

# **BANKS, FINANCIAL INNOVATIONS AND REGIONAL GROWTH**

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## ***Abstract:***

There is a well-documented cross-country literature on the relationship between finance and growth. This paper contributes to this literature by analysing the relationships between financial intermediation and economic growth within the regions of one country, rather than different countries. The focus on regions is relevant since regional information is more homogeneous, the legal and institutional factors are similar, and the relevant financial market is more accurately defined. Our study also incorporates the effects of a set of innovations in the banking sector on the regional growth. The empirical analysis is undertaken for the Spanish regions over 1986-2001.

***JEL Classification:*** R11, G21

***Keywords :*** economic growth, financial intermediation, regions.

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<sup>‡</sup> **Acknowledgements:** Financial support from MCYT and FEDER, SEC2002-00348 is acknowledged and appreciated by the authors. Santiago Carbó also acknowledges financial support from the “Ayudas a la Investigación en las áreas de Economía, la Demografía y Estudios de Población y los Estudios Europeos” of the Fundación BBVA in the project “Integración, competencia y eficiencia en los mercados financieros europeos”. We thank comments from the participants in the International Workshop on European Financial Markets, Investment and Technological Performance, held at University of Warwick (U.K.) (February 2004) within the Contract HPSE-CT-1999-0039, DG Research, European Union.

## 1. INTRODUCTION

The links between financial intermediation and economic growth has concentrated a great deal of academic attention during the last fifteen years. This literature highlights the role of banks and the financial system as a key ingredient of the economic development puzzle. Most of the finance-growth studies follow a Schumpeterian view of financial intermediaries as agents that monitor, finance and foster entrepreneurship -and, hence, investment and growth- based on the grounds of the seminal contribution of Goldsmith-McKinnon-Shaw<sup>1</sup>. In parallel, many cross-country empirical approaches have been undertaken prompted by institutions such as the World Bank<sup>2</sup> or the International Monetary Fund<sup>3</sup>. These studies show the relevance of financial intermediaries development in explaining the differences in economic growth across countries.

The geographical scope is relevant since it conditions the methodology, the empirical evidence and the subsequent policy implications of any economic or financial analysis. The present study analyses the relationship between financial intermediation and growth from a regional perspective, rather than from a cross-country viewpoint. Our paper incorporates two major innovations with regard to the existing empirical literature in this field. First of all, the use of regions within a country implies that the institutional, legal and cultural factors are more adequately controlled<sup>4</sup>, the availability and homogeneity of financial information is larger and the relevant (financial) market is more accurately defined than for previous cross-country research. Moreover, it has been demonstrated that the significance of the relationship between financial development

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<sup>1</sup> See Goldsmith (1967), McKinnon (1969) and Shaw (1973).

<sup>2</sup> Claessens and Glaessner (1997).

<sup>3</sup> Lindgren et al. (2000).

<sup>4</sup> See Demirgüç-Kunt and Maksimovic (1998) for a survey of the implications of different legal and financial environments for economic growth.

and economic growth depend on the level of financial development itself while cross-country studies usually consider a set of heterogeneous countries jointly independently of their level of financial development (Rioja and Valev, 2004). Secondly, we consider various financial innovations that have emerged in recent years and that are likely to have affected the financial intermediation- economic growth nexus (Mayer, 1988). Specifically, the effects of the different level of business and technological developments in the regional banking sectors on regional growth are also studied.

The paper is divided in four main sections following this introduction. Section 2 establishes the theoretical and empirical grounds. The framework of the so-called *AK* growth model is employed in order to identify the different contributions of intermediation to growth while the results and implications of previous empirical studies are also summarized. In section 3, we discuss the (dynamic panel) methodology, data, variables and the relevance of employing regions in this context. The main empirical findings are identified in Section 4. The paper ends with the main conclusions in Section 5.

## **2. BANKING AND ECONOMIC GROWTH. THE REGIONAL APPROACH**

### **2.1. Financial intermediation and growth: an assessment**

The financial intermediation-growth nexus has been modelled recently from various perspectives. The dichotomy between neoclassical and endogenous growth models -as for all sort of analyses on the sources of economic growth- is also relevant in this context. Benhabib and Spiegel (2000) argue that both approaches appear to be valid in the aim of evaluating the effects of financial intermediation. Nevertheless, the endogenous growth perspective appears to dominate the analysis in recent years, with

banks emerging endogenously and monitoring, evaluating and financing investment projects, thereby augmenting the productivity of capital.

This view was implicit in the contribution of Goldsmith-McKinnon-Shaw. Banks reduce transaction costs when transforming savings into investment and the quantity and quality of financial services help explain differences in growth rates across countries. Gertler (1988) assesses this view of the role of finance in the economic thought of the twentieth century showing that the contribution of banks and financial markets has not been considered until recently. New models where both growth rates and financial intermediation emerge endogenously have been developed in recent years.

