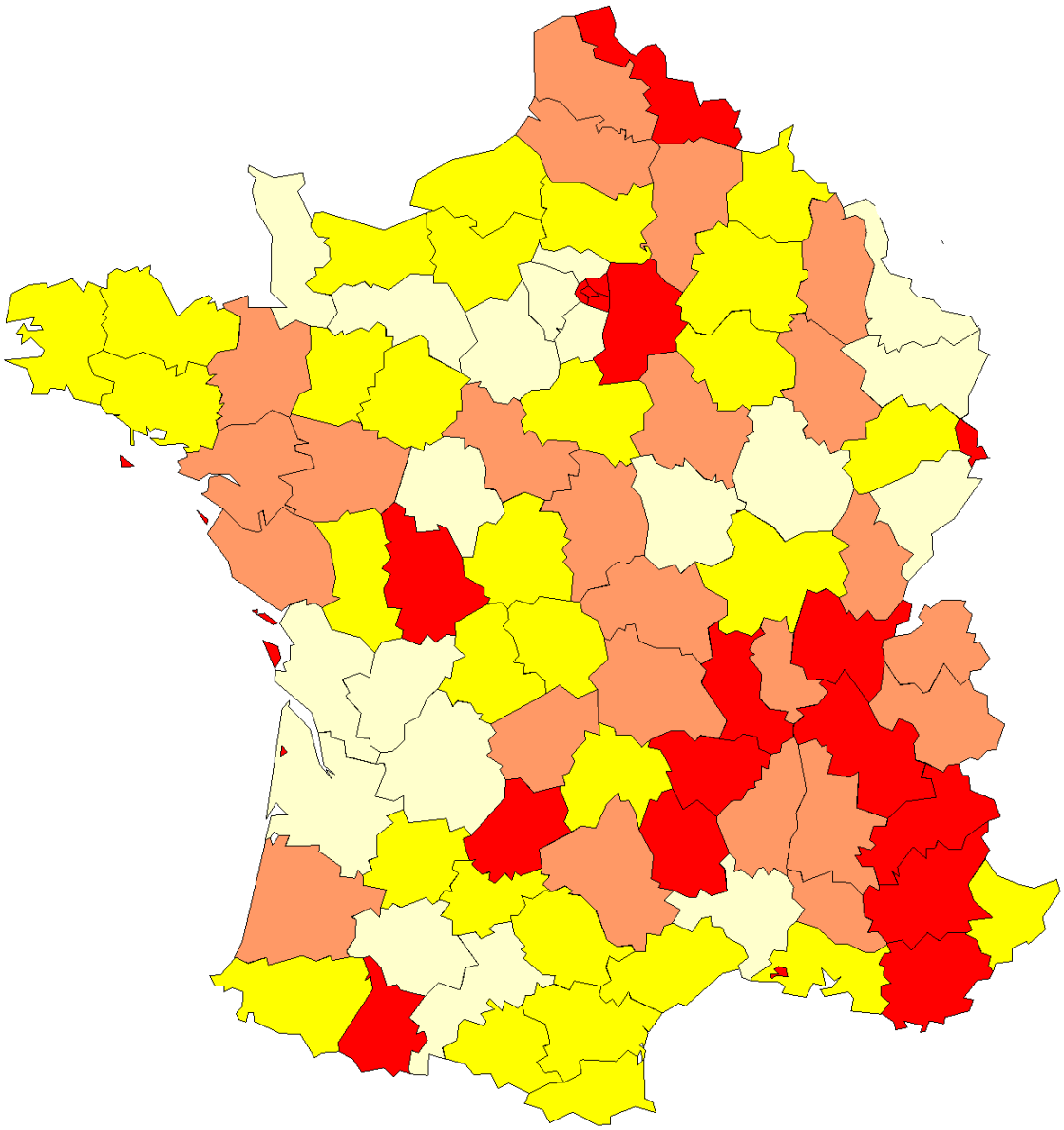
Map 1: local bank branches per deposit bank branches in 1911

If LBS belong to: [0;1] pale yellow,]1;2] yellow,]2,3] salmon,]3;4], orange,]4;+∞[red. The "Seine" district is excluded from the map.



