Dipartimento di Economia Politica

Materiali di discussione

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Credit, Venture Capital and Regional Economic Growth

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January 2012

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ISSN: 2039-1439 a stampa
ISSN: 2039-1447 on line

CREDIT, VENTURE CAPITAL AND REGIONAL ECONOMIC GROWTH

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ABSTRACT

In this paper we investigate the role of credit and venture capital investments on regional economic growth. The dataset consists of a panel of 53 regions belonging to three countries, Germany, Italy and Spain, for the period 1995-2008. To avoid a problem of endogeneity, we estimate a dynamic panel using the generalised method of moments (GMM). The results underline the important role played by different types of financial intermediaries in regional economic growth: both mutual and commercial banks are important for regional growth but the role of mutual banks is greater in economically deprived areas [EDAs]. Similar results are obtained for the venture capital investments.

JEL classification: C21, G21, G24, O43, O57

EFM classification codes 510, 760, 810

Keywords: regional economic growth, relationship lending, venture capital, economically deprived areas, dynamic panel techniques.

1. Introduction

During the last few years the general conclusion from the empirical literature on economic growth is that countries with "better" financial systems enjoy more rapid economic growth, but they have not provided unequivocal answers to what "better" is, that is which financial system characteristics, for example size, efficiency, competitive context, regulation, role of non-banking intermediaries, are most significant to foster economic growth.

With respect to this literature, we partially review in the next section, the present paper is one of the first attempts to investigate the nexus between finance and regional economic growth by means of an international comparison, making joint use of banking system structural indicators (i.e. the predominance of mutual bank circuits or large commercial banks) and risk capital values obtained in a local context.

The focus on the distinction between commercial and mutual banks was intended to categorise mutual banks as those intermediaries which also use soft information and implement relationship lending policies, important for the provision of finance to support local economies.

To assess the nexus between banking system structure, risk capital operators and economic performance, information about the structure of the regional financial system must be added to the information about local economic development. In our study, regional size is taken as approximate to NUTS

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level 1 and 2 depending on the country, while the banking system characteristic of significance here is approximated by the amount of credit supplied and the share of loans granted by mutual/commercial banks. The role of risk capital operators is proxied by the value of investments for the initial stages of development (seed and start-up), measured at the local level.

The evidence of a statistical relationship between financial variables and growth does not allow unequivocal identification of the direction of the relationship and a problem of simultaneous causality bias exists. OLS estimates are inconsistent and different estimators are necessary. Hence, following for example Levine at al. (2000) and Beck et al. (2000a), we use the dynamic panel generalised method of moments (GMM) to address the potential endogeneity of the data.

In particular, we analyse a panel of 53 regions belonging to three countries, Germany, Italy and Spain, during the period 1995-2008. The number of countries investigated is limited by data availability. The choice of Italy, Germany and Spain stems from the fact that these countries differ with regard to the characteristics of their financial systems and the degree of regional disparity in terms of local economic development. For this reason the financial system characteristic of significance here is disaggregated depending on whether the region can be classified as an EDA (Economically deprived area) or not (other regions), in order to ascertain whether the behaviour of the financial variables differs in relation to the different regions' level of economic development.

The results underline the important role played by bank lending in regional economic growth. The distinction between mutual and commercial credit suggests that both types of bank are important for regional growth but the role of mutual banks is greater in economically deprived areas [EDAs]. Similar results are obtained for the venture capital variable.

The paper is structured as follows. Section 2 reviews the theoretical and empirical literature on the nexus between finance and economic development. Section 3 briefly presents the econometric methodology and the data used. Section 4 describes the results. Finally, Section 5 concludes.

2. Literature Review

2.1. Theoretical literature

There are at least three different streams of literature relevant to this study. The first is the large body of literature on the nexus between financial structure and economic development originated by Goldsmith (1969) and its follow-up, also within the framework of endogenous growth literature (see in particular Pagano, 1993). The second is a relatively smaller set of studies which investigate the relationship between different aspects of the banking firm – ownership structure, size, organisational features, etc. – and its lending behaviour. The third line of investigation focuses on the role played by venture capital operators, and more in general by risk capital investors, in fuelling innovation and economic growth.

With reference to the first aspect, study of the relationship between finance and growth started from the works of Schumpeter (1911), who underlined the boost to production and growth provided by a highly developed financial system. Academic output on the subject subsequently intensified from the early 1990s in response to the development of endogenous growth models, which shed light on the main channels of transmission between the financial system and the real economy. According to the theory described by Pagano (1993), through its lending operations the financial system influences growth by means of three main transmission channels. Progress in the development of the financial system generates real growth, since it provides a means of overcoming market frictions and increases the productivity of capital. From this point of view, financial intermediaries may improve the allocation of funds by allowing larger investment projects to be financed by means of the fund-pooling mechanism (Acemoglu and Zilibotti, 1997); the liquidity management mechanism enables intermediaries to target resources to high-risk investments with low liquidity (Diamond and Dybvig, 1983; Bencivenga and Smith, 1991); in addition, their ability to gather, select and use information (Diamond, 1984; Boyd and Prescott, 1986) permits intermediaries to allocate

funds more effectively (Greenwood and Jovanovic, 1990). Last but not least, financial intermediaries' controlling function reduces the degree of ex-post information asymmetry (de la Fuente and Marin, 1996).