An important issue is the direction of the causality relationship between financial intermediation and growth. Greenwood and Jovanovic (1990) build a long-run model that suggests a double direction of causality over a time horizon. In this model, economic growth favours the expansion of financial intermediaries in their early stages of development while, later on, a mature and consolidated financial system enhances more efficient investment decisions and faster economic growth. The contribution of intermediaries do not rely directly on capital accumulation but on capital productivity. Causality effects have been also evaluated within the so-called bisectoral models of growth such as Odedokun (1996) or Wang (1999). These models are defined in two ways. A first stage of the model assumes that the financial sector positively affects economic growth (financial-leading) while the second poses that the economic conditions stimulate financial development (real-fostering). The joint evaluation of these equations also favours the hypothesis of double causality.

Bencivenga and Smith (1991) find that the contribution of banks to growth results from their screening and monitoring functions that permit an easier, more efficient and faster access to external finance. This contribution is related, *inter alia*, to

geographical variables, including distance, which affect transaction costs (Degryse and Ongena, 2004).

Banks increase the productivity of investment by reducing the holdings of liquid funds by households and directing them to illiquid but high-performance projects. King and Levine (1993) demonstrate that changes in intermediation margins affect the growth rate of aggregate output and, interestingly, these changes are associated with the costs of financial innovation. Innovation increases efficiency and reduces risk, so that monitoring costs decrease and investment productivity rises for any given equilibrium growth rate. Galetovic (1996) also highlights the role of innovation in a model where endogenous financial intermediation is a necessary condition for growth sustainability. Financial innovation improves the efficiency of the screening and monitoring functions in evaluating specialized firm investment projects. De la Fuente and Marín (1996) find that endogenous financial intermediation also avoids the duplication of monitoring and risk control of investment when entrepreneurs do not have incentives to develop this functions in the presence of transaction costs. The optimal level of monitoring depend on input prices and increases with capital accumulation. Similarly, improvements in monitoring ameliorate the risk properties of corporate loan contracts and foster firms innovations.

In the endogenous growth framework, the *AK* model assumes that a decrease in intermediation costs reduces the fraction of savings that is “lost” in the process of intermediation and increases lending and investment. Pagano (1993) identifies three specific contributions of financial intermediaries. First of all, an efficient banking system reduces the leakage of resources in funnelling savings to firms. Secondly, intermediation ameliorates the allocation of funds since banks discriminate among bad

and good projects, choosing those with a higher marginal productivity of capital<sup>5</sup>. Third, both the level and the growth rate of savings can also be affected by financial intermediation. However, these effects are ambiguous since the savings rate may increase or decrease. As bank markets develop, the availability of consumer or mortgage lending to households is higher and –if insurance markets develop in parallel– the need of precautionary savings may diminish<sup>6</sup>. In any event, the net effect of intermediary development on savings depends on the risk-return properties of consumer utility function. The risk-return combination of savers portfolio improves with bank efficiency. Nevertheless, the impact on the level of savings will depend upon the effects of the expectation of higher returns (or lower risk) on the relationship between present and future consumption.

## 2.2. An AK model of growth with financial intermediation

We depart from an AK model in an economy (region) where aggregate output ( $Y$ ) is obtained with capital as the only input factor. Population in this economy is stationary. Aggregate output at time  $t$  is a function of the productivity of capital ( $A$ ) and the capital stock ( $K_t$ ):

$$Y = f(K, A) \tag{1}$$

$Y$  can be consumed or invested. Capital stock is a function of investment flows ( $I$ ) and the capital depreciation rate per period ( $\delta$ ):

$$K = g(I, \delta) \tag{2}$$

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<sup>5</sup> Pagano (1993) notes that the productivity of capital may increase in two ways: (1) banks collect information on borrowers that permit them to discriminate among alternative investment projects; and (2) banks induce individuals to invest in riskier but more productive technologies enhancing risk sharing.

<sup>6</sup> On the other hand, overlapping generations models such as Jappelli and Pagano (1992) show that binding liquidity constraints may also increase savings since present consumption of certain type of consumers (as young households) is limited by current resources (not permanent income).

All savings ( $S$ ) are channelled through banks and they are assumed to be enough as to finance investment. However, there are intermediation costs associated to this process so that only a fraction of saving ( $\phi$ ) can be finally channelled and investment results in:

$$I = h(S, \phi) \quad (3)$$

Aggregate saving ( $S$ ) in equation (3) will depend on the social and economic structure of the economy (region). At the same time, the proportion of saving that is lost in the process of financial intermediation ( $1-\phi$ ) is expected to be largely affected by the evolution and the state of the financial and technological innovations and developments of banks operating in this economy (region). All these influences, can be specified in the vector  $X$  so that equation (3) can be written as:

$$I = j(X) \quad (4)$$

Given the relationship between  $I$ ,  $K$  and  $Y$ ,  $X$  can be considered as the representative vector of the set of factors that determine the level of saving and, hence, investment and growth.