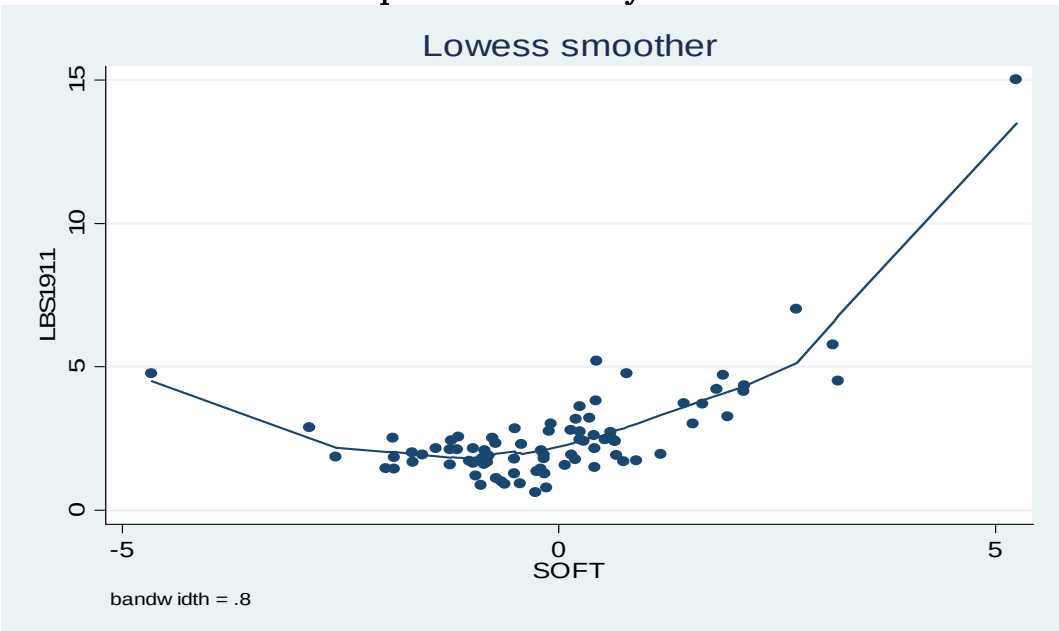
Map 1: share of soft information

If SOFT belong to: [-∞;-1] pale yellow,]-1;0] yellow,]0,1] orange,]1;+∞[red. The “Seine” district is excluded from the map

