Social Capital, Investment and Economic Growth: Evidence for Spanish Provinces*

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Abstract

This article analyzes the impact of social capital on economic growth in Spain during the 1985–2005 period. The existing literature in this context is virtually nonexistent and, in addition, whereas most studies, regardless of the context in which they are applied, have been using survey data in order to measure social capital, we use a measure whose construction is based on similar criteria as other measures of capital stock. In addition, compared with more standard measures of social capital and trust, ours is available with a high level of disaggregation and with annual frequency for a long time period. Following a panel data approach, our findings indicate that social capital has a positive impact on per capita GDP growth in the context of Spanish provinces, implying that "social features" are important for explaining the differences in wealth one may observe across Spanish provinces. We also explore the transmission mechanisms from social capital to growth, finding a highly positive relation between social capital and private physical investment.

Keywords: Spanish provinces, disparities, social capital, growth, physical capital investment.
JEL classification: R11; Z13; O18

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1. Introduction

Traditionally, economic growth has been one of the topics which has attracted more interest in the economic literature. The first steps in the issue are attributed to Solow (1957), who proposed a model which included physical capital investment, labor and technological change. Subsequently, the economic growth literature has considered a large set of *potential* explanatory variables of a different nature, such as human capital or regional, political, religious and social variables. However, despite the remarkable efforts for determining which the *robust* factors behind the economic growth really are (Levine and Renelt, 1992; Sala-i-Martin, 1997; Crespo-Cuaresma et al., 2011), a consensus has not been reached as of today.

In the last few years, a new variable has been considered by several studies on this issue: social capital, which was introduced by Coleman (1988). In the context of growth empirics, the analyst would be confronted with evaluating whether social features such as trust, associationism, social participation, or public-spiritedness influence on the economic performance of one region and how important might the social component be.

However, despite the growing importance of these issues, scholars face up two important problems. The first one is what some authors refer to as the *vagueness* of the concept (Torsvik, 2000). Social capital is characterized by an interdisciplinary nature and, although this might be *a priori* good, in practical terms it impedes a consensus to be reached about the impact of social capital—both *where* and *how* it truly impacts. The second problem scholars face when approaching the concept, and perhaps the most relevant from a point of view of *measuring* how it affects growth, is that data on social capital are relatively scarce and the data provided by different institutions usually carry different meanings—and, therefore, the implications for growth may also vary from one measure to the other. As we will see throughout the study, this will ultimately be the main reason for considering a social capital measure which has been constructed with similar underpinnings to those used for building other databases such as physical or human capital.

Considering the particular discipline of economics, over the last few years some studies have been analyzing how social capital affects different dimensions of economic activity in different countries and regions, finding positive links between trust and economic growth, and using social capital data provided by (WVS) and (EVS). [1] In this line of research we may highlight the contributions by Knack and Keefer (1997), Portela and Neira (2002), and Schneider et al. (2000), who carry out cross-country studies and, more recently, Beugelsdijk and Van Schaik (2005), who consider a sample of 54 European regions.

Some of the studies cited above report interesting conclusions contributing to the understanding as to why some countries, or regions, are systematically richer than others in terms

[1] More detailed information on these data bases and the information used in the studies in section 2.2.

of GDP per capita. In the particular case of Spain, on which we focus, Pérez (2007) concluded that all provinces have experienced an intense economic growth during the 1955–2005 period. However, there is a broad consensus among scholars who have studied the Spanish case that the process of regional convergence in GDP per capita slowed down in the 1980s, whereas labor productivity followed a convergent path (see, for instance, Raymond Bara and García Greciano, 1994; Maudos et al., 1998; Goerlich and Mas, 2001; Goerlich et al., 2002).

Nevertheless, this literature seems to be immerse in a sort of *stagnation period*. Whereas it is true that contributions in the matter are growing (Castro, 2007; Peña Sánchez, 2008; Pons Novell and Tirado Fabregat, 2008; Peña Sánchez, 2011; Escribá and Murgui, 2011), these studies confirm the previous results using more sophisticated techniques but they do not shed additional evidence on the factors behind the disparities apart from the traditional and well-known private and public capital, human capital or productivity. We find studies such as De la Fuente (2003) and Martín Mayoral and Garcimartín (2009) recognizing the influence of additional factors and claiming the necessity of studying the *"black box"* or *"Solow's residual"* of the Neoclassical model where it might be hidden factors such as business climate or the institutions effect affecting growth profiles. From our point of view one important variable embedded in that *residual* is social capital.

There are powerful additional arguments supporting the use of social capital. Pérez (2007), determined that the persistent disparities are consequence of the distinct capacity of the provinces for attracting activity. In that sense, studies such as Becattini (1979) or Trigilia (2005) concluded that the existence of social capital in one territory is one of the factors for the activity attraction and local development. Furthermore, the presence of social capital in one territory can also impel the generation of other kinds of capital, such as human or physical capital (Dearmon and Grier, 2011). So, due to the economic development in Spain has been accompanied by greater levels of physical investment (Pérez, 2007), we go further and analyze if social capital is a driver of physical capital formation in the Spanish provinces, making a differentiation among total investment and non-residential investment.[2] Additionally, whereas the great majority of the studies are focused on Comunidades Autónomas, we develop the study at Province level, which implies further detail.[3]

This paper is structured as follows. In the next section we present a revision of the literature around the social capital concept and its measurement. Afterwards, we explain the advantages of using Pérez et al. (2005) model of social capital generation and accumulation. Section four presents the models which will be estimated and in section five some descriptive statistics can be found. Results are detailed in section six and, finally, section seven concludes.

[2]The decision and the nature of this double consideration will be explained with posteriority in section 4.2.

[3]When studying Spanish growth and convergence profiles we find studies basically with two distinct levels of disaggregation: NUTS 2 if the disaggregation is at Comunidades Autónomas level and NUTS 3 if that disaggregation is at Provinces level. NUTS classification corresponds to European nomenclature.

2. Social capital literature review

2.1. Two different approaches for the same concept

The concept of social capital can be examined from different perspectives. A great number of contributions deal with the concept itself and its impact on a variety of fields. It is widely accepted among scholars that social capital contributes to reduce transaction costs and affects positively economic development, among other beneficial effects. However, nowadays, there is no agreement as to which definition, approach or methodology is the most appropriate to determine its effects.

Robert Putnam, in his seminal study entitled "Making Democracy Work" (1993), analyzed the effect of social capital for explaining the differences in economic development and institutional performance in the Northern and Southern regions of Italy. The main conclusion he arrived to was that social capital partly explains the large differences between the North and South of Italy in terms of institutional performance and economic development. Other authors have focused their interest on testing whether Putnam's results can be generalized using a sample of countries (Schneider et al., 2000), finding some conflicting results.

We can find two distinct views for explaining the origins of social capital. Jackman and Miller (1998), compiled and discussed the different social capital approaches. They argued that the pioneering social capital studies employed an *endogenous* approach of the concept. That view implies that social capital is born inside the individual and the organizations. Be A and B two representative individuals in one determined society, Coleman (1988) defined trust as the expectation created in A of being corresponded by B when A makes something for B. This would imply that a stock of social capital in a given society can be created by the accumulation of reciprocal trust relationships. Coleman (1988) also argued that information is needed in providing a basis for trusting the others.[4] Another relevant factor is the penalties imposed if one individual acts in opportunistic way.[5] Opportunistic behavior may imply an exclusion and the impossibility to participate in the aggregated benefits that social capital provides.[6] Thereby, trust to the long term is also viewed as an instrument to reach a cooperative solution in a context of the Prisoner's Dilemma (Torsvik, 2000).[7]

In contrast, there is an *exogenous* view of the concept, which stresses that social capital is not a personal cooperative decision but a structural element of the society created by a

[4] In a society with certain and clear information, making decisions is easier and securer because individuals can check all the important variables they need to know to make a decision.

[5] The nature of these penalties may be formal (laws and regulations) or informal (social cost imposed to opportunistic actors). The last one would be closely related with social capital.

[6] Exclusion has a damaging effect not only on the excluded but on the global society.

[7] In the classic iterated Prisioner's Dilemma game, participants cooperate because they know that long-term benefits of cooperation are higher than short-term benefits derived from deviations of the cooperative solution. The nature and the mechanisms of the endogenous view are very close to this theory.

confluence of certain cultural values, religion, political system, past and current institutions and social structure. Whereas both of the mentioned views are incompatible for some authors like Jackman and Miller (1998), others have not made that distinction, combining different endogenous and exogenous aspects. Let's see, for instance, Knack and Keefer (1995), Knack and Keefer (1997), Keefer and Knack (1997), Keefer and Knack (2002), Putnam (1995), Helliwell and Putnam (1995), Akçomak and Ter Weel (2009), La Porta et al. (1997), Fukuyama (1995), or Granato et al. (1996a).