We consider the case whereby aggregate output at time  $t$  can be expressed as a linear function of the productivity of capital ( $A$ ) and the capital stock ( $K_t$ ):

$$Y_t = AK_t \quad (5)$$

The gross investment function equals:

$$I_t = K_{t+1} - (1-\delta)K_t \quad (6)$$

Let us now combine both the  $AK$  model and the role of financial intermediaries in this context. The costs of intermediation in the transformation function of banks imply that a proportion of savings ( $1-\phi$ ) can not be funnelled to private agents (Pagano, 1993; Thiel, 2001), so that:

$$\phi S_t = I_t \quad (7)$$

Market equilibrium condition is given by:

$$\phi_s Y_t = I_t \quad (8)$$

where  $s=S/Y$ . From equation (5), the growth rate at time  $t+1$  in our economy is  $g_{t+1} = (Y_{t+1}/Y_t) - 1 = (K_{t+1}/K_t)$ . Considering the new capital market equilibrium and the role of financial intermediaries, the steady-state growth rate of the economy (dropping the time indices) can be written as:

$$g = As\phi - \delta \quad (9)$$

### 2.3. Assessing the role of financial intermediaries in the model

Equation (9) summarizes the direct effect of financial intermediation in the *AK* models: a fraction of savings is taken by the bank(s) as a reward for services supplied. The fraction of savings “lost” with financial intermediation depends on several variables. Firstly, any kind of market power in the banking industry is likely to increase the amount of savings that are “lost” with intermediation (Demirgüç-Kunt et al., 2004). Secondly, efficiency at banks is also important in the sense that managerial abilities (X-efficiency, scale/scope efficiency) can also modify bank prices. Berger et al. (2004) suggest that greater market shares and efficiency ranks of small, private, domestically-owned banks are associated with better economic performance. Regulation may also be of importance here since factors such as taxes or solvency requirements alter bank margins frequently. Financial innovation deserves specific attention given the aim of this study. If banks offer non-traditional products or new technological services, consumers benefit from these innovations –provided that these products do not alter market power significantly- and banks diversify their sources of income so that they can afford lower interest margins.



Banks could also contribute to economic growth by augmenting the productivity of capital. According to Greenwood and Jovanovic (1990) or Bencivenga and Smith (1991), banks collect information allowing that financial flows to investment grow until the marginal cost of monitoring/screening functions equals the marginal utility of investment in physical capital. The transformation function of banks permits that a significant share of financial (savings) flows that would be invested in short-term projects can be invested in long-term (high-yielding) projects. Banks also increase the productivity of capital when they act as brokers, allowing savers to diversify their portfolio by investing in products such as shares, mutual and pension funds or insurance services. Therefore, regulation –allowing broad banking activities- and financial innovation –developing new services- are also relevant in promoting capital productivity and investment.

Another pillar of financial intermediation and growth interactions in the *AK* model is the effect on the savings rate itself. As noted above, this effect is ambiguous since it may imply different perceptions on the present and future consumption in the event of better risk-return opportunities. On one hand, one could expect that an increase in loan demand with lower interest rates will have a negative impact on  $s$  since consumers' perception will be that they could reach the same future consumption with a higher present consumption. On the other hand, financial innovation may increase the savings rate if households and firms find that new banking products may offer long-run investment and portfolio diversification opportunities<sup>7</sup>.

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<sup>7</sup> The framework of financial intermediation within the *AK* model has been extended to show other effects of financial development as in Bacchetta and Caminal (2000). First of all, distribution effects have been observed since differences in marginal productivity across firms have been shown to increase with intermediation costs. These studies also show a non-neutral effect of intermediation on aggregate output volatility with banks dampening growth volatility caused by macroeconomic shocks and magnifying monetary shocks.

#### **2.4. Empirical approaches: deepening, dependence and growth**

The empirical evidence in cross-country studies has shown, so far, a close relationship between financial intermediation and economic growth. Financial deepening and financial dependence are two key elements in this context. Financial deepening can be defined as the level of development and innovation of traditional and non-traditional financial services. Most of previous studies employed a bank credit variable as a measure of financial deepening. King and Levine (1993) find a positive and significant correlation between bank credit development and faster economic growth and also a positive influence of financial liberalization on bank efficiency reducing intermediation costs. Similarly, Rosseau and Wachtel (1998) suggest that financial development enhances long-run economic growth in early stages of industrial development. Rioja and Valev (2004) also find a positive relationship between financial development and growth although its significance is found to differ depending on the starting level of financial development.

Unobservable individual (country) effects have been taken into account as a key factor in this type of empirical research. Beck et al. (2000) and Levine et al. (2002) demonstrated that omitted variables, simultaneity or reverse causality do not alter the main finding of positive correlation between intermediaries development and growth if unobservable effects are appropriately controlled. Considering these individual effects, Benhabib and Spiegel (2000) estimate various growth equations under the underlying framework of both neoclassical and endogenous models showing that financial development (deepening) indicators are positively correlated with total factor productivity growth and investment.