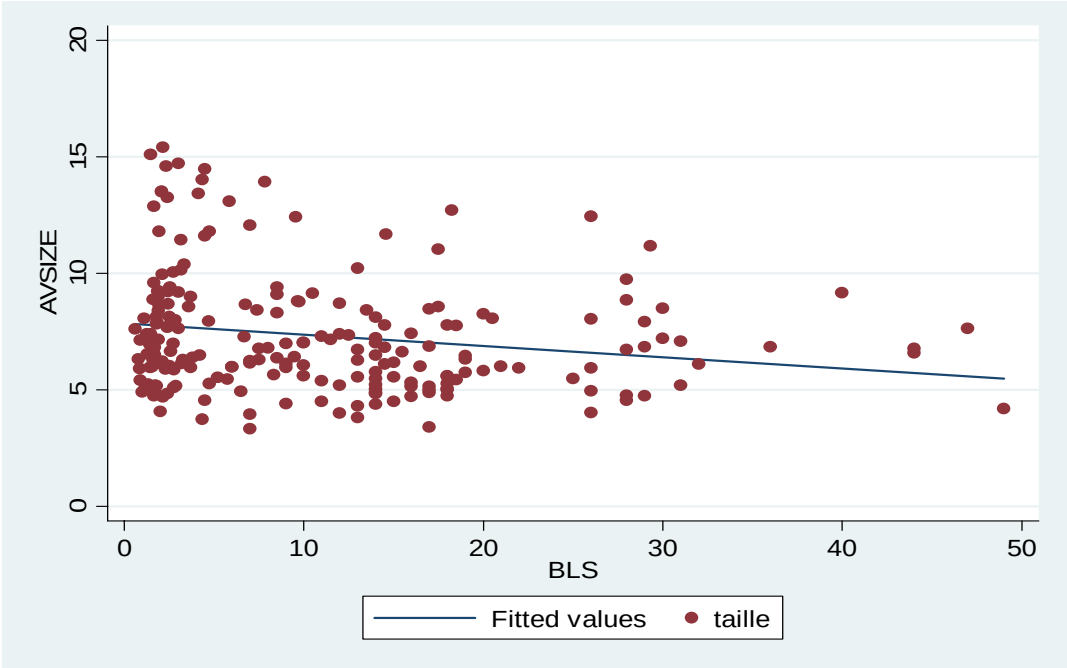


Annexe B: Graph

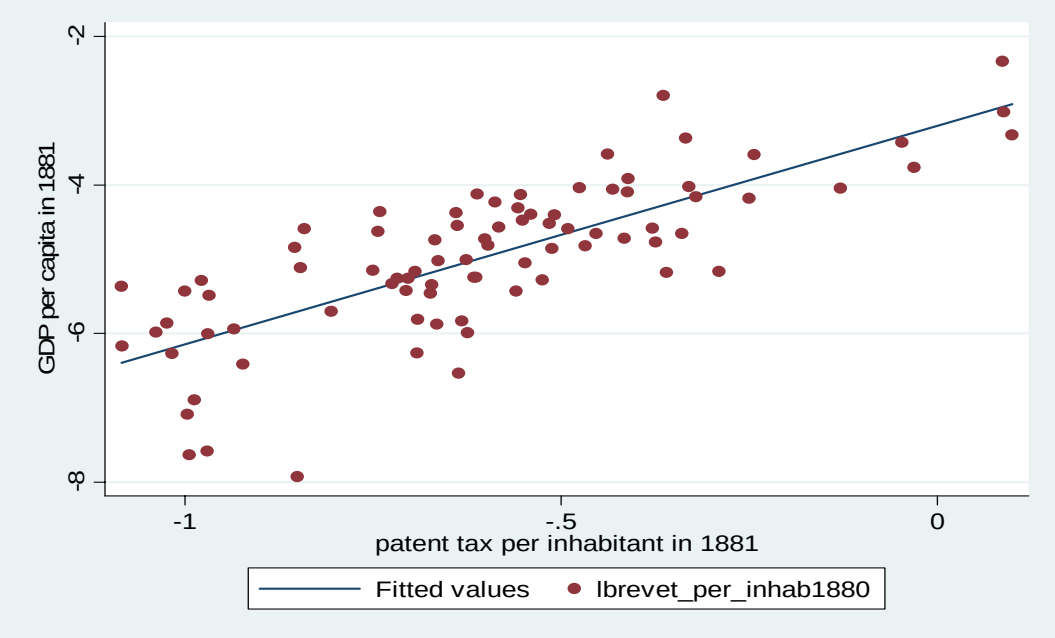
Graph 1: LBS1910 by SOFT



Graph 2: firm's average size by BLS

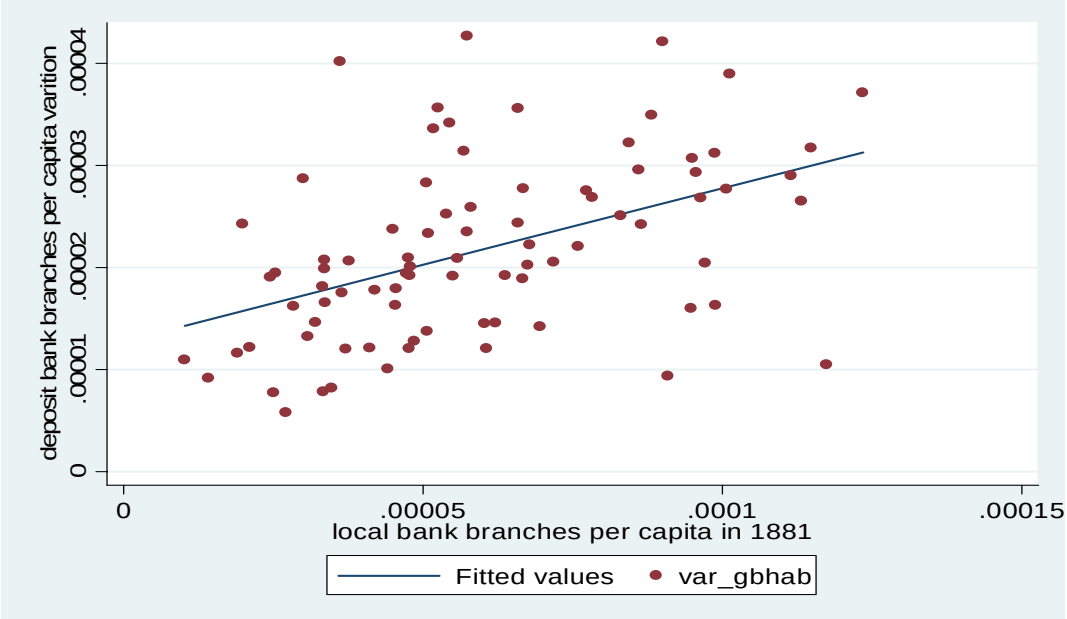


Graph 3: innovation's efficiency and GDP per capita in 1881



Variables explain in logarithm

Graph 4: effect of banking business level on deposit bank expansion



Annexe C: Table

Table 6: Effect of DEVCRED on INN

Independent variable	[1]	[2]	[3]	[4]	[5]	[6]
DEVCRED	-.02*	-.017	.02***	.01	.004***	.02***
	(.011)	(.012)	(.008)	(.007)	(.001)	(.008)
NONAGR t-10		-.052		.04		.03
		(.08)		(.04)		(.04)
AVSIZE t-10		-.002		.001		.001
		(.002)		(.002)		(.002)
CONST	.04***	.08***	.01**	-.013	.01**	-.002
	(.007)	(.027)	(.004)	(.012)	(.01)	(.009)
fixe/random	fixe	fixe	random	random	no	no
R^2	.19	.20	.17	.19	.18	.19
N	251	251	251	251	251	251

***, **, * significant at 1%, 5% and 10% confidence

The dependant variable is INN: the patent tax divided by the urban population in thousand of inhabitant. DEVCRED is the amount of credit on GDP, NONAGR is the non agricultural production dived by GDP and AVSIZE is the firm's average size. All regressions add temporal dummies. The district of Paris is excluded.

Table 7
Determinant of the firm's average size

Independant variable	[1]	[2]
LBS	-0.012**	-0.014*
	[0.005]	[0.007]
GDP per CAP t-10	4.67***	3.19***
	[0.63]	[1.25]
DPOP t-10	0.01***	0.011**
	[0.003]	[0.004]
NONAGR t-10	9.7***	4.42*
	[1.15]	[2.44]
CONST	-1.71***	2.02
	[0.47]	[2.00]
R^2	0.86	0.81
N	296	296

***, **, * significant at 1%, 5% and 10% confidence

First regression generates random effects, second regression generates fixe effects. Both tests add temporal dummies. Dependant variable is AVSIZE. LBS is the number of local bank branches divided by the number of other branches, GDP per CAP is the GDP per capita, DPOP is the population density and NONAGR is the non agricultural production dived by GDP. The district of Paris is excluded. All variables except LBS are 10 years' lagged.