Within the exogenous view, we can find other authors whose research is focused on social capital as a result of political regimes and policies (Granato et al., 1996b; Paldam and Svendsen, 2000; Torcal and Montero, 2000; Rose, 2000; Paxton, 2002)[8], as well as studies focused on the implications of social capital for the credit market, being Guiso et al. (2004) one of the maximum exponents.[9]

Until now, we have been focusing on the different views of social capital and the fields where its positive effects have been demonstrated. Nevertheless, in order to understand how social capital is spread inside a society we need to know a key concept: the *network*, which role has been widely stressed (Coleman, 1988; Woolcock and Narayan, 2000; Paldam and Svendsen, 2000; Paxton, 2002; Torsvik, 2000). The network is understood as the relationships and ties between members in the society we are considering and it is itself the instrument which allows for the diffusion of social capital. If individuals in one society are rich in terms of social capital but the network is not wide enough, the positive effects that social capital provides will not be achieved. According to Pérez et al. (2005), high trust societies are characterized by a high-density, well connected network.[10]

The above overview has shown that there is not a consensus on how social capital should be understood. Only one thing seems clear: regardless of the approach followed, either endogenous or exogenous, in those areas where social capital is abundant, contracts and agreements may be enforced with lower transaction costs. However, in spite of the advances in the knowledge of this issue, more evidence on the effects of social capital is needed—at least from the point of view of some disciplines such as economics.

Yet it is not an easy task because the analysts are firstly confronted with the difficulties in quantifying social capital itself. Accordingly, in recent years there has been a growing interest by scholars for determining and quantifying how important social capital is in order to achieve certain levels of economic development.

[8]The general conclusion is that democracy and social capital are highly correlated and that communist societies are harmful for the generation of social capital.

[9]The authors concluded that in countries or regions with high social capital endowments, their inhabitants can gain better access to credit since there is an increase in the number of credit instruments used.

[10]Societies with isolated groups may be harmful for the creation of a social capital stock (Paxton, 2002).

2.2. Measuring social capital

From the previous section it may be easily inferred that one of the major problems in the study of social capital is its *measurement*. Two of the measures traditionally used (Granato et al., 1996a; Knack and Keefer, 1997; Zak and Knack, 2001) are relevant examples, are the *trust* and *associational activity* indicators contained in the World Values Survey (WVS)[11] and in the European Values Survey (EVS)[12] databases. Trust is measured using what scholars have referred to as "the generally speaking question". Specifically, the question asked by the WVS and the EVS is: *"Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?"*, with two possible answers: *"most people can be trusted"*, or *"can't be too careful"*. Both WVS and EVS also provide a membership association indicator.

Other measures have also been utilized as proxies for social capital including political participation, institutional variables, confidence in government, compound civic indicators like Knack and Keefer (1997), or different items or questionnaires used to measure specifically social capital levels in a concrete region such as Narayan and Pritchett (1999), who constructed a measure from "Social Capital and Poverty Survey Questionnaire" to test the role of social capital viewed from a domestic perspective.

Unfortunately, the measures reviewed in the preceding paragraphs have certain disadvantages which can jeopardize their use under some circumstances. First, they have a limited coverage both in the dimensions of space (number of countries or regions included) and time (years in the sample). Second, in the particular case we are dealing with, in which we attempt to understand how social capital might have affected the wealth profiles of the fifty Spanish *provinces*, the measures just reviewed do not provide the required level of disaggregation (provinces, NUTS 3 in European terminology, which would also include the autonomous cities of Ceuta and Melilla).[13]

In order to expand both the space and time dimensions of our data we will consider a new measure of social capital constructed by the Ivie.[14] This measure is available not only for Spanish provinces and regions, but also for a large sample of countries and long time span, which is updated on a regular basis. In addition, it has some additional features which make its use quite attractive in this particular setting. We summarize its main characteristics in the next section. This measure has already been used in recent studies applied to different contexts but with aims related to ours such as Pastor and Tortosa-Ausina (2008) or Miguélez et al. (2011).

[11] See http://www.worldvaluessurvey.org.

[12] See http://www.europeanvaluesstudy.eu.

[13] As indicated in the introduction, some studies such as Beugelsdijk and Van Schaik (2005) have analyzed social capital issues for European *regions*; however, the level of disaggregation employed was far less detailed than that corresponding to Spanish NUTS 3.

[14] Instituto Valenciano de Investigaciones Económicas (www.ivie.es), in collaboration with the Banco Bilbao Vizcaya Foundation (FBBVA, www.fbbva.es).

3. Using an economic approach to social capital

As indicated above, an important stem of the literature has been devoted to measure the impact of social capital on growth using proxies from surveys. In contrast to other measures of social capital such as those reviewed in the previous section, the measure we use is a bit more sophisticated. We devote this section to stress those of its features which are more relevant to our study. In so doing, most details will be referred to section Appendix A, where the technical details of the measure are provided.[15]

As discussed previously, data from surveys provided by WVS or EVS are not available neither for a detailed level such as the different Spanish provinces nor for the analyzed time period.[16] In contrast to the surveys described above, the measure of social capital we use provides yearly data, which facilitates constructing a balanced panel data and, therefore, it can lead to sounder conclusions.

One of the most interesting features of the measure we use is that it deals with social capital as an asset in which to invest. Solow (2000) disagreed with the idea that social capital can be one of the drivers of economic activity, partly because of considering that social capital cannot be considered as *capital*. Specifically, he claimed that the word *capital* is related to a *stock* of factors of production which are expected to yield productive services for a given period of time.

Dasgupta and Serageldin (2001) suggested the plausibility of the construction of an index of aggregated social capital, concluding also that additional research should follow in that direction. Meanwhile, Glaeser et al. (2000) expressed that the traditional measures for social capital might not be the most appropriate in the particular field of economics. They developed a model of individual social capital accumulation, acknowledging the existence of difficulties in the aggregation at the society level. Therefore, this model cannot provide an answer when studying the differences among provinces, which are not individuals but communities of individuals and, consequently, aggregation becomes essential. In the same line, Durlauf (2002) criticized the lack of a theoretical framework for the determinants of social capital formation and accumulation and also pointed out the *weakness* of those studies which test the importance of social capital from a macroeconomic perspective.

The social capital measure we use provides an answer on this respect. The model of social capital accumulation considered is based for its construction on similar ideas as those for models of physical capital accumulation. This implies that social capital is understood as an additional *input* in the production process, and a stock of it is available for each society,

[15] However, all details on the measure we use are provided by its authors in (Pérez et al., 2005) or, in a more condensed way, in Pérez et al. (2006).

[16] Data are provided at country level, being possible a European regional disaggregation in EVS, although there is no data with high enough level of disaggregation for studying Spanish provinces during our reference period. With respect to time periods, surveys are available for several years, but their frequency is far from being annual.

which depreciates over time as any other type of capital stock. Individuals invest in social capital because they expect future positive returns derived from that investment. Our approach considers that social capital provides services, and those services translate into a reduction of transaction costs. That cost reduction conforms the final benefits of investing in social capital.

Another advantage of this approach is the importance that the measure devotes to the economic aspects in the generation of social capital, as opposed to other measures focusing on social and cultural characteristics. Our approach considers the economic relationships such as trade, employment, finance or income distribution as determinants of the incentives for investing in social capital. Pérez et al. (2005, 2006) claim that the cited economic variables have not been sufficiently considered by the literature of social capital, and that their importance could have been underrated compared to other social or cultural variables, more broadly accepted. These authors also provide several explanatory reasons justifying the dominance of social variables over economic variables in the measurement of social capital. The main conclusion they arrive to is that social capital generation cannot be exclusively confined to non-economic relationships, and that economic relationships must also be taken into account, especially when dealing with advanced economies with expectations of continuous progress—which is, precisely, the case of Spanish provinces.

The above arguments provide reasons justifying that our approach might be more appropriate in the specific context we are dealing with. This *economic approach* to measure social capital overcomes some of the biggest difficulties highlighted by the literature: the *vagueness* of the concept (Torsvik, 2000), its measurement, the aggregation issues, the treatment of social capital as an asset in which to invest, and the consideration of economic variables in the social capital formation process. It can also offer additional insights in order to better understand the role of a concept characterized by a multifaceted perspective, and its use will allow for comparison with previous results from studies which have been using more *traditional* measures, as described above.

4. Model specification

4.1. Determinants of economic growth

Selecting the explanatory factors which determine economic growth is not an easy matter. As it was commented in the introduction, a vast number of contributions have focused on determining the *true* determinants of economic growth (Brock and Durlauf, 2001). The contributions to this literature do not decrease neither in quantity nor in quality, as demonstrated in other recent papers such as those by Durlauf et al. (2008), Ciccone and Jarocinski (2010), Henderson et al. (2012), or Moral-Benito (2012), to name few. The number of theories put forth that attempt to explain economic growth is so large that they have led to an empirical

conundrum known as *"theory-openendedness"* (Brock and Durlauf, 2001), which suggests that, while several theories may explain the growth of an economy's output, no particular theory can possibly rule out another theory as an authoritative predictor of cross-country growth (Henderson et al., 2012).