Financial dependence is related to the extent to which households and firms rely on bank finance to undertake their investment projects. Therefore, financial dependence

implies a lack of financial sources different from bank credit for a substantial proportion of private agents. Rajan and Zingales (1998) analyse these relationships finding that financial intermediation reduces external finance costs of most dependent firms. Cetorelli and Gambera (2002) study dependence including market structure considerations. Their results are somewhat paradoxical since higher market concentration (employing a Herfindahl-Hirschman index) is found to be beneficial for bank credit-dependent industrial sectors and improve credit conditions for junior firms entering the market. Carbó et al. (2003) found that there is not evidence of causality between bank concentration and growth when regions of one country are employed and concluded that there might be third factors that might influence both variables.

Differences between bank-based or market-based financial systems could imply diversity in growth patterns. According to Levine (2002) there is evidence of positive effects of intermediary (or financial system) development in both cases. Interestingly, Dermigüç-Kuntz and Maksimovic (2002) undertake a cross-country analysis employing microdata to show that the (positive) contribution of banks to growth is more likely to occur in the short-run while financial markets development effects frequently show up in the long-run.

As for bank deepening, legal and institutional factors may also contribute substantially to explain the growth effects of financial dependence according to recent studies. Recent liberalization of bank activities (with a trend towards broad banking in most financial systems) has been shown to increase financial intermediation efficiency and enhance their contribution to economic growth (Arestis and Demetriades, 1997; Jayaratne and Strahan, 1996; La Porta et al., 1998 and 2002; Carbó and Rodríguez, 2004).

### **3. REGIONAL GROWTH REGRESSIONS: EMPIRICAL ESPECIFICATION**

#### **3.1. The benefits of the regional perspective: a closer look at the finance-growth nexus**

There are three major potential advantages of a regional analysis (within a country) compared with cross-country studies: (i) persistent heterogeneity across regions within a single country is lower and more easily controlled than across countries; (ii) the exogenous component of financial deepening –such as the degree of liberalisation or the quality of the legal and institutional framework- can also affect the results significantly and this component may be controlled more adequately at a regional level than in a cross-country perspective. It has been also acknowledged that the link between intermediation and growth is the sum of multiple effects and the regional analysis may captured some effects that are hidden on cross-country comparisons<sup>8</sup>; and (iii) analysing regions within a country provides with a higher availability of information on banking system developments and, at the same time, the contractual relationships between banks and their customers are more likely to be observed on a regional than on a national basis.

#### **3.2. Empirical specification: the relationship between regional bank innovations and growth**

As in other empirical analyses of economic growth, dynamic panel data is employed since the initial (lagged) values of GDP, gross fixed capital formation and gross savings may partially explain the behavior of these variables over time. In order to avoid estimation bias with panel data and dynamic variables, we follow Arellano and

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<sup>8</sup> This is the view, for instance, that prevails in the joint project of the ECB and the Center for Financial Studies “ECB-CFS Research Network on Capital Markets and Integration in Europe. A Road Map” where there is claim for regional studies of this nature.

Bond (1991). Two simultaneous equations are estimated, one in levels and another one with first-differenced variables. The estimation method is GMM. Given the results obtained in our theoretical setting, there are three sets of simultaneous equations to be estimated for *GDP*, Gross Fixed Capital Formation (*GFCF*) and Gross Savings (*GS*), respectively:

$$GDP_{i,t} - GDP_{i,t-1} = \alpha(GDP_{i,t-1} - GDP_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (10)$$

$$GDP_{i,t} = \alpha GDP_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (11)$$

$$GFCF_{i,t} - GFCF_{i,t-1} = \alpha(GFCF_{i,t-1} - GFCF_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (12)$$

$$GFCF_{i,t} = \alpha GFCF_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (13)$$

$$GS_{i,t} - GS_{i,t-1} = \alpha(GS_{i,t-1} - GS_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (14)$$

$$GS_{i,t} = \alpha GS_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (15)$$

where  $X$  is the vector of explanatory variables representing both the general determinants of growth and banking sector developments –all the expected influences expressed by  $X$  in equation (4)- while the unobservable regional effects are denoted by  $\eta_i$ . Equations (10) to (15) are estimated both with and without the bank innovation variables to test if bank innovation is significant on its own. All variables are expressed in logs so that the differences can be interpreted as growth rates.