Secondly, the development of the financial system encourages real growth because it may reduce the cost of financial intermediation; this financial system efficiency factor also affects economic growth. The financial system's degree of efficiency, in terms of the resources lost in the transfer from sectors in financial surplus to those in deficit, may depend on the financial industry's market power (Demirgüç-Kunt et al., 2004); the banks' level of efficiency in terms of cost economies (scale, scope, etc.) and x-efficiency (Berger, et al., 2004); and also on the regulatory system of legal and supervisory constraints (La Porta et al., 2002).

The last transmission channel identified by endogenous growth models is saving, and in particular the propensity to save. The relationship between the development of the financial system and propensity to save is not clear-cut. An efficient financial system can be expected to provide savers with better risk-return combinations. However, it is not clear whether the prospects of a better return, or lower risk, actually lead investors to save more. The prospect of a better future return may stimulate higher current consumption, thus reducing the propensity to save. If investors are faced with lower risk levels, due to diversification, for example, they may tend to choose higher-risk, higher-return combinations, triggering a reduction in precautionary saving. This ambiguity is also reflected in the results of empirical studies (Thiel, 2001).

The second stream of literature relevant for our work focuses on the interaction between lending styles and some characteristics (organisational structure, ownership, etc.) of the banking firm. In particular, the financial literature (Petersen and Rajan, 1994; Berger and Udell, 1995) has identified relationship lending as the key to overcoming the problems deriving from information asymmetry. The concept of customer relations in the banking industry has been the subject of study since the 1960s. Of the various approaches to the relationship in the literature (Bongini et al. 2009), the most relevant here is the most recent, which considers relationship banking as a lending technology alternative to transaction banking. In relationship lending, the assessment of a borrower's credit-worthiness is based partly on qualitative information (the abilities of the entrepreneur and/or management, their ethical profile, etc.) not easily evaluated in quantitative terms, known as soft information in contrast to hard information, which is quantifiable and usually obtained from the company's accounts (Berger and Udell, 2002; Petersen, 2004); hard information is the only type used in transaction banking. Alongside studies investigating the nature of soft and hard information, work has also been done to ascertain whether the bank's ability to gather and use soft information affects its structural, organisational and operating characteristics, and if so, to what extent. The bank characteristics focused on are: - the bank's size and its degree of lending efficiency; with regard to this aspect the hypotheses proposes, and in many cases empirically proven, suggest that smaller-sized banks – in which there is little or no separation between those who gather information and those who use it for granting credit , and the bank is very close to the client – are more efficient in assessing prospective borrowers with problems of information opacity, especially small and medium-sized enterprises (Angelini et al. 1998, De Young et al. 2003, Scott 2004, Avery e Samolik 2004, Bongini et al. 2007). – another line of study in the literature investigates the relationship between banks' ownership structure and their relationship with their clientele. From this point of view, the proven benefits of relationship banking are further enhanced when the bank has a cooperative ownership structure (a finding illustrated starting from the work of Hansmann 1996). In this case, the risk relating to the lending operation is reduced – and the same should apply to the price of credit – by the fact that the bank benefits from sanctions arising from peer monitoring (Stiglitz 1990) – for example, criticism by other shareholders and members of the same community – which encourage borrowers to fulfil their repayment obligations (Angelini, Di Salvo and Ferri 1998, Banerjee et al.1994, Chaddad and Cook 2004, Hesse and Čihák 2007). Last but not least, studies have also been performed on the relationship between organisational structure and lending efficiency, meaning the nexus between the bank's organisational structure and its efficacy in the use of information in the lending process. These studies interlock with research into the "proximity" between client and bank and concentrate on the organisational procedures adopted within the latter, especially the fact that organisations with a number of decision-making levels – normally a pyramidal

structure – appear to be less efficient in using soft information than flat structures (Stein 2002). The resulting implication is thus that relationship banking should not be considered as a technique or strategic approach only available to small banks; large banks or banking groups may also adopt this method provided they have flat organisational structures.