Few variables appear to be significant across studies. Among them, we can highlight three, namely, initial level of income, investment rate and human capital. However, one should also take into account that recent contributions in the field advocate for using different techniques which do not focus on *average* effects but rather allow for variation in the parameter coefficients (Henderson et al., 2012). Yet studies based on linear specifications still dominate. Among them we find the "Barro-type" regressions (Barro, 1991), including the three variables referred to above as well as a great number of regressors which are potential drivers of economic growth.

Sala-i-Martin (1997), in an effort to further investigate additional (more robust) variables apart from the cited ones, considered a modified version of the *extreme bounds test* initially developed by Leamer (1985), concluding that a considerable set of variables could be used as *robust growth determinants*.[17] Unfortunately, a measure of social capital was neither included in this robustness analysis nor in the majority of studies on the determinants of economic growth, partly because most of the studies incorporating social capital are relatively recent and the data on social capital have some limitations related to their availability.

Yet in our study we will base on Mankiw et al. (1992) (henceforth MRW), which is one of the most widely-accepted models in the economic growth literature. One of the reasons is that when studying *regions* within a country instead of *countries*, some widely used variables in "Barro-type" regressions such as political, religious, or cultural variables are quite homogeneous and it is difficult to draw sensible conclusions which could explain economic growth disparities. MRW's model is simpler in that sense. It is an extension of the basic Solow's model, including human capital as an additional regressor, so that the final list of regressors includes the initial level of income, population growth, physical capital investment and human capital. We add to these variables our variable of interest, namely, social capital.

Following MRW, the economic growth will be estimated using a model such as:

$$GGDP = \alpha + \beta_1 GDP_0 + \beta_2 NGS + \beta_3 PRPK + \beta_4 PLPK + \beta_5 HK + \beta_6 SK + \mu \qquad (1)$$

were the dependent variable is economic growth ($GGDP$), measured as the difference of per capita real income logarithm between the end and the beginning of the period. As explanatory variables we have: (i) the initial level of per capita real income (GDP_0); (ii) population growth

[17] Specifically, along with the three cited variables, Sala-i-Martin (1997) found nine different "groups" of robust variables: regional variables, political variables, religious variables, types of investment, primary sector production, trade openness, types of economic organization and former Spanish Colonies.

(NGS), corresponding to the growth population rate plus a fixed coefficient equal to 0.05[18]; (iii) private ($PRPK$) and public ($PLPK$) physical capital investment, as a percentage of GDP[19] and (iv) human capital (HK), which is measured in terms of schooling years of the working population.[20]

These variables conform the MRW's framework. We also factor in social capital per capita (SK).[21] A full description of the variables and sources has been referred to Appendix B.

4.2. Determinants of investment

In the second stage of the study we test the impact of our social capital measure on private physical capital investment. This additional study would be justified in the light of some recent contributions, which manifest that the impact of social capital on growth might be canalized trough other factors. For instance, Akçomak and Ter Weel (2009) or Miguélez et al. (2011)[22], found evidence in favor of positive links from social capital to innovation. Closer to this section of the paper, Knack and Keefer (1997), Zak and Knack (2001) and recently, Dearmon and Grier (2011), showed a positive impact of social capital on physical investment, highlighting that investment processes need trust and, consequently, social capital is a relevant element in the investment decision. In this part of the paper we analyze which elements are driving the investment in the Spanish provinces and if social capital plays an important role in this concern.

Once more, there is no agreement as to which are really the determinants of this type of investment, and authors studying this matter have weighed in different explanatory variables. Studies such as those by Knack and Keefer (1997) or Zak and Knack (2001), consider the price of investment goods, which is, *a priori*, one of the potential drivers of investment. However, the consensus on this matter is not wide and other recent contributions such as Dearmon and Grier (2011) do not consider this variable, but incorporate other *macroeconomic indicators* which capture the investment environment in a certain period such as the lag of the inflation, the lag of government spending as percentage of GDP and the lag of GDP growth, along with a human capital indicator, for which it is argued that some spillover effects which can affect investment could be present. We estimate a very similar model for our sample of Spanish provinces, although with some differences that will be explained in the ensuing paragraphs.

[18] In contrast to MRW and, in line with Islam (1995), we take the total population growth instead of the working population growth. The coefficient 0.05 represents technological growth and depreciation rate and its value is the used in MRW's model, commonly accepted in the literature.

[19] In MWR, both variables are considered together but we prefer a separate inclusion. The reason is that the role of public investment is not unanimous among the studies so, it could be quite interesting its separate inclusion which will allow for comparison.

[20] This variable differs from the original MRW model, which measured human capital taking the rate of working age population with secondary school studies. Nevertheless, this variable is not free of critics, see Islam (1995) for a complete discussion of this matter and, therefore, we proxy human capital with the years of education.

[21] As previously commented in section 3, Ivie's social capital index is an aggregation of the social capital of the individuals, so we must take *average per capita* values in order to control for the population factor.

[22] This study focuses on Spanish regions (NUTS 2) and uses social capital data provided by the Ivie.

Specifically, in the case being analyzed here the dependent variable is the private physical capital investment as a percentage of GDP ($PRPK$) and the explanatory variables are: (i) the real interest rate (R)[23]; (ii) lagged GDP growth ($GGDP_{-1}$); (iii) lagged inflation (INF_{-1}); (iv) lagged public investment as a percentage of GDP ($PLPK_{-1}$) and (v) human capital (HK). To that basic Dearmon and Grier's framework we add social capital per capita (SK) as an additional regressor.[24]

In addition, due to the large impact of the construction sector in Spain during some years of the analyzed period, which is partly responsible for the current crisis affecting the country, we also consider using as a dependent variable the private physical investment subtracting the amount corresponding to the residential investment ($PRPKNR$). In Figure 1 it is shown how in provinces such as Málaga (in the region of Andalusia), Alacant (in the region of Valencian Community), and Illes Balears (which is a region, the Balearic Islands, made of a single province), the residential component is around the 50% of total private physical investment. To our knowledge, the literature focused on the role of social capital in investment detracting that residential component is virtually non-existent. We consider this a valid strategy in the specific case of Spain we are dealing with, where this separate analysis is essential. The reason is that the construction bubble, which burst around 2008, short after the US subprime crisis, had started in the mid-nineties, after the 1993–94 economic crisis. Therefore, a large part of the analyzed period is affected by this fact. If social capital is one of the determinants of investment, it could be of interest to determine if its effects remain significant when the residential component is removed, and how important the possible differences might be.

Therefore, we estimate two models, whose only difference is the dependent variable. In the first one, the dependent variable is the *total private physical capital investment*, whereas in the second is *non-residential private physical capital investment*. A complete description of the variables and their sources can be found in Appendix B. The models are:

$$PRPK = \alpha + \beta_1 R + \beta_2 GGDP_{-1} + \beta_3 INF_{-1} + \beta_4 PLPK_{-1} + \beta_5 HK + \beta_6 SK + \mu \tag{2}$$

$$PRPKNR = \alpha + \beta_1 R + \beta_2 GGDP_{-1} + \beta_3 INF_{-1} + \beta_4 PLPK_{-1} + \beta_5 HK + \beta_6 SK + \mu \tag{3}$$

[23]This variable is not included in Dearmon and Grier (2011) but we have considered it as a relevant variable in the investment decision in line with Knack and Keefer (1997) and Zak and Knack (2001).

[24]Dearmon and Grier (2011) incorporate a social capital measure provided by WVS. They also include variables such as openness or trade liberalization, but we have not considered them because the information used in their construction is more addressed to countries instead of regions inside a single country, which is our case. A description of how exactly these variables are constructed can be found in their paper.

5. Data and descriptive statistics

Before reporting the estimation results of the previous models, we devote this section to carry out a descriptive analysis of our data. Table 1 introduces the Spanish regions along with some data of interest. In the first column of the table are displayed the different *"Comunidades Autónomas"* (NUTS 2) and in the adjacent column, the *"Provinces"*(NUTS 3), in which each Comunidad Autónoma is subdivided. The subsequent columns show some important variables in the beginning (1985) and the end (2005) of the studied period, enabling a better knowledge of the differences across provinces, highlighting important disparities.[25]

As commented in section 4.2, figure 1 depicts the division of the investment in residential and non-residential components and justifies the importance of the double analysis developed, due to the relevancy of the non-residential component in most of the provinces.

Figures 2, 3 and 4 plot bivariate Kernel density functions. All values have been 0–1 scaled. In the first case, when we put together GDP per capital and social capital per capita we can advert a positive relationship. As we can observe, an important probability mass is around the mean, becoming this a high-density area. We also found another isolated high-density area, showing high values of GDP per capita and social capital. Figures corresponding to investment, both total and non-residential, show a very similar pattern. We can observe a positive correlation and high densities around the mean for both cases. However, in this case we do not notice isolated high-density areas.