The GMM simultaneous equation procedure requires the use of appropriate instruments in each case. The instruments for the equations in differences are the one-lagged explanatory (and lagged dependent) variables. The lagged explanatory variables in first differences are the appropriate instruments for the equations in levels. Although there might be correlation between the explanatory variables in levels and the individual

effects, these effects are not necessarily correlated with the first- differenced variables, as noted by the following moment conditions of the GMM estimator:

$$E[y_{i,t-s} - y_{i,t-s-1}(\eta_i - \varepsilon_{i,t})] = 0, \quad s = 1 \quad (16)$$

$$E[X_{i,t-s} - X_{i,t-s-1}(\eta_i - \varepsilon_{i,t})] = 0, \quad s = 1 \quad (17)$$

where  $y$  represents any of the dependent variables ( $GDP$ ,  $GFCF$  or  $GS$ ). Consistency of the GMM estimator depend on the validity of the instruments employed which is analysed employing a Sargan test for restrictions overidentification. The null hypothesis in this test is that the instrumental variables and the residuals are not correlated.

### 3.3. Predicting the effects of bank innovations on regional economic growth

An additional analysis is developed employing GMM estimations. Most of the financial innovations considered –mutual funds, loan commitments, cards, ATMs– experienced a significant growth in the second half of the sample period, mainly from 1993. Additionally, it might be possible that a structural change took place between the periods 1986-1992 and 1993-2001 both induced by financial and economic events such as the advent of the European Single Market. As to measure structural change, a Chow test is undertaken for the growth equations with and without financial innovations. The F-test is defined as the difference between estimated parameters in both periods where the null hypothesis is that the structural change did take place. Considering the different impact of innovations in both periods, we aim to isolate the effect of bank innovation variables in growth patterns between 1993 and 2001 by estimating the following two set of equations:

$$Y_{i,t}^{POST} - Y_{i,t-1}^{POST} = \alpha(Y_{i,t-1}^{POST} - Y_{i,t-2}^{POST}) + \beta'(G_{i,t}^{POST} - G_{i,t-1}^{POST}) + \beta'(I_{i,t}^{POST} - I_{i,t-1}^{POST}) + \eta_i + \varepsilon_{i,t} \quad (18)$$

$$Y_{i,t}^{POST} = \alpha Y_{i,t-1}^{POST} + \beta' G_{i,t}^{POST} + \beta' I_{i,t}^{POST} + \eta_i + \varepsilon_{i,t} \quad (19)$$

$$Y_{i,t}^{POST} - Y_{i,t-1}^{POST} = \alpha(Y_{i,t-1}^{POST} - Y_{i,t-2}^{POST}) + \beta'(G_{i,t}^{POST} - G_{i,t-1}^{POST}) + \beta'(I_{i,t}^{PRE} - I_{i,t-1}^{PRE}) + \eta_i + \varepsilon_{i,t} \quad (20)$$

$$Y_{i,t}^{POST*} = \alpha Y_{i,t-1}^{POST} + \beta' G_{i,t}^{POST} + \beta' I_{i,t}^{PRE} + \eta_i + \varepsilon_{i,t} \quad (21)$$

where  $Y_{i,t}^{POST}$  is the estimated *GDP* (or *GFCF* of *GS*) in the period 1993-2001.  $G_{i,t}^{POST}$  states for the vector of the general determinants of growth in the period 1993-2001 including (as in cross-country studies) the impact of lending to private sector while  $I_{i,t}^{POST}$  is the vector of bank innovations (including mutual funds, loan commitments, cards and ATMs) in the same period. Finally,  $I_{i,t}^{PRE}$  in equations (20) and (21) is the vector of the level of bank innovations in the periods 1986-1992. This way, we are virtually comparing growth patterns in the period 1993-2001 employing the true value of innovations in this period –equations (18) and (19)- and the growth patterns as if the level of innovations had never changed (kept constant) in the period (1993-2001). The average value of the ratio  $Y_{i,t}^{POST} / Y_{i,t}^{POST*}$  is an estimate of the contribution of bank innovations to *GDP*, *GFCF* and *GS*<sup>9</sup>. A separate estimation is also run for two types of innovations:

- a) Business innovations: mutual funds and loan commitments.
- b) Technological innovations: (credit and debit) cards and ATMs.

### 3.4. Data

The study covers the 17 administrative regions<sup>10</sup> of Spain over the period 1986-2001 summing up to 272 panel observations. The Spanish regional banking markets represent a unique case study for our empirical purposes. During this period, a wide process of liberalization, modernization and innovation in the financial system took

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<sup>9</sup> All sets of equations are estimated following the aforementioned GMM procedure.

<sup>10</sup> These regions are called “Comunidades Autónomas”.

place along with changes in growth patterns. Financial intermediation development is analysed by looking at the evolution of lending together with other business and distribution channels innovations in banking services. Two main groups of variables are defined. The summary statistics and sources of information for these variables are summarized in Table 1<sup>11</sup>. There are three dependent variables: regional GDP; regional Gross Fixed Capital Formation; and regional Gross Savings. The first set of regional explanatory variables refer to some of the major determinants of economic growth according to most of the cross-country or regional growth empirical studies:

- Capital stock: including both private and public capital<sup>12</sup>.
- Level of schooling: defined as the percentage of population with secondary or university studies.
- Weight of the industrial sector in the economy: measured as the weight of industry and construction sector on the GDP.
- Percentage of urban population: population in territories with at least 10.000 inhabitants over total population in the region.
- Ageing rate: measured as the percentage of inhabitants over 65 years old.
- Inflation: the regional price consumption index.