The third line of investigation concentrates on the role played by risk capital operators in fuelling economic growth. From a theoretical point of view, the venture capital market is important for two principal reasons. On the one hand, venture capital operators can properly represent the "agent" analysed in financial intermediation theory. In particular, the financial market can fail to be effective for several reasons. Uncertainty and informational asymmetries in terms of both private information (adverse selection or costly monitoring) and hidden behaviour (moral hazard) can give rise to particularly tight financial constraints. Financial intermediation theory has identified a number of solutions capable of reducing the agency problem between principal and agent, in particular through the adoption of screening procedures and control and enforcement mechanisms. In this sense, in their operations venture capital investors can solve the problems of adverse selection, moral hazard and monitoring and agency costs through the use of a mix of contract forms of finance and specific activities. Adverse selection, in particular, is overcome by means of thorough due diligence activities (see Gompers and Lerner (1999), Kaplan and Stromberg (2000)) undertaken to support the decision for or against the investment. Control and monitoring carried out once the project is underway are also important, as Hellman and Puri point out (2000). In fact, the study of venture capitalists' behaviour shows that they do not actually adopt the solutions to the conflict of interests identified by financial intermediation theory until the financing contracts between the parties concerned have been signed. As Kaplan and Stromberg (2001) state, contracts specify both cash flow and administrative rights in detail in order to align the different types of interests. On the other hand, venture capital is considered important due to its possible contribution to financing growth and economic development through the channel of R&D and innovation. The results are not conclusive. For the US, Hellman and Puri (2000) and Kortum and Lerner (2000) point out the positive role of venture capital investments in innovative activities. Various authors (Berger and Udell, 1998) have reported that, due to market failures, equity is the form of finance best suited to providing the entrepreneur with the additional resources needed for the development of an innovative project. Moreover, the relative backwardness of European financial systems (Rajan and Zingales (2001), European Commission (1998, 2003)), compared to that of the United States, when it comes to providing financial backing to the most innovative firms, which also represent the highest investment risk, aggravates the structural difficulties faced by SMEs in obtaining access to finance, and in particular amplifies the problems related to the availability of equity. The various commentators have attributed slow growth to the scarcity of venture capital.

2.2. Empirical literature

During the last few years research into the nexus between finance and economic development has generated a large number of empirical studies which report, with a few exceptions (Favara 2003), a positive causal relationship between financial sector development and economic growth. For the purposes of this paper, attention will be focused on an analysis of empirical findings at the cross-country and regional levels, while reference may be made to the many general surveys available (Levine (2005) and Thiel (2001)) for an examination of the studies which have attempted to isolate the transmission mechanisms using sectorial data or data relating to an individual firm for international comparison.

The first empirical evidence in favour of a long-term relationship between financial system development and economic growth is found in the work of Goldsmith (1969)[1], who used unsophisticated econometric techniques to document the positive relationship between financial development and the level of economic activity. Empirical output on the topic intensified with the contributions of King and

[1] "One of the most important problems in the field of finance, if not the single most important one, … is the effect that financial structure and development have on economic growth" (p. 390).

Levine (1993a, 1993b). Their studies concentrate on 80 countries during the period 1960-1989; they control for other variables which may affect long-term growth and introduce different measurements for approximating the degree of financial system development, all focusing on lending. King and Levine identify a significant positive correlation between the four financial variables used and the three growth variables chosen, after checking for a set of growth-explaining factors. Very soon, studies on the nexus between finance and development using lending-based measurements were followed by analyses introducing the role of the capital market. Amongst these, Levine and Zervos (1998) conclude that banking sector and capital market development is positively correlated with growth, productivity and capital accumulation.

Cross-country studies share a number of basic features (Thiel, 2001). In terms of methodology, the main tool used is cross-country growth regression, where a combination of financial variables relating to a large sample of countries, combined with a number of additional control variables, are used to explain economic growth. The financial variables usually relate to the size of the financial sector; the most common indicators are bank lending to the private sector, market capitalisation and the turnover of stock exchange transactions, all expressed as a ratio of GDP. The dependent variable consists mainly of a real growth rate figure for the economy, growth in productivity, or capital accumulation. Control variables are usually chosen from those produced by the large body of literature on the subject of growth (Barro, 1997 and Temple, 1999). During the last few years, studies of the nexus between finance and growth have also used panel data analysis techniques to mitigate the statistical problems associated to simple cross-section regressions. These include the work of Levine et al. (2000), whose results confirm that the development of the financial system has considerable positive impact on economic growth (see also Beck et al., 2000a and Rousseau and Wachtel, 2000).

However, the evidence of a statistical relationship between finance and growth does not allow unequivocal identification of the direction of the relationship. Inverse causality – high economic growth creates additional demand for financial services, thus contributing to the development of the financial sector – is equally plausible (Gurley and Shaw, 1967). King and Levine (1993a) attempt to justify the direction of the relationship by pointing out that the level of the financial variables at the start of the period (1960) is correlated with the average growth of the period (1960-1989), demonstrating the direction of the causal relationship from finance to growth. However, use of a variable associated to the beginning of the period studied does not provide undisputable evidence of causality (Giannetti et al., 2002); therefore, some authors have attempted to reply to this query by including instrumental variables in their analysis[2] or using more sophisticated econometric techniques[3].