We also provide some maps in order to better understand how variables are distributed across Spanish provinces. In Figure 5 we can observe this is actually the case, as significant disparities exist within the Spanish territory. In 1985, the regions by the Mediterranean Sea, comprising some provinces of Catalonia (Tarragona, Barcelona and Girona), Valencian Community (especially València and Alacant), Murcia, Balearic Islands, as well as Zaragoza in the region of Aragon, some of the Northern regions (A Coruña in the region of Galicia, the Basque Country and Asturias), Sevilla and Málaga in the region of Andalusia and Madrid, had the highest levels of GDP per capita, whereas the rest of the country had lower levels. The pattern differs slightly for 2005, but remarkable differences across provinces persist. Concretely, we can observe how the wealthier regions are those located in the North and the Northeast part of the country, apart from Madrid.

Focusing on the stock of social capital, figure 6 depicts how the largest quantities in 1985 correspond to Madrid, part of Catalonia (Barcelona, Girona and Lleida) and Northern provinces such as Cantabria, some coastal provinces of the Basque Country and all provinces of Galicia (A Coruña, Lugo, Pontevedra and Ourense), together with Balearic Islands. The dif-

[25]It can be noticed that variables physical capital investment (total and non-residential) and public investment are provided in monetary terms instead of rates, as in the regression analysis. We prefer this option for the table because it allows for a better comparison of the magnitudes across provinces.

ferences are specially noticeable if we compare the Northern with the Southern provinces. If we observe the map for the year 2005, the most remarkable is how social capital largest stocks move to the Northeast part of the country. Social capital decreases pronouncedly in Galicia and Asturias while in the region of Valencia (Castelló, València and Alacant), Guadalajara (in the region of Castile-la Mancha), La Rioja and finally, Zaragoza (in the region of Aragon), increased their stock of social capital per capita.

This section provides a preliminary idea about the distribution and the behavior of our data. Kernel density graphs exhibit positive relationships between social capital and both GDP per capita and investment (total and non-residential). Furthermore, in the light of what is depicted by the maps, one may infer how changes in GDP per capita and social capital show a similar pattern. In 2005, the polarization among the Spanish provinces is evident, being the Northeast provinces those which present higher levels of both social capital per capita and GDP per capita.

6. Results

6.1. Social capital and growth

In this part of the paper we perform a regression analysis that includes those variables defined in section 4.1. We take the data as averages of five-year periods. Studies such as Islam (1995) broadly discussed this consideration and concluded that when working with panel data in the field of economic growth, using yearly data is not recommended because the high volatility of growth rates, although it reduces considerably the number of observations. The common approach in the literature is the construction of five-year averages. Since we have data for the 1985–2005 period, they will be disaggregated in four periods, namely, 1985–1990, 1990–1995, 1995–2000 and 2000–2005. With that aggregation we work with 200 observations. We test for potential specification problems.[26] Table 2 provide the statistics from these test.

With the purpose of controlling for unobservable heterogeneity, we use fixed effects by province. We test its convenience through the Hausman's test. Because standard Hausman's test does not work properly under the specification problems referred to above, we perform the test adopting the refinement proposed by Wooldridge (2002), which provides valid statistical inference for these particular circumstances. Results corroborate that fixed effects are indeed important and contributions such as Islam (1995), have largely supported its adequacy in the economic growth studies across regions or countries.

[26] We test for heteroscedasticity, using modified Wald's test considering Greene and Zhang's (2003) suggestion, which makes that the test works properly under the assumption that errors are non-normal distributed. Serial autocorrelation is tested with Wooldridge's (2002) autocorrelation test and finally, Pesaran's (2004) spatial autocorrelation test allows for testing whether our data suffer cross-sectional dependence. For all three tests we reject the null hypothesis of no specification problem, so, we carry out the estimations correcting the mentioned problems in order to provide valid statistic inference.

Whereas "heteroscedasticity", "endogeneity" or "individual fixed effects" are topics broadly discussed in the literature, when working with panel data it can appear other serious problems such as correlations in the disturbances, not only serial but also *spatial*, meaning that errors are correlated across individuals, provinces in our particular case. It is not common to find studies considering that concern and, following the recent work by Hoechle (2007), ignoring cross-sectional correlation in the estimation of panel data models can lead to severely biased statistical results. We test the spatial correlation by using Pesaran's test, and we reject the null hypothesis of no-correlation, as showed in table 2. This lead us to estimate the model using Driscoll and Kraay (1998) standard errors, providing robust standard deviations in presence of heteroscedasticity and both serial and spatial correlation, instead of the common "White-robust standard errors", which only correct for heteroscedasticity.

In addition, in order to control for the possibility of endogeneity, we also perform a two stage least squares (2SLS) regression with instrumental variables. We use as an instrument for social capital its own lagged value (one period lag). As indicated by several authors (Temple, 1999; Dearmon and Grier, 2009) among others, using lags of one variable as instruments for its current value is a valid strategy in the case there is not a long list of likely instruments to choose from.

Results are reported in table 3. The different columns correspond to models for which different types of regressions are performed. The first two models correspond to ordinary least squares (OLS) regressions, where the social capital variable is introduced sequentially (only the second model includes it).

Results generally support the hypothesis that the variable of interest, social capital (SK), has a positive and significant impact on growth. Specifically, a 10% increase in per capita levels of social capital yields a 0.29% increase in growth. This impact is relatively modest in comparison with the coefficients shown by physical capital or human capital, whose coefficients are higher in all regressions. This result is not surprising, given that physical and human capital are expected to have a more *direct* impact on growth, but social capital impact might be more *indirect* and it could be channeled using other ways.

This positive impact is in accordance with previous studies using country-level data such as Knack and Keefer (1997), Zak and Knack (2001), Whiteley (2000) and, more recently, Neira et al. (2010), or data for European regions (Beugelsdijk and Van Schaik, 2005), although the magnitude of the coefficient is not directly comparable because the approach and the proxy variables used widely differ.

When potential endogeneity is controlled for by conducting a 2SLS instrumental variables regression, conclusions are analogous to "standard" OLS regressions, but in this case the effect of social capital is higher (1.2% increase in growth as a response to 10% increase in social capital), and comparable with the effect of physical capital.

The rest of variables considered in the model are also mostly significant at the 1% level. This is the case of the initial level of GDP (GDP_0), whose sign is negative according to the *Neoclassical growth model* and is representing the well-known β conditional convergence effect, which implies that poorer provinces are converging faster to their own steady state, rather than with the richest provinces. The growth of population plus the fixed value 0.05, the last component capturing depreciation and technology advance, (NGS), has also a negative and significant coefficient, although this effect only exists for the most comprehensive models (models 2 and 3), both of which include social capital. Finally, the variable measuring public physical investment ($PLPK$) has also a negative and significant sign (at the 1% level), in contrast to some previous contributions in Spain such as Peña Sánchez (2008), although their study is focused on NUTS 2 (regions) instead of NUTS 3 (provinces), like we do. This is an important difference, since most decisions on infrastructures, education, or health (which are powers corresponding to regional governments), for instance, are made on a regional basis. However, some relevant country-level studies (Grier and Tullock, 1989; Barro, 1991) have also found a negative impact, similarly to us.

Which it seems to be clear is that social capital matters for explaining the disparities across Spanish provinces' growth profiles. By factoring in this variable it is possible to make a step further for understanding why some of the inequalities in GDP per capita observed across the Spanish territory still persist.

6.2. Social capital and investment

In order to test the impact of social capital on private physical capital investment, both total and non-residential, we estimate the models presented in section 4.2.

One more, the availability of data for all years of the period analyzed allows constructing a balanced panel data. One of the great problems scholars face when working with panel data in the field of economic growth is the shortage of observations derived from the aggregation of the data, as we have just done in the preceding section. However, in this occasion data will not be aggregated in five-year periods because there is no evidence pointing out that such an aggregation can be more adequate for measuring the determinants of investment, since investment rates are quite stable in time. Therefore, we use yearly data, obtaining a larger sample of 1,050 observations, although the final sample was actually a bit smaller because some of the variables included in the analysis are lagged (one period), as presented in section 4.2.

As in the preceding section, fixed effects is an issue to control for. Heteroscedasticity, serial and spatial autocorrelation tests indicate that we can reject the hypothesis of no specification problems (see table 2 for a view of the statistics). In order to provide valid statistical inference, analogously to the previous section, results are estimated using Driscoll and Kraay's standard

errors. Once more, in order to control for a possible endogeneity of social capital, we perform a two stage least squares (2SLS) regression, using as an instrument for social capital its own lagged value (one period). Table 4 shows the estimation results.

We find a positive and significant (1% level) relationship between social capital and investment, for both total investment and non-residential investment. Specifically, when the variable considered is total investment, an increase of 10% in social capital is corresponded by a 1.10% increase in investment and, for the case of non-residential investment, the same increase in social capital turns into a 0.81% increase in non-residential investment. We test if both coefficients are statistically different and we strongly support that hypothesis. Concretely, the test provides a $\chi^2 = 7.08$, significant at the 1% level so, social capital effects are stronger when considering the total investment.