As for the objectives of this study, a second set of variables analysing the evolution of regional banking sectors and related financial innovations is also included:

- Lending to private sector/GDP: total loans (in real terms) over GDP.
- Branches/intermediation business: where intermediation business is the sum of loans and deposits. This variable proxies the physical structure needed per

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<sup>11</sup> The larger homogeneity on the institutional, legal and cultural factors across regions does not necessarily imply that there are no differences in the levels of the variables behind economic growth across regions (i.e. level of schooling, capital stock and financial variables). In our analysis, variability across regions is observed by simply looking at regional information (these data are publicly available).

<sup>12</sup> The results remain very similar when including private or public capital separately.



unit of intermediation business and it is expected to proxy intermediation costs<sup>13</sup>.

- Number of bankruptcies and suspensions of payments: as a proxy for the quality and risk conditions of bank business opportunities.
- HHI index in the deposits market.
- Mutual fund business/GDP: as a proxy for product innovation<sup>14</sup>.
- Loan commitments/total lending (including loan commitments): this variable reflects the extent to which regional banks develop long-run contractual relationships that improve their monitoring and screening activities.
- ATMs/branches: as a first proxy of technical change in distribution channels.
- Number of cards issued: the total number of bank credit and debit cards showing technological developments in payment services<sup>15</sup>.

#### **4. THE FINANCE-GROWTH NEXUS: MAIN RESULTS FOR REGIONS**

Dynamic panel data results on the determinants of regional GDP are shown in Table 2<sup>16</sup>. Similarly to previous empirical analyses, the initial value of GDP and inflation are significantly related to GDP growth. As expected, the level of schooling, the weight of the industrial sector in the economy and the capital stock have a significant (positive) impact on growth, while the ageing rate is negatively related to growth.

When region-based bank structure variables are added, the coefficient of the variable representing lending to private sector is found to be positive and significant, as

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<sup>13</sup> There is no regional information on bank operating costs or bank margins. For this reason, we need to proxy operating costs by using one of the main sources of operating costs (branches).

<sup>14</sup> Mutual funds in Spain have experienced a dramatic expansion during the 1990s –being the largest bank product innovation in recent years- and banks manage approximately the 90% of their distribution.

<sup>15</sup> Alternatively, the number of EFTPOS (electronic fund transfers at point of sale) was also employed and the results were very similar.

<sup>16</sup> The instruments employed seem to be appropriate in all cases according to the values of the Sargan test.

it happens in most previous studies. The coefficient of the loan quality variable (number of bankruptcies and suspensions of payments) presents its expected (negative) expected sign showing the importance of risk conditions in channelling funds to investment. As for innovations, two of them are found to affect growth positively, namely, mutual funds and bank cards. This finding appears to show the importance of diversification opportunities in savings portfolios (mutual funds) and the beneficial effects of promoting long-run customer relationships (bank cards) to reduce transaction costs.

The second set of results correspond to the determinants of regional Gross Fixed Capital Formation (Table 3). These results are similar to those obtained for GDP. The initial value of investment, the weight of industrial and construction sectors and the capital stock are statistically significant variables. Importantly, there is also a significant and negative effect of the variable that proxies intermediation costs (branches/intermediation business) showing the negative effect of augmenting transformation costs on investment. Regarding the impact of bank innovations, the positive sign of loan commitments and the number of (credit and debit) cards suggest that capital monitoring and screening improve along with the information content of contractual agreements between lenders and borrowers. As for the variable that relates ATMs to the level of branches, its positive sign might be indicating cost savings from technological change that facilitate investment.

The last set of results correspond to the equation where Gross Savings is the dependent variable (Table 4). The significance of capital stock and schooling variables indicate that the level of regional development favours savings. As expected, the weight of lending to private sector is negatively related to gross savings. However, bank mutual funds and cards growth appear to affect savings positively. In this case, innovations appear to ameliorate the risk/return/liquidity diversification opportunity set for savings.

The results of the predicted change in *GDP*, *GFCF* and *GS* related to bank innovations –as a result of the estimation of equations (16) to (19)- are shown in Table 5. First of all, the Chow test suggests that there has been a structural change in growth patterns between the periods 1986-1992 and 1993-1999 both considering and excluding bank innovations in the estimated equations. There is a significant average contribution of bank innovations to GDP during the period (0.17%). As theory suggests, the largest contribution is found for the gross fixed capital formation, which grows an additional 0.29% due to innovations. The net effect of these innovations on savings is lower but also positive (0.10%). Regarding the effects of the different types of innovations, business innovations are found to be significantly more important than technological innovations in all cases. Risk diversification –due to the growth of mutual funds in households portfolio- and customer relationship –with loan commitments and cards diffusion - effects are then highly significant at the regional level to define the intermediation-growth nexus.