Apart from the problems arising from questions of methodology, there are also difficulties concerning the variables chosen as proxy for financial system development. The few studies produced on aspects of the financial system other than the ever-present size factor therefore deserve special attention here. Amongst the first analyses aimed at assessing the relationship between financial system structure and growth, it is worth highlighting the studies which include financial system structure variables concerning the different relative degrees of development of the banking sector and the financial market[4]. These studies conclude that the financial structure archetype has no effect on growth; it is the degree of financial deepening of the system which is linked to economic development. La Porta et al. (2002) examine the effects of bank ownership structures on economic growth, by means of a panel study, revealing that an initially higher level of public ownership has a negative impact on the real per capita growth rate. The nexus between the level of competition on the banking market and economic growth, on the other hand, is the subject of a number of studies which are not cross-country analyses but refer to conditions within individual countries, from the regional point of view. The study by Jayaratne and Strahan (1996), confirmed and extended by the work by Dehejia and Lleras- Muney (2003), focuses on individual federal states of the USA. Specifically, Jayaratne and Strahan (1996) estimate the impact of liberalisation of the banking market on local growth, concluding that regulatory reform has produced an improvement in the quality of lending and accelerated the per capita GDP growth rate. Dehejia and Lleras-Muney (2003) confirm these

2 King and Levine (1993b), La Porta et al. (1998), Beck et al. (2000a) and Levine et al. (2000).

3 Demetriades and Hussein (1996); Shan et al. (2001), Rousseau and Wachtel (1998) and Calderon and Liu (2003).

4 Beck et al. (2000b), Levine (2002) and Afonso et al. (2002).

conclusions, extending them to assess the impact of deposit insurance schemes on growth. The work of Carbó S et al. (2003) concludes that the competitive context appears not to have any major influence on the growth of regional GDP. Yet others, Carbó et al. (2004 a,b), assess the relationship between the degree of development and innovation of the banking system and regional growth. The results, in line with the main findings of the cross-country studies, confirm the significant correlation between banking system development and local growth, identifying product innovation (with investment fund business as its main proxy) as one of the main sources of development in the financial sector.

Among the studies that focus on the interaction between lending styles and some characteristics of financial intermediaries, a growing number of researchers concentrate on the relationship between type of bank and specialisation (see Ayadi et al., 2009 for a review of the literature). Since cooperative banks (being both small and local) are best suited to adopt relationship banking methods, several studies provide a comparative investigation of the role of cooperative banks, savings banks and large commercial banks, analysing the different roles they may play in an area's economic development. Berger et al. (2004) analyse whether economic growth is affected by the development of efficient local banks; the main results of their analysis indicate that countries with a higher proportion of relatively more efficient local banks, compared to other categories of banks, have higher economic growth. In their regional analysis of the Italian case Usai and Vannini (2004) concentrate on the 1970-1993 period, and in line with Loayza and Ranciere (2005) they study the medium and long term effects with 3 and 5 year averages, focusing on four types of bank: cooperative and savings banks, special credit institutions and public banks. With the aid of fixed effects and weighed least squares, the authors reveal that cooperative and savings banks and special credit institutions have a positive effect on regional growth, while "commercial" banks have no significant effects, indicating that the first two categories in particular may be more efficient in financing Italian SMEs. There are only a few studies which make an international comparison on regional data: these include Quinto et al. (2006) and Ayadi et al. (2009). Quinto et al. (2006) investigate the effects on growth of the overall weight of the financial sector and consider the number of commercial bank branches as an indication of the structure of the banking sector. The findings reveal that the financial sector plays a positive role while the role of the structure is not significant, while case study interviews identify key factors in the financing of small and medium sized enterprises: autonomy in lending decisions, the inclusion of soft information in credit scoring, and specific guarantees and segmentation for SMEs are found to be fundamental for intermediaries which provide lending to small firms (in line with Berger and Udell, 2002). Ayadi et al. (2009) show that from the point of view of efficiency and profitability there are no distinctions between savings banks and commercial banks, but differences do emerge with regard to lower risk levels (Z-score), greater stability of returns and a positive effect on economic growth. The importance of the sector, especially in Spain and Germany, is confirmed, and savings banks are found to be specialised in financing SMEs and in the economically most deprived areas.

Finally, mention must be made of the lack of studies on segments of the financial industry apart from bank lending and the capital market. Of the few which have appeared, some of them relate to the role of bond market development in fostering economic growth (Fink et al. (2003)) while during the last couple of years some studies have explicitly introduced the role of risk capital operators. In particular, the literature on finance and growth has traditionally placed less emphasis on the role of this particular type of financial intermediaries, and in particular on the role played by venture capitalists. Despite the widespread interest in venture capital as a stimulus for economic growth, little empirical research has examined the validity of these claims. The studies on venture capital can be divided into two principal categories. On the one hand, the vast majority of them concentrate on the relative performance of venture funded firms. Evidence from firm level studies generally suggests that venture backed companies enjoy higher employment and sales growth rates than the average start-up[5]. As underlined by Samila and Sorenson (2011) from the conclusions of the firm level studies one cannot easily extrapolate to the implications of venture capital for the economy as a whole, since it is quite possible that VC firms simply select the most promising start-ups and substitute for the other forms of financing that those ventures would have used had venture capital been unavailable. On the other hand, the macrolevel relationship between the supply of venture capital and

[5] Jain and Kini (1995), Engel and Keilbach (2007).

economic growth has been the subject of little empirical research, and some questions are still unanswered. To our knowledge, the first paper that explicitly attempts to evaluate the economic impact of venture capital dates back to 2003 (Romain and Pottelsberghe). The results of the paper indicate that venture capital must be considered as an additional link for explaining variations in economic performances; in this sense the econometric results suggest that venture capital contributes to growth through two main channels: the introduction of new products and processes onto the market and the development of an improved capability for absorption of the knowledge generated by research institutions. Among the other few studies performed on the macrolevel relationship, mention must be made of the analyses by Di Giorgio and Di Odoardo (2007) and by Samila and Sorenson (2011). The former carried out a simple cross-country analysis for the 1993-2004 period, also using instrumental variable techniques. Although as the authors state, conclusions must be drawn with caution since the sample is quite limited (19 countries), the study suggests a positive relationship between venture capital markets and economic growth. The study by Samila and Sorenson (2011) centred on US metropolitan areas concludes, with a variety of caveats including some that address endogeneity, that an increase in the supply of venture capital positively affects firm start-ups, employment and aggregate income.