The estimations via 2SLS lead to analogous conclusions. The regression allows us for determining other important relationships. As expected, the real interest rate's coefficient (R) is negative and significant in all instances, a result in consonance with previous findings in the literature such as Zak and Knack (2001) or Knack and Keefer (1997). The lagged value of growth ($GGDP_{-1}$) and the lagged value of public investment ($PLPK_{-1}$) have a positive impact on private investment and are always highly significant. However, the positive impact that we find for public investment is opposed to Dearmon and Grier's (2011) findings, and also to our own results reported in the previous section (table 3). This can be interpreted as further evidence on the "ambiguity" of public capital, since it is affecting *positively* private investment, as shown in table 4, but negatively economic growth, as shown in table 3.

The lagged value of inflation (INF_{-1}) is always significant, except when considering the total investment and social capital is not included as a regressor. Its effect is negative for all regressions, a result contrary to the findings of Dearmon and Grier (2011). Barro (1996) found that inflation only affects investment and growth when high-inflation countries are included in the sample, although the agreement on this matter is not wide (Temple, 2000). In our case, results are in line with Pindyck and Solimano (1993), who concluded that high inflation implies higher economic uncertainty, detracting investment. Finally, human capital (HK) shows an unexpected pattern. It is positive and significant if social capital is not included in the model but when we include the last one, it turns non-significant, raising some doubts about the possible spillover effects of human capital.

In this part of the paper we have highlighted the fact that social capital is one of the elements contributing to explain the heterogeneity of private physical capital investment patterns across Spanish provinces. There is no previous evidence on this respect for the Spanish case and, therefore, comparison with previous results is unfeasible. Yet our results are in line with those encountered in other cross-country studies such as Hall and Jones (1999) and, more recently, Zak and Knack (2001) or Dearmon and Grier (2011).

There is a broad consensus across studies about the positive effects of physical capital on growth. Our results are aligned with these findings so, the growth patterns of the different provinces depend, among other factors, on their capacity for attracting investment, which can generate more activity, employment and wealth. Connecting with that idea, the results of the second stage of the paper suggest that the differences in social capital endowments among provinces can be one of the factors which contribute to explain away the large disparities in terms of per capita income growth during the period analyzed.

6.3. Robustness analysis

In order to test for the robustness of our results, we perform a bootstrap estimation, which is a common nonparametric resampling procedure. It assumes that the sample is the population and it runs a great number of different regressions using several sub-samples with replacement. We perform 400 repetitions, a number high enough to estimate standard errors according to the literature (Andrews and Buchinsky, 2000). Standard errors are constructed as the mean standard deviation of the 400 standard deviations calculated. Table 5 reports the results for all three regressions.

When bootstrap is applied to the model estimated in the first part of the study (first column), being ($GGDP$) the dependent variable, all variables remain significant, although significance of social capital drops from 1% to 10%. Nevertheless, when bootstrap is applied to the models in the second half of the paper (columns two and three), being ($PRPK$) and ($PRPKNR$) respectively the dependent variables, the real interest rate, significant in the previous analysis (non-bootstrapped) is now non-significant. The rest of the variables suffer small changes in significance but remain always significant and the conclusions we can extract are exactly the same. For the case of our variable of interest, social capital, it remains highly significant (1% level).

The robustness analysis manifests that the positive effects that social capital provides on growth and investment are not driven by a determined sample composition.

7. Concluding remarks

Spanish provinces have presented historically considerable disparities in terms of GDP per capita and growth patterns. Although differences reduced significantly during the 1955–1980 period, and the conclusions hinge upon the variable considered (per capita income, labor productivity, capital intensity or total factor productivity), the literature has reached a consensus according to which convergence halted by the end of the 1980s.

Although several factors contribute to explain away the differing growth and convergence patterns for the different provinces, there is an important variable whose importance has been

scarcely highlighted, namely, social capital. This importance has been stressed by a growing literature which has attempted, among other things, to determine whether social capital has an impact on economic growth.

In the particular case of the Spanish regions and provinces, data on social capital have only been available recently. The availability of a new database, which provides data for the period 1983–2005 not only for Spanish regions and provinces but also for a broad sample of countries, has enabled us to include social capital in our study for the Spanish provinces and to analyze its role with some precision.

As commented on throughout the study, an important feature of the social capital measure we use is that it is not only available for both a higher degree of disaggregation and a wider time span than other measures based on surveys more frequently used, but also it solves some of the problems highlighted by the literature in terms of measure, aggregation and how it is constructed—apart from the elements considered for its construction.

According to our results, social capital has a positive influence on growth for Spanish provinces, corroborating the importance found for this variable in previous research studies. This would support its importance as an additional factor to control for when analyzing the differences presented by Spanish provinces in terms of GDP per capita. Therefore, if social capital is one of the mechanisms to achieve a higher stage of economic performance, policies should pursue the generation of greater endowments of social capital in those provinces where this *asset* is relatively scarcer.

Our results also point out social capital is important to foster investment. We report evidence that investment may be one of the candidate channels through which social capital impacts on growth. This evidence is new for the case of Spain. Furthermore, the enormous importance of the construction sector in Spain, especially in second half of the analyzed period (1995–2005), leads us to disaggregate the investment to have closer look to the residential component. Results indicate that the effects of social capital are slightly lower when we detach the last component.

Therefore, investment is not only a relevant factor itself for explaining economic growth, but also an activity for which trust is essential. It is well-documented that borrowing is crucial for investment activities. According to our results, the presence of social capital in a given society or region impacts positively, by making them easier and cheaper these kinds of activities. The theory of social capital claims it is important, among other issues, due to its ability to reduce transaction costs. As indicated by the relationship banking literature, if banks can save costs in monitoring and supervising the reliability of their clients, the latter can obtain cheaper credit. So, in the current economic context in which credit does not flow as few years ago, social capital might be an additional instrument to contribute for restoring the pre-crisis levels of credit so as to foster growth again.

Appendix A. An economic approach to measuring social capital. Some basic ideas

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The social capital measure we use is based on three initial hypothesis:

1. Cooperation in a society is favored by the economic incentives derived from a higher expected incomes, result of a continuous growth.
2. The incentives for cooperation are reinforced/weaken by two factors:
   - The effective opportunity of participation in the final incomes.
   - The culture of reciprocity fulfillment.
3. The effects of cooperation are increased in societies with a high density network.

The investment in social capital is denoted by (I_s). A member in a given society invests in social capital if the expected benefits of cooperation are positive $(I_s > 0)$. If the economy follows a continuous growth trend, the income achieved is higher than the simple reposition of the production factors and, moreover, the results are crescent in time.

$$y > rk + \bar{w} \tag{4}$$

where y is the income, rk is the cost of the physical capital and $\bar{w}$ is the salary of labor.

Other assumptions of this approach are:

- The individuals observe the difference in the incomes that they obtain under certain time and place conditions and other conditions less favorable.
- This difference determines the incentives for cooperation and trust (investment in social capital).

An individual incurs in two types of costs to obtain incomes:

- Cost of contribution with productive resources (we expect a retribution equal to the reposition costs).
- Cost in terms of effort of cooperation inside an incomplete information environment. Cost of cooperation include both time and psychical costs.

Following the above statements, benefits are expressed as:

$$\pi = y - (rk + \bar{w}) - \bar{w}C(I_s) \tag{5}$$

where $C(I_s)$ is the cost of cooperation measured in wage terms.

If one individual *owns* social capital, she/he would expect to obtain additional income using it for her/his economic transactions. The T horizon defines her/his expectations according to the duration of her/his economic relations inside a society or network. If her/his expectations are not fulfilled, her/his social capital will be depreciated at ρ rate.

In a given moment, our representative individual invests in social capital if,

$$\pi = \sum_{t=0}^{T} \frac{1}{(1+\rho)^t}(y_t(1-G) - rk_t - \bar{w}_t(1+C(I_{st}))) > 0 \tag{6}$$

where $(1-G)$ is the Gini's Index and measures the inequality in the society.

The next step is to focus on the services that social capital provides, (fks). The capability of social capital to contribute to an increase of total output depends on its capacity to generate services, i.e. a reduction in transaction costs.

$$fks_i = c_i ks_i \tag{7}$$

where c_i is the degree of connection of the network and ks_i is the social capital stock of the individual i. If a given individual is perfectly connected, it implies $c_i = 1$, the contribution of social capital is maximum. The opposite holds for $ci = 0$. The economic value of the services of social capital is defined in terms of its use cost u_i.

$$u_i = \rho_i + d_i \tag{8}$$

where ρ_i is the financial opportunity cost, and d_i is the depreciation cost.