## **5. CONCLUSIONS**

The regional perspective contributes to previous cross-country analyses since persistent heterogeneity across regions and exogenous components of growth are more easily controlled than across countries, information availability is higher and the relevant credit and deposit markets are more appropriately defined.

Following the assumptions of an AK model of growth with financial intermediation, a dynamic panel data analysis is undertaken for the Spanish regions in order to show the impact of various regional banking sector developments and innovations during 1986-2001. The results are in line with cross-country studies, in that there is a positive and significant correlation between bank financial deepening and

regional growth. Nevertheless, our empirical evidence is more detailed with regard to the sources of financial intermediaries development: product and service delivery innovations contribute positively to GDP, investment and gross savings growth.

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**TABLE 1. Summary Statistics**

	<i>Mean</i>	<i>Standard deviation</i>
<i>GDP*</i>	23559.15	21771.20
<i>Gross Fixed Capital Formation*</i>	4058.93	4140.04
<i>Gross Savings*</i>	6297.46	7310.94
<i>Level of schooling*</i>	0.01792	0.00648
<i>Relative weight of the industrial sector in the economy*</i>	0.30332	0.07253
<i>Capital stock*</i>	41518.35	36658.67
<i>Percentage of urban population*</i>	0.50999	0.55990
<i>Ageing rate*</i>	0.05869	0.04655
<i>Inflation*</i>	106.4995	21.1672
<i>Lending to private sector/GDP*</i>	0.61882	0.29166
<i>Branches/intermediation business* (x1000)</i>	0.5503	0.0829
<i>Number of bankruptcies and suspensions of payments*</i>	5.8368	7.4650
<i>HHI index in the deposits market*</i>	0.11688	0.03925
<i>Mutual fund business/GDP<sup>Ⓞ</sup></i>	0.89345	0.51613
<i>Loan commitments/total lending (including loan commitments) *</i>	0.22416	0.02693
<i>ATMs/branches<sup>Ⓞ</sup></i>	0.89202	0.37523
<i>Number of cards issued<sup>Ⓞ</sup></i>	24173600	17181000

Data sources:\* National Statistical Office (INE). [<http://www.ine.es>]\* Ivie [<http://www.ivie.es>]\* Spanish Savings Banks Foundation (FUNCAS) [<http://www.funcas.ceca.es>]\* Bank of Spain [<http://www.bde.es>]\* Spanish Bank Association (AEB) [<http://www.aebanca.org>] and Spanish Savings Banks Confederation (CECA) [<http://www.ceca.es>].Ⓞ Spanish Stock Markets Commission (CNMV) [<http://www.cnmv.es>]Ⓞ ECB Blue Book on Payment Systems [<http://www.ecb.int>] and Bank of Spain [<http://www.bde.es>].

**TABLE 2. Banking sector developments and regional GDP growth (1986-2001)**

Dynamic panel data (GMM)

Variables in logs

Observations = 272

t-statistics in parenthesis (White heteroskedastic-robust standard errors)

	(1)	(2)
<i>Initial GDP</i>	0.01741* (1.78)	0.01420* (1.84)
<i>Level of schooling</i>	0.08159 (0.43)	0.05783* (1.82)
<i>Relative weight of the industrial sector in the economy</i>	0.13222** (2.12)	0.31683* (1.83)
<i>Capital stock</i>	0.78485*** (23.30)	0.64517*** (8.52)
<i>Percentage of urban population</i>	0.08957 (0.96)	0.01824 (1.61)
<i>Ageing rate</i>	-0.18804* (-1.88)	-0.04687 (-0.85)
<i>Inflation</i>	-0.85591*** (-7.60)	-1.13095*** (-5.24)
<i>Lending to private sector/GDP</i>	0.31531*** (7.59)	0.32075*** (-6.65)
<i>Branches/intermediation business (x1000)</i>	-0.01243 (-0.79)	-0.03598 (-1.62)
<i>Number of bankruptcies and suspensions of payments</i>	-0.08834 (-1.36)	-0.01127* (-1.76)
<i>HHI index in the deposits market</i>	0.03298 (-0.15)	0.03457 (0.11)
<i>Mutual fund business/GDP</i>	-	0.06369*** (3.13)
<i>Loan commitments/total lending (including loan commitments)</i>	-	0.03255 (0.35)
<i>ATMs/branches</i>	-	0.06183 (1.24)
<i>Number of cards issued</i>	-	0.11565*** (2.70)
	R <sup>2</sup>	0.96
	Sargan Test (p-value)	0.017
	Overall equation significance – F-test (p-value)	0.033

\*, \*\*, \*\*\*: statistically significant at 10%, 5% and 1% level, respectively.