The review of the literature provided above suggests the following hypotheses to be tested in the remainder of the paper:

H1 – the greater the level of financial deepening the higher the rate of local economic growth – in our work we will evaluate the relationship between financial deepening at the local level and regional economic growth.

H2 – the greater the importance of mutual/cooperative banks, the higher the rate of local economic growth - in our work we will valuate whether banking system structural indicators (i.e. the predominance of mutual bank circuits or large commercial banks) affect regional economic development.

H3 – the higher the level of venture capital the higher the rate of local economic growth - in our work we will evaluate the "macroeconomic" role of aggregated venture capital investments as a determinant of regional economic growth.

3. Methodology and data

It is well known that there is a simultaneous causality bias when the nexus between finance and economic development is analysed. In this case, OLS estimates are inconsistent; in other words, they may not accurately represent the true value of the regressor coefficients even when the sample is very large. To allow for this problem, following Levine at al. (2000) and Beck et al. (2000a), we use the dynamic panel generalised method of moments (GMM) to address the potential endogeneity of the data [6].

Let $y_{i,t}$ be the logarithm of per capita GDP in region *i* at time *t (PPP* - purchasing power parity). We are interested in the following equation:

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \beta^{i} X_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (1)$$

where $y_{i,t} - y_{i,t-1}$ is the growth rate and $X_{i,t}$ is a set of explanatory variables including the measures of financial development chosen (see Table 1). All the financial variables are in logs to capture possible non-

6 This method is described in Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998).

linearities in the relationship between finance and growth as suggested by Levine et al. (2000). η_i captures the unobserved country-specific effect and $\varepsilon_{i,t}$ is an error term. Rewriting the previous equation as

$$y_{i,t} = \alpha y_{i,t-1} + \beta^{i} X_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (2)$$

and taking the first differences to eliminate the country specific effect

$$y_{i,t} - y_{i,t-1} = \alpha\left(y_{i,t-1} - y_{i,t-2}\right) + \beta^{i}\left(X_{i,t} - X_{i,t-1}\right) + \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right) \qquad (3)$$

By construction, in Eq. 3, the lagged difference in growth is correlated with the error term, which, together with the potential endogeneity of the explanatory variable X, requires the use of instruments. The GMM difference estimator uses the lagged levels of the explanatory variables as instruments provided that the error term is not serially correlated and the lagged levels of the explanatory variables are uncorrelated with future error terms.

Following Blundell and Bond (1998), we use two specification tests: the Sargan test which tests the validity of the instruments, and a test to ensure that the error term of the difference equation is not serially correlated.

The panel consists of 53 regions belonging to three countries, Germany, Italy and Spain, for the period 1990-2008, chosen due to the availability of data. The data are averaged over 5-year intervals (5-year horizon): 1990- 1994, 1995-1999, 2000-2004, 2004-2008, so there are four observations per region. To check for robustness, we also estimate the panel using a one-year overlapping horizon. Following Bekaert et al. (2001, 2004), we decided to modify the timing using an ad hoc frequency, taking average with 5 rolling dynamic observations (calculated year by year); in this case, there are ten observations.

The data comprise information from a variety of publicly available and proprietary sources (see Table 1). Instead of using a cross-national research design, we focus on a small number of intra-country items of information which help us to avoid cross-country idiosyncrasy and ensure the comparability of data.

The data on regional economic activity were obtained from Eurostat information produced at NUTS level 1 and 2. The Nomenclature of Territorial Units for Statistics (NUTS) was produced by Eurostat in order to provide a single, uniform breakdown of territorial units for the compilation of regional statistics for the European Union. The NUTS classification is a hierarchical system for dividing up the economic territory of the EU, also for the purpose of the harmonisation of EU regional policy. For Italy and Spain we use NUTS level 2 data, corresponding to regions and autonomous communities respectively; for Germany, we were obliged by the financial data available to use NUTS level 1 data, corresponding to the Länder.

The data on the structure of the regional banking system derived from information from the Central Banks – for Germany Deutsche Bundesbank, for Italy Bank of Italy, for Spain Bank of Spain. Our information on venture capital originates primarily from the principal national venture capital and private equity associations. In particular, statistics for Germany have been derived from the Bundesverband Deutscher Kapitalbeteiligungsgesellschaften – German Private Equity and Venture Capital Association e. V. (BVK) and for Spain from the webcapitalriesgo website, while for Italy the data are from the ISTAT (Italian National Statistical Institute), which produces information on venture capital at the regional level.