Therefore, the value of the *services* of social capital can be expressed as:

$$vks_i = u_i fks_i = (\rho_i + di)c_i ks_i \tag{9}$$

The final step is the *aggregation* of the social capital of the individuals. Services cannot be directly added because of their varying nature. Therefore, authors follow a multiplying process, weighting each social capital unit by its own use cost weighted respect the total use cost. The weight is calculated as:

$$v_i = \frac{vks_i}{\sum_{j=1}^{N} vks_j} \tag{10}$$

Regarding the above consideration, the services of social capital are aggregated as follows:

$$KS = N \prod_{i=1}^{N} fks_i^{vi} = N \prod_{i=1}^{N} c_i^{vi} ks_i^{vi} \tag{11}$$

Appendix B. Variables and data sources

- **GGPD**: Real GDP per capita growth. Difference of the logarithms between the final and the initial value of each five-year period. GDP measured in (€). Serie deflated using 2000 as base year. [*Source*: Instituto Nacional de Estadística (INE)].
- **GDP0**: Real GDP per capita in the first year of each five-year period. [*Source*: Instituto Nacional de Estadística (INE)].
- **PRPK**: Private physical capital investment as a percentage of GDP. Serie deflated using 2000 as base year. [*Source*: BBVA Foundation and Instituto Nacional de Estadística (INE)].
- **PRPKNR**: Private physical capital investment detracting the residential component as a percentage of GDP. Serie deflated using 2000 as base year. [*Source*: BBVA Foundation and Instituto Nacional de Estadística (INE)].
- **PLPK**: Public physical capital investment as a percentage of GDP. Serie deflated using 2000 as base year. [*Source*: BBVA Foundation and Instituto Nacional de Estadística (INE)].
- **NGS**: Total population growth plus a fixed component equal to 0.05. The last represents depreciation and technological advance. [*Source*: Instituto Nacional de Estadística (INE)].
- **HK**: Years of education of working population. [*Source*: IVIE].
- **SK**: Per capita social capital services stock. Data from Ivie's (1964–2001) database and its updating until 2005. Both series have been connected using Spain 1983 = 100 as a reference point. [*Source*: IVIE]
- **INF**: Consumer Price Index (CPI) variation. CPI series homogenized (year 2001 = 100). [*Source*: Instituto Nacional de Estadística (INE)].
- **R**: Real Interest Rate. [*Source*: Instituto Nacional de Estadística (INE)].

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Table 1: Descriptive statistics for Spanish provinces, 1985–2005

Region	Province	GDP per capita[a]		Private physical capital[b]		Private physical capital (non-residential)[b]		Public investment[b]		Population [c]	
		1985	2005	1985	2005	1985	2005	1985	2005	1985	2005
Andalusia	Almería	7,550	15,330	710,204	2,740,018	369,453	1,825,803	139,415	357,079	430,069	612,315
	Cádiz	7,804	13,010	1,365,110	4,532,782	703,085	3,023,796	274,546	763,525	1,034,533	1,180,817
	Córdoba	7,043	11,070	820,859	2,410,765	514,528	1,862,800	207,220	548,778	741,582	784,376
	Granada	6,243	11,590	1,245,980	3,078,974	602,352	1,998,060	327,410	533,311	776,907	860,898
	Huelva	8,581	13,960	612,504	2,272,457	301,740	1,506,026	110,460	311,578	429,582	483,792
	Jaén	6,949	10,550	709,590	2,024,585	460,162	1,408,666	200,590	366,352	646,066	660,284
	Málaga	8,008	13,390	2,229,009	7,541,517	868,325	4,014,079	374,068	925,160	1,072,204	1,453,409
	Sevilla	7,597	13,160	1,954,017	6,702,257	1,037,225	4,888,329	435,952	835,515	1,542,752	1,813,809
Aragon	Huesca	10,905	16,810	541,352	1,705,614	383,475	1,046,041	152,944	277,149	212,937	215,864
	Teruel	10,472	17,760	359,153	967,757	269,409	815,867	90,669	300,966	151,006	141,091
	Zaragoza	10,168	18,420	1,620,467	4,530,717	1,069,562	3,430,601	297,180	706,192	837,727	912,072
Asturias	Asturias	8,973	14,750	1,840,294	4,686,708	1,442,251	3,135,047	318,698	1,013,603	1,124,646	1,076,635
Balearic Islands	Illes Balears	13,324	18,280	1,032,476	5,926,796	650,902	3,713,662	245,533	828,264	665,580	983,131
Canary Islands	Las Palmas	10,718	15,810	1,676,442	4,089,235	1,070,897	3,193,413	271,603	690,601	730,419	1,011,928
	Sta. Cruz de Tenerife	8,988	14,590	1,756,380	5,512,771	1,074,423	3,367,001	262,561	653,286	685,354	956,352
Cantabria	Cantabria	10,027	16,360	1,111,854	2,904,759	673,303	1,921,967	186,882	707,455	523,640	562,309
Castile and León	Ávila	7,539	13,440	297,323	752,477	185,600	542,461	90,487	151,371	181,565	167,032
	Burgos	11,909	19,330	891,089	2,246,669	530,420	1,441,889	115,957	361,784	361,872	361,021
	León	9,422	14,890	1,421,383	2,096,107	914,184	1,840,156	195,393	584,490	531,887	495,902
	Palencia	9,764	16,720	384,868	946,299	340,874	637,787	86,551	190,924	190,306	173,990
	Salamanca	7,655	14,140	621,404	1,512,273	507,488	901,996	164,953	341,011	366,367	352,414
	Segovia	10,189	17,460	300,672	1,034,366	198,484	692,543	67,069	266,586	149,749	155,517
	Soria	10,536	16,230	246,127	400,218	156,595	283,739	73,450	123,413	99,281	92,773
	Valladolid	10,372	18,100	892,359	2,470,537	631,953	1,825,826	147,273	445,883	491,911	514,674
	Zamora	7,773	12,910	415,005	799,689	303,497	551,533	95,979	170,479	224,498	198,045
Castile-La Mancha	Albacete	7,600	12,610	412,674	1,622,143	269,041	1,334,066	121,612	302,928	342,768	384,640
	Ciudad Real	7,897	13,150	813,625	2,087,364	479,829	1,412,041	159,747	371,372	479,256	500,060
	Cuenca	7,414	12,990	327,427	958,033	253,039	853,040	115,482	327,880	214,622	207,974
	Guadalajara	9,492	14,680	276,865	1,214,615	208,738	747,728	77,132	466,372	146,104	203,737
	Toledo	8,295	13,440	808,405	3,258,054	493,077	2,309,667	140,191	696,617	483,733	598,256
Catalonia	Barcelona	10,941	19,860	6,078,015	24,876,603	4,962,312	17,751,762	984,079	2,668,053	4,461,185	5,226,354
	Girona	12,742	19,950	1,859,843	4,107,277	794,235	2,593,299	159,623	466,700	480,939	664,506
	Lleida	12,303	19,490	738,945	2,201,314	585,722	1,468,780	150,015	390,917	355,331	399,439
	Tarragona	14,337	20,110	1,831,663	6,197,371	1,133,040	3,196,789	235,779	527,957	525,942	704,907
Valencian Community	Alacant	9,798	14,450	3,044,543	7,646,879	1,036,961	4,286,020	408,446	885,462	1,207,292	1,739,389
	Castelló	11,160	18,130	833,327	2,717,139	462,700	1,985,540	143,925	372,765	439,108	543,432
	València	9,751	15,290	2,754,498	9,866,996	1,766,609	6,871,262	547,515	1,562,106	2,091,526	2,416,628
Extremadura	Badajoz	5,595	11,560	1,054,138	2,000,653	680,113	1,582,951	279,507	589,369	653,414	671,299
	Cáceres	7,090	11,590	909,945	1,857,649	627,879	1,120,060	145,631	435,852	422,285	412,580
Galicia	A Coruña	9,105	14,400	1,998,946	5,220,250	1,328,368	3,625,406	366,440	1,008,110	1,100,896	1,126,707
	Lugo	8,889	13,270	748,892	1,342,710	567,804	945,050	200,223	268,165	401,690	357,625
	Ourense	7,302	12,090	678,495	1,213,252	460,553	883,513	159,815	306,094	403,489	339,555
	Pontevedra	8,334	13,550	1,413,538	3,526,668	879,861	2,429,082	241,702	671,329	896,355	938,311
Madrid	Madrid	12,770	22,120	8,390,965	34,926,663	5,633,038	23,942,998	1,382,975	5,087,283	4,810,015	5,964,143
Murcia	Murcia	9,056	13,810	1,608,605	5,861,135	854,005	4,057,558	247,860	1,022,518	997,149	1,335,792
Navarre	Navarra	12,814	21,450	882,062	3,915,349	674,644	2,775,697	239,767	453,661	516,918	593,472
Basque Country	Álava/Araba	15,539	23,780	684,908	2,015,551	509,142	1,387,599	102,529	187,317	266,527	299,957
	Guipúzcoa/Gipuzkoa	12,379	21,740	1,056,681	3,813,429	892,246	2,480,161	325,743	405,325	696,000	686,513
	Vizcaya/Bizkaia	12,239	20,970	2,173,846	6,368,429	2,024,123	4,622,732	533,014	927,447	1,189,955	1,136,181
La Rioja	La Rioja	11,195	18,460	490,859	1,825,959	330,550	1,259,599	103,622	226,491	260,118	301,884 0.16

[a] In (€). Serie deflated using 2000 as base year.
[b] In thousands (€). Serie deflated using 2000 as base year.
[c] People.