**TABLE 3. Banking sector developments and regional Gross Fixed Capital Formation growth (1986-2001)**

Dynamic panel data (GMM)

Variables in logs

Observations = 272

t-statistics in parenthesis (White heteroskedastic-robust standard errors)

	(1)	(2)
<i>Initial Gross Fixed Capital Formation</i>	0.03678** (2.23)	0.05556*** (3.53)
<i>Level of schooling</i>	0.06551 (0.18)	0.34711 (1.24)
<i>Relative weight of the industrial sector in the economy</i>	0.38154*** (3.44)	0.4904*** (2.64)
<i>Capital stock</i>	0.52207** (1.99)	1.4061*** (5.29)
<i>Percentage of urban population</i>	-0.03970 (-0.16)	-0.04304 (-0.15)
<i>Ageing rate</i>	-0.40537*** (-6.18)	-0.42523*** (-3.89)
<i>Inflation</i>	-1.83830*** (-6.34)	-0.30801* (-1.88)
<i>Lending to private sector/GDP</i>	0.63990*** (3.17)	0.74945*** (3.63)
<i>Branches/intermediation business (x1000)</i>	-0.45205*** (-4.21)	-1.31953*** (-3.89)
<i>Number of bankruptcies and suspensions of payments</i>	-0.06132** (-2.32)	-0.06483*** (-3.07)
<i>HHI index in the deposits market</i>	-0.09634* (-1.74)	-0.03109*** (-4.69)
<i>Mutual fund business/GDP</i>	-	0.07766 (1.56)
<i>Loan commitments/total lending (including loan commitments)</i>	-	0.491007*** (2.62)
<i>ATMs/branches</i>	-	0.645306*** (3.34)
<i>Number of cards issued</i>	-	0.550342*** (4.23)
	R <sup>2</sup>	0.93
	Sargan Test (p-value)	0.007
	Overall equation significance – F-test (p-value)	0.009

\*, \*\*, \*\*\*: statistically significant at 10%, 5% and 1% level, respectively.

**TABLE 4. Banking sector developments and regional Gross Savings growth (1986-2001)**

Dynamic panel data (GMM)

Variables in logs

Observations = 272

t-statistics in parenthesis (White heteroskedastic-robust standard errors)

	(1)	(2)
<i>Initial Gross Savings</i>	0.04584** (2.52)	0.03358 (1.28)
<i>Level of schooling</i>	1.44897*** (3.73)	1.16166** (2.25)
<i>Relative weight of the industrial sector in the economy</i>	0.98908*** (3.38)	1.12226*** (4.24)
<i>Capital stock</i>	1.54157*** (3.70)	1.77591*** (4.44)
<i>Percentage of urban population</i>	-0.06401 (-0.21)	-0.08226 (-0.32)
<i>Ageing rate</i>	-0.55946** (-2.23)	-0.29941 (-0.78)
<i>Inflation</i>	-2.90374*** (-5.95)	-2.14354*** 0.7884
<i>Lending to private sector/GDP</i>	-0.20781* (-1.77)	-0.37317* (-1.79)
<i>Branches/intermediation business (x1000)</i>	0.48327 (0.75)	0.23507 (0.37)
<i>Number of bankruptcies and suspensions of payments</i>	-0.03826* (-1.85)	0.01553 (0.07)
<i>HHI index in the deposits market</i>	0.15022 (1.39)	0.02677 (0.18)
<i>Mutual fund business/GDP</i>	-	0.08348** (2.39)
<i>Loan commitments/total lending (including loan commitments)</i>	-	-0.65156 (-1.57)
<i>ATMs/branches</i>	-	0.08304 (1.55)
<i>Number of cards issued</i>	-	0.22473* (1.78)
	R <sup>2</sup>	
	0.80	0.77
	Sargan Test (p-value)	
	0.007	0.095
	Overall equation significance – F-test (p-value)	
	0.015	0.014

\*, \*\*, \*\*\*: statistically significant at 10%, 5% and 1% level, respectively.

**TABLE 5. PREDICTED CONTRIBUTION OF BANK INNOVATIONS TO REGIONAL GROWTH (GDP), GROSS FIXED CAPITAL FORMATION (GFCF) AND SAVINGS (GS) DURING THE PERIOD 1993-2001.**

Percentage			
	<i>Contribution to GDP</i>	<i>Contribution to GFCF</i>	<i>Contribution to GS</i>
<i>Banking system innovations</i>	0.176	0.291	0.109
<i>a) Business innovations</i>	0.159	0.241	0.096
<i>b) Technological innovations</i>	0.017	0.050	0.012
<i>Chow test for structural change (model without innovations )(p-value)</i>	0.01	0.01	0.01
<i>Chow test for structural change (model with innovations )(p-value)</i>	0.01	0.01	0.01