The regions in the sample are also subdivided in relation to their degree of economic development:, with regions characterised by a high level of development on the one hand and economically deprived areas [EDAs] on the other, to ascertain whether behaviours differ in relation to the degree of economic development. To identify EDAs, the European regions were disaggregated into quartiles on the basis of per capita GDP (with purchasing power parity) at the beginning of the period for which data are available

(1995). The regions having the lowest per capita GDP in the European context are in the first quartile, we identify these regions as Economically Deprived Areas (EDAs). The analysis by quartile provides an effective proxy for the European criterion for identifying regions qualifying for access to structural funds (Objective 1).

In the empirical analysis, we use this regional distinction to evaluate the interaction between stage of economic development and financial structure. We also return on this point in the next section. In order to do this, we create a dummy HD equal to 0 when the region can be considered as an economically deprived area [EDA] and equal to 1 otherwise. This dummy interacts with the financial variables as follows:

$$y_{i,t} = \alpha y_{i,t-1} + \beta_1 X^1_{i,t} + ... + \beta_2 HD * X^1_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (4)$$

A major challenge in this paper was to identify a suitable proxy for financial system characteristics. In empirical investigations of the nexus between finance and regional development, particular attention is focused on an analysis of the banking sector, in view of banks' central role in the management of financial flows; moreover, at the regional level indicators such as market capitalisation or other proxies for financial market development often become meaningless when transposed to the local level (Guiso et al., 2002).

Moreover, in spite of the consolidation processes, in many countries there are still differences between the various banks in terms of size and geographical area, and some banks are still specialised by areas of business. Differences in terms of governance and ownership structures also persist: the public sector is still of significance in Germany [Sparkassen] and the mutual movement, together with a large public sector [Cajas de Ahorros], has retained its importance in Spain. In contrast, Italy is characterised by the prevalence of large private regional/national groups. To assess these differences, first of all we proxy financial deepening by the total amount of credit supplied by monetary financial institutions at the regional level to households, enterprise and general government, divided by GDP.

Then, in order to evaluate financial institutions' ability to collect and manage soft information, the total amount of credit was disaggregated on the basis of the commercial/mutual-cooperative structure of the financial institutions. In fact, of all the various characteristics of the banking system, the most significant in this context is the relationship between the role of the mutual/cooperative banks (i.e.: non commercial banks) and the rate of economic growth. Commercial credit is the amount of credit supplied by commercial monetary institutions while mutual credit is the amount supplied by mutual/cooperative financial institutions, both expressed in terms of GDP. More precisely, the term "mutual banks" refers to all banks which traditionally belong to major mutual banking circuits, as well as independent banks operating on a local basis. On the other hand, commercial banking business is the amount of credit supplied by privately owned profit-seeking financial institutions. The classification is intended to categorise mutual banks as those intermediaries which also use soft information and implement relationship lending policies (Ayadi et al. 2009). Mutual banks are found to be particularly interesting in our study at the regional level, since they normally operate within relative small geographical areas and have simple organisational structures with decision-making autonomy granted to the periphery (Berger and Udell, 2002). The aim of the distinction between commercial and mutual banks is to ascertain whether the differences between the lending behaviours of the two types of bank (indicated by their lending volumes) may lead to differences in the level of economic growth; as reported by Berger and Udell (2002), the adoption of relationship lending policies should lead to an improvement in the volumes of credit, and the terms, available to borrowers.

To test the role of venture capital, we use the amount invested in early stage (seed and start-up) business divided by GDP, evaluated on a local basis. The variable relating to venture capital investments made in a local context were included in the estimate due to the fact that investors of this kind finance early-stage enterprises, often working in high-tech sectors, and thus act as catalysts for an area's economic growth. For the same reason, buy-out investments were not included in the venture capital aggregate since they are usually only directed at corporate restructuring projects.

Table 1 Variables definition and sources

Variable	Definition	Source
GDP	Gross Domestic Product	Eurostat. General and regional statistics database [http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database]
Total Credit	Total credit, excluding interbank business	National Central Banks [Deutsche Bundesbank, Bank of Italy, Bank of Spain]
Venture capital	Venture Capital investments [seed + start-up financing]/GDP	BVK [German Private Equity and Venture Capital Association] , Istat [Italian Institute of Statistics], ASCRI [Spanish Venture Capital Association]
Commercial Credit	Total credit, excluding interbank business, provided by commercial banks. For the different countries the definition of commercial banks includes: Germany: Kreditbanken [Commercial Banks] Italy: Banche SpA [Commercial Banks] Spain: Bancos [Commercial Banks]	National Central Banks [Deutsche Bundesbank, Bank of Italy, Bank of Spain]
Mutual Credit	Total credit, excluding interbank business, provided by mutual/ banks. For the different countries the definition of mutual banks includes: Germany: Sparkassen [Saving Banks] + Kreditgenossenschaften [Cooperative Banks] Italy: Banche Popolari [Cooperative Banks]+ Banche di Credito Cooperativo [Mutual Banks] Spain: Cajas de Ahorros [Saving Banks] + Cooperativas de Creditos [Cooperative Banks]	National Central Banks [Deutsche Bundesbank, Bank of Italy, Bank of Spain]

4. Results

Tables 2 and 3 show the dynamic panel data results. In particular, Table 2 presents the results of the dynamic panel for data averaged over 5-year intervals and Table 3 for data calculated on a one-year overlapping horizon. In general, the results are robust to the change in data frequency[7].