Table 2: Tests of specification

Test	Model 1 Dependent variable *GGDP*	Model 2 Dependent variable *PRPK*	Model 3 Dependent variable *PRPKNR*
Fixed effects Hausman's test	212.53***	5.24***	3.11***
Heteroscedasticity Wald's test	10,786.40***	983.23***	719.98***
Serial autocorrelation Wooldridge's test	12.15***	71.10***	47.65***
Spatial autocorrelation Pesaran's test	14.57***	8.35***	15.34***

*, ** and *** indicate significance at 10%, 5%, and 1% significance levels, respectively.

Table 3: Determinants of economic growth for Spanish provinces, 1985–2005

Coefficient	Dependent variable: GGDP		
	Model 1[a,b] (OLS)	Model 2[a,b] (OLS)	Model 3[a,c,d] (2SLS)
(Intercept)	5.956***	6.675***	6.090***
	(1.306)	(1.438)	(2.164)
GDP_0	−0.936***	−0.978***	−0.870***
	(0.165)	(0.167)	(0.157)
NGS	−0.129	−0.185***	−0.590***
	(0.090)	(0.746)	(0.118)
PRPK	0.135***	0.125***	0.109*
	(0.140)	(0.015)	(0.591)
PLPK	−0.109***	−0.106***	−0.083***
	(0.037)	(0.033)	(0.320)
HK	1.078***	1.019***	0.898***
	(0.193)	(0.173)	(0.169)
SK		0.029***	0.117***
		(0.010)	(0.590)
N	200	200	150
F	497.23***	22.72***	544.84***
R^2 (within)	0.69	0.70	0.63

[a] *, ** and *** denote significance at 10%, 5%, and 1% significance levels, respectively.
[b] OLS regressions with Driscoll and Kraay's (1998) standard errors in brackets.
[c] 2SLS regression with robust standard errors in brackets. Variable *SK* instrumented using SK_{-1}.
[d] The use of lagged values of *SK* as an instrument generates the loss of 50 observations.

Table 4: Social capital and physical investment, 1985–2005

Coefficient	Dependent variable: *PRPK*			Dependent variable: *PRPKNR*		
	Model 1[a,b] (OLS)	Model 2[a,b] (OLS)	Model 3[a,c] (2SLS)	Model 1[a,b] (OLS)	Model 2[a,b] (OLS)	Model 3[a,c] (2SLS)
(Intercept)	-1.844^{***}	0.466	0.373	-2.090^{***}	-0.395	-0.677^{*}
	(0.426)	(0.682)	(0.370)	(0.432)	(0.739)	(0.386)
R	-0.057^{***}	-0.022^{***}	-0.024^{***}	-0.049^{***}	-0.023^{*}	-0.025^{**}
	(0.011)	(0.008)	(0.009)	(0.010)	(0.013)	(0.011)
$GGDP_{-1}$	0.531^{**}	0.345^{**}	0.353^{**}	0.525^{**}	0.389^{***}	0.400^{***}
	(0.201)	(0.135)	(0.143)	(0.199)	(0.142)	(0.141)
INF_{-1}	-0.044	-0.045^{***}	-0.045^{***}	-0.048^{*}	-0.048^{*}	-0.048^{***}
	(0.030)	(0.016)	(0.014)	(0.027)	(0.025)	(0.015)
$PLPK_{-1}$	0.164^{***}	0.152^{***}	0.152^{***}	0.195^{***}	0.186^{***}	0.187^{***}
	(0.027)	(0.022)	(0.0169)	(0.028)	(0.024)	(0.192)
HK	0.364^{*}	-0.800	-0.060	0.353^{*}	0.028	0.055
	(0.189)	(0.183)	(0.092)	(0.188)	(0.210)	(0.094)
SK		0.110^{***}	0.105^{***}		0.081^{***}	0.074^{***}
		(0.024)	(0.016)		(0.026)	(0.185)
N	1,000	1,000	1,000	1,000	1,000	1,000
F	84.22^{***}	156.69^{***}	2024.18^{***}	36.74^{***}	77.60^{***}	1598.45^{***}
R^2 (within)	0.36	0.40	0.62	0.33	0.36	0.63

[a] *, ** and *** denote significance at 10%, 5%, and 1% significance levels, respectively.
[b] OLS regressions with Driscoll and Kraay's (1998) standard errors in brackets.
[c] 2SLS regressions with robust standard errors in brackets. Variable SK instrumented by SK_{-1}.

Table 5: Robustness analysis (bootstrap estimations), 1985–2005

Coefficient	Model 1[a,b] (OLS, bootstrapped)	Model 2[a,b] (OLS, bootstrapped)	Model 3[a,b] (OLS, bootstrapped)
Intercept	6.675***	0.466	−0.395
	(0.603)	(0.752)	(0.640)
GDP_0	−0.978***		
	(0.550)		
NGS	−0.185***		
	(0.070)		
$PRPK$	0.125***		
	(0.047)		
$PLPK$	−0.106***		
	(0.028)		
HK	1.019***	−0.800	0.028
	(0.066)	(0.188)	(0.156)
R		−0.022	−0.023
		(0.015)	(0.163)
$GGDP_{-1}$		0.345**	0.389**
		(0.161)	(0.171)
INF_{-1}		−0.045***	−0.048**
		(0.170)	(0.019)
$PLPK_{-1}$		0.152***	0.186***
		(0.022)	(0.020)
SK	0.029*	0.110***	0.081***
	(0.017)	(0.031)	(0.030)
N	200	1,000	1,000
χ^2	548.91***	220.96***	313.69***
R^2 (within)	0.70	0.40	0.36

[a] *, ** and *** indicate significance at 10%, 5%, and 1% significance levels, respectively.
[b] Standard errors are calculated by performing 400 bootstrap replications.

Figure 1: Investment components by provinces. Mean values 1985–2005

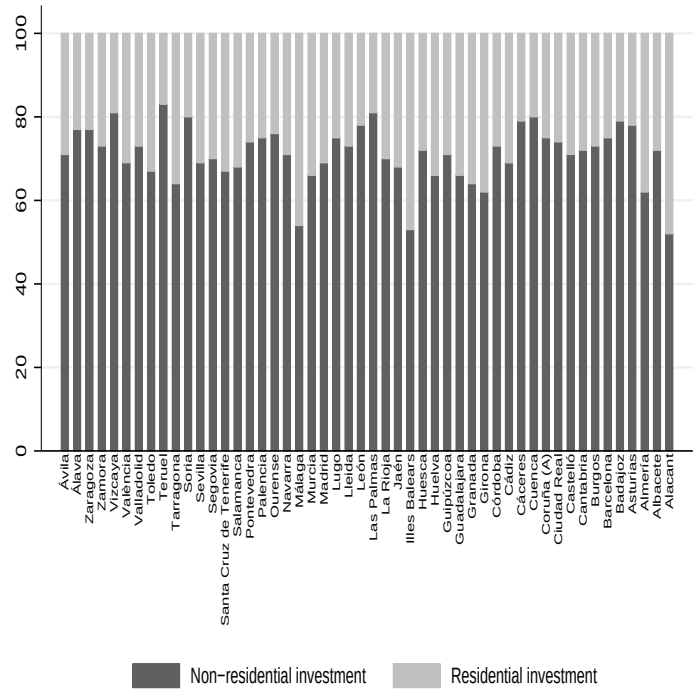


Figure 2: GDP per capita vs. social capital. Kernel density estimation (1985–2005)

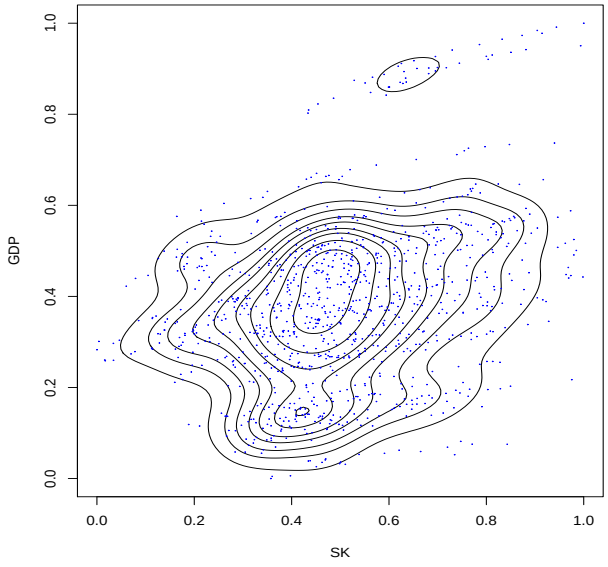


Figure 3: Total physical capital investment vs. social capital. Kernel density estimation (1985–2005)