Both Tables show the important role played by bank lending in regional economic growth. The coefficients related to the total credit over GDP in all the specifications are always positive and highly significant (1% significance level).

The prevalent marginal effect for Total Credit on regional growth is around 0.04 (except the estimates in Columns 1 and 2 in Table 1, which are higher). This estimate implies that a 0.10 increase in total credit /GDP leads to a 0.4 percentage point increase in regional growth rate.

Similar results are obtained for the Venture Capital variable. In all the specifications (Table 1 and 2) the estimated coefficients are positive and highly significant (1% significance level). However, the marginal effect is lower than for total credit, ranging from 0.012 to 0.019 (columns 2, 4 and 5 in Table 2 and column 5 Table 3). This means that a 0.10 increase in Venture Capital leads to a 0.12 (0.19) percentage point increase in regional growth rate.

The distinction between mutual and commercial credit suggests that both types of bank are important for regional growth but the role of mutual banks is greater. Consider, for example the estimates

[7] Similar results are also obtained by using annual data.

in column 3 Table 2: a 0.10 increase in Mutual Credit leads to a 0.33 percentage point increase in regional growth rate, compared to the 0.23 percentage point increase for Commercial Credit. The important role of mutual banks is robust to the inclusion of Venture Capital (e.g. column 6, Table 1).

Next we consider the interaction between stages of economic development and financial structure. In order to do this, we use a dummy HD equal to 0 when the region can be considered as an economically deprived area [EDA] and equal to 1 otherwise. To identify EDAs, the European regions were disaggregated into quartiles on the basis of per capita GDP (with purchasing power parity) at the beginning of the period for which data are available (1995). The regions having the lowest per capita GDP in the European context are in the first quartile, we identify these regions as Economically Deprived Areas (EDAs). Note that our results do not depend on the EDAs distinction[8].

The HD dummy interacts with all the financial variables. For example in the case of the interaction between mutual credit and HD: β_1 × Mutual Credit + β_2 × (Mutual Credit /GDP* HD). Thus this specification provides the basis for two different population regression functions relating to economic growth (Y) and the financial variable (X), in this case mutual credit. With this specification the effect of mutual credit in the poor regions (D =0) is β_1 while in the rich regions (D = 1) it is $\beta_1 + \beta_2$. Hence, β_2 is the difference in the effect of an increase in mutual credit (e.g 1% or 10%) for the rich regions.

The interaction terms for each financial variable are reported in Tables 2 and 3. The most striking outcome concerning the interaction between stage of development and financial structure regards the role of mutual banks and venture capital. In both cases the marginal effects of these financial variables is larger in the economically deprived areas. Moreover, these effects are always statistically significant (Columns 5 and 6 both Tables). For mutual credit and venture capital, the estimated β_2 is always negative. This means that in the rich regions the marginal effect of an increase in mutual credit (or in venture capital) is lower than in the poor regions: in other words, the final effect is $\hat{\beta}_1 - \hat{\beta}_2$.

Consider, for example the estimates in Column 6, Table 2: a 0.10 increase in Mutual Credit induces an increase of 0.34 percentage points in the growth rate of the poor regions, but only 0.22 percentage points in the rich ones. The estimated difference effect parameter is $\hat{\beta}_2$ is – 0.012, hence $\hat{\beta}_1 - \hat{\beta}_2$ = (0.034 - 0.012) = 0.22.

A similar mechanism applies for Venture Capital. Consider, for example, the estimates in Column 5, Table 2: a 0.10 increase in Venture Capital induces an increase of 0.19 percentage points in the growth rate of the poor regions but only 0.11 percentage points in the rich ones. In fact, the difference effect between rich and poor regions is $\hat{\beta}_2$ is -0.008 . Hence $\hat{\beta}_1 - \hat{\beta}_2$ = (0.019 - 0.008) = 0.011.

With respect to the three hypothesis stated in the previous section, we find that the greater the level of financial deepening the higher the rate of local economic growth (H1). The greater the importance of mutual/cooperative banks, the higher the rate of local economic growth (H2), the higher the level of venture capital the higher the rate of local economic growth (H3). Moreover, the role of mutual credit and venture capital is greater in economically deprived areas [EDAs].

[8] We change the clustering of regions obtaining similar results. Moreover, we also analyse country dummies but the national distinction is less statistically significant to capture the role of different types of banks or financial investments. This latter result is consistent with the findings of the literature on European growth (e.g Forni and Reichlin, 2001): the national dimension of European growth is not important but is important the local one in other words the core of the most integrated regions in Europe does not have national boundaries. The results are available on request.