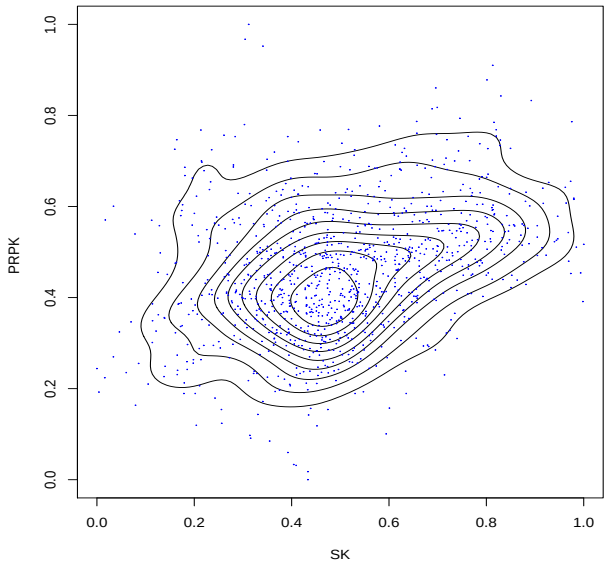


Figure 4: Non-residential physical capital investment vs. social capital. Kernel density estimation (1985–2005)

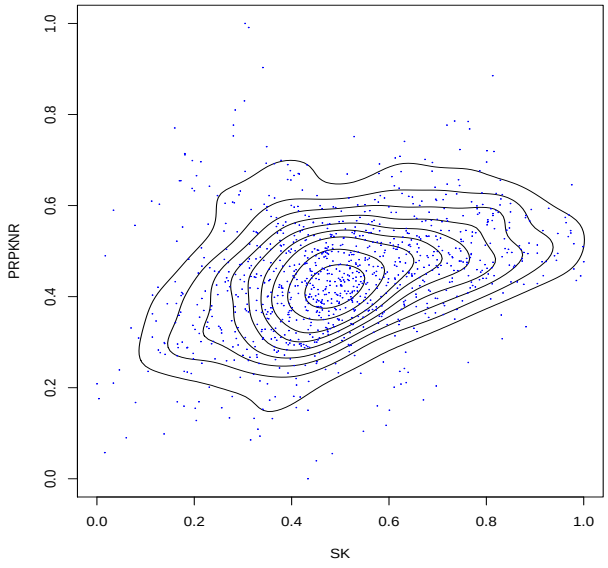
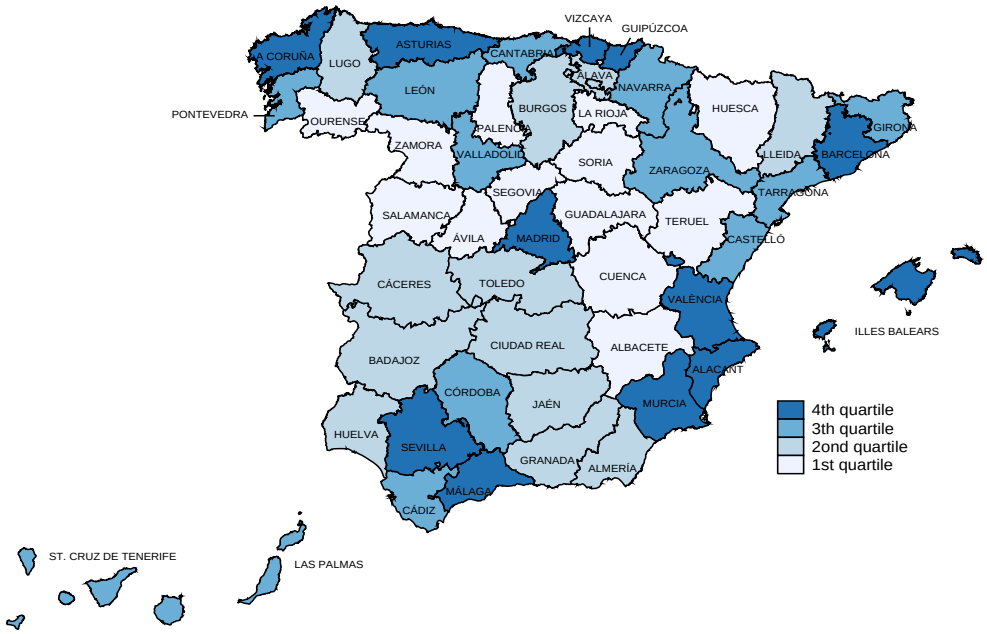


Figure 5: GDP per capita by provinces

a) 1985



b) 2005

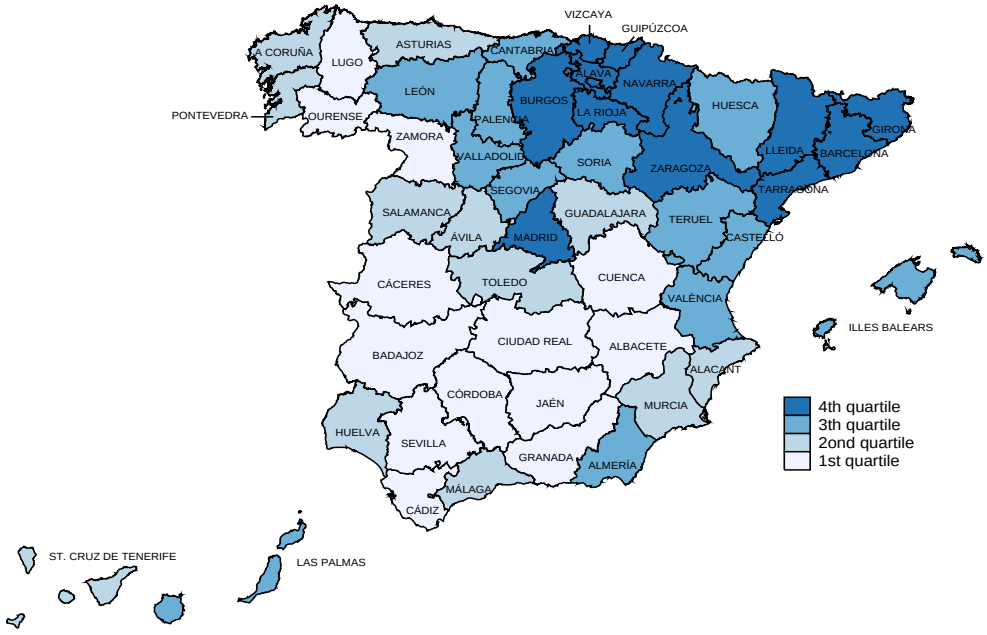
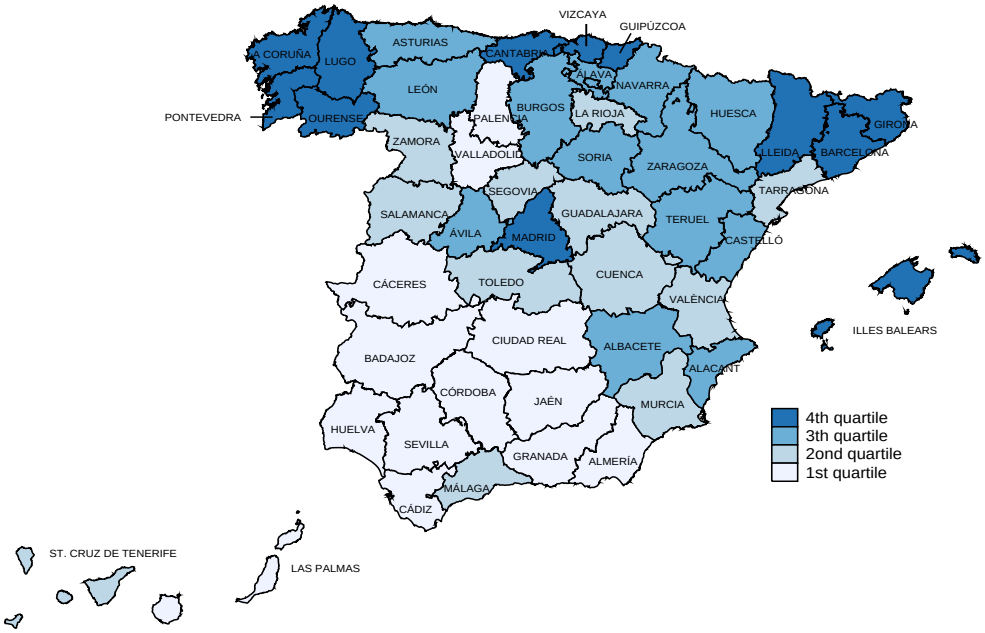


Figure 6: Social capital by provinces

a) 1985



b) 2005