Table 2 Financial development and growth.
Dynamic panel regression, system estimator: *5-years horizon (data averaged over 5-year intervals)*
Dependent variable: growth rate of per capita GDP (PPP adjusted)

Regressors	(1)	(2)	(3)	(4)	(5)	(6)
Constant	2.52*** (0.38)	2.63*** (0.49)	2.67*** (0.43)	2.25*** (0.30)	2.34*** (0.34)	2.32*** (0.26)
Total Credit/GDP	0.087*** (0.014)	0.071*** (0.013)		0.042*** (0.012)	0.046*** (0.013)	
Venture capital/GDP		0.012*** (0.004)	0.080** (0.004)	0.015*** (0.003)	0.019*** (0.003)	0.008*** (0.003)
Commercial Credit/GDP			0.023** (0.012)			-0.009 (0.008)
Mutual Credit/GDP			0.033*** (0.006)			0.034*** (0.003)
Interactions						
(Total Credit/GDP) * HD				0.009** (0.003)		
(Venture Capital/GDP) * HD					-0.008** (0.003)	
(Commercial Credit/GDP) * HD						0.022*** (0.006)
(Mutual Credit/GDP) * HD						-0.012*** (0.006)
Time Dummies	Yes	No	No	No	No	No
Temporal dummies = 0 Wald test: p-value	0.27					
Number of observations	106	98	98	98	98	98
*Sargan test: p-value^*	0.99	0.86	0.82	0.55	0.49	0.56

***Notes**:* the variables are in *logs*. Numbers in parenthesis are p-values. *** 1% , ** 5%, *10% significance level. ^ the null is because the instruments used are not correlated with the residuals.

Table 3 Financial development and growth.
Dynamic panel regression, system estimator: *one-year overlapping horizon*
Dependent variable: growth rate of per capita GDP (PPP adjusted)

Regressors	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.89***	0.89***	0.92***	2.16***	1.97***	2.01***
	(0.05)	(0.05)	(0.06)	(0.30)	(0.22)	(0.27)
Total Credit/GDP	0.045***	0.040***		0.035***	0.042***	
	(0.003)	(0.03)		(0.005)	(0.005)	
Venture capital/GDP		0.002***	0.002***	0.004***	0.012***	0.003***
		(0.0005)	(0.0006)	(0.001)	(0.002)	(0.0009)
Commercial Credit/GDP			0.016***			0.003
			(0.0019)			(0.003)
Mutual Credit/GDP			0.012***			0.013***
			(0.0008)			(0.001)
Interactions						
(Total Credit/GDP) * HD				0.017***		
				(0.003)		
(Venture Capital/GDP) * HD					-0.013**	
					(0.002)	
(Commercial Credit/GDP) * HD						0.020***
						(0.003)
(Mutual Credit/GDP) * HD						-0.002
						(0.002)
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Temporal dummies = 0 Wald test: p-value	0.000	0.000	0.000	0.000	0.000	0.00
Number of observations	467	428	428	428	428	428
*Serial correlation test: p-value^*	0.10	0.11	0.18	0.14	0.25	0.15
*Sargan test: p-value^^*	0.02	0.06	0.37	0.80	0.99	0.42

***Notes**:* the variables are in *logs*. Numbers in parenthesis are p-values. *** 1% , ** 5%, *10% significance level. ^ the null is because the instruments used are not correlated with the residuals. ^^the null is because the residuals in first difference regression are not second order autocorrelated.)

5. Discussion and conclusions

This work investigates two factors rarely discussed in the literature on finance and growth: venture capital investment, seen as a catalyst for growth and a discrete part of the financial system, and financial intermediaries' capacity for collecting and managing soft information. From this point of view, the distinction between commercial and mutual banks was intended to categorise mutual banks as those intermediaries which also use soft information and implement relationship lending policies, important for the provision of finance to support local economies. Therefore, this work studies venture capital investments and the type of intermediary involved in the financing of local economies, alongside the conventional financial growth parameter (the amount of lending).

The association between venture capital and regional economic growth was found to be sound and statistically important, separate from other factors and stable over time. At the local level in particular, the contribution of venture capital to growth might have been relatively insignificant, since if the main channel for risk capital investments to take effect had been the technological development of the companies financed, this feature would have easily been able to spread across regions, since they are commercially and financially integrated. However, the estimates produced, and their consistency over time in particular, have revealed that, in spite of this integration, venture capital generates a specific, significant effect in the region where the target company is based.

The distinction between mutual and commercial credit suggests that both types of bank are important for regional growth but the role of mutual banks is greater in economically deprived areas [EDAs]. Mutual banks and venture capital both proved to be substantial factors for economic growth in regional contexts, regardless of the time periods considered.

Our results are consistent with the findings in the earlier literature covering cross-country studies, with regard both to the role of mutual banks (Ayadi et al. 2009, Usai and Vannini, 2004) and to that of venture capital (Samila and Sorenson 2011, Di Giorgio and Di Odoardo 2006). Both factors proved to be separate, significant catalysts in the process of long-term economic growth especially when the different economic growth rate of the local context considered is introduced as in Rousseau and Wachtel (2005), and Rioja and Valev (2003).

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