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Banks and Innovation: Microeconometric Evidence on Italian Firms*

Luigi Benfratello (Università di Torino)

Fabio Schiantarelli (Boston College and IZA)

Alessandro Sembenelli (Università di Torino)

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Abstract

In this paper we investigate the effect of local banking development on firms' innovative activities, using a rich data set on innovation for a large number of Italian firms over the 1990's. There is evidence that banking development affects the probability of process innovation, particularly for small firms and for firms in high(er) tech sectors and in sectors more dependent upon external finance. The evidence for product innovation is weaker. There is also some evidence that banking development reduces the cash flow sensitivity of fixed investment spending, particularly for small firms, and that it increases the probability they will engage in R&D.

JEL Classification: D24, G21, G38, O31, O33

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1 Introduction

Does banking development stimulate the introduction of innovations? The answer to this question is crucial in understanding how financial development and its nature affects a country's growth prospects. The effect of financial development on real development has been investigated in many recent papers and the empirical evidence suggests a positive effect of financial development on GDP and TFP growth, while its impact on the quantity of aggregate investment and on saving is instead debatable.[1] This suggests that the effect of financial development on the efficiency with which resources are allocated may be what matters most. The ability of the financial system to allocate funds to the highest return projects has characterized the theoretical literature, but there is little direct evidence on this issue.[2] More specifically, we do not know much about the effect of banking development on the pace of technological progress, although the role of financial intermediaries in selecting more capable innovators may be the key mechanism through which GDP growth is affected, as emphasized by King and Levine (1993a, 1993b) in the context of an endogenous growth model.

A direct empirical investigation of the effect of banking development on firm's innovative activities is exactly what we carry out in this paper. We use a rich data set on innovation at the firm level collected by Capitalia's Observatory of SME's for a large number of Italian firms over the 90's that contains detailed categorical information on the introduction of process and product innovation. Moreover, the data set contains quantitative information on inputs of the innovation process at the firm level, such as R&D spending, and fixed investment, and on the way they are financed, in addition to standard

[1] Many studies are based on cross sectional growth regressions (see, for instance, King and Levine (1993a, 1993b), Levine (1997), Levine and Zervos (1998)), others on pooled time series-cross sectional country level data (see Beck et al. (2000) and Levine et al. (2000)). For a different approach see Rajan and Zingales (1998) who rely on industry level data to show that industries with the greater need of external finance, grow faster in more financially developed countries. Guiso, Jappelli, Padula, and Pagano (2004) confirm this result for a larger set of countries. They use also firm level data to show that small firms benefit more than large ones from financial development. Demirguc-Kunt and Maksimovic (1998) show that firms grow at a faster rate, relative to a benchmark growth rate that would hold in the absence of external finance, in countries with a more developed financial system. Finally, see Bekaert, Harvey and Lundblad (2005) and Henry (2000) for evidence on the effect of stock market liberalization on growth and investment respectively.

[2] See, for instance, the theoretical contributions of Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), Saint Paul (1992). Empirical evidence on this issue is limited. Beck et al. (2000) find that measures of financial development have a positive effect on aggregate TFP growth. Wurgler (2000) and Galindo, Schiantarelli, and Weiss (2003) present evidence on the beneficial effect of financial development or reform on the allocation of investment funds, using, respectively, industry or firm level data.

firm balance sheet variables. The availability of direct input and output measures of the innovation process allows us to address the issue of the effect of banks on innovation head on, instead of relying on the link between financial development and the observed consequences for TFP and GDP growth of the (unobserved) innovative process.

Focusing on Italy is very informative because it allows us to isolate the role of banks in fostering innovation. The financial system in Italy can definitely be characterized as bank-based, and the stock market plays a very limited role in providing external finance to firms at any stage of their life cycle. Moreover, there is considerable spatial diversity in the degree of banking development, and it is reasonable to assume that "distance" matters in banking relationships, particularly for certain types of firms that may experience more difficulties in accessing security markets. Finally, the process of regulatory reform in the late 80's and 90's has led to important changes both in the size and structure of the banking sector. A large fraction of the spatial diversity observed has been generated by the nature of banking regulation in effect from 1936 to the end of the 80's. The different initial conditions in the banking market resulting partly from the pre-existent regulations, have also had an effect on the pace of change in the local credit markets. As suggested by Guiso et al. (2004a, 2004b), the partly exogenous geographical variation in banking development may help in identifying its effect on real outcomes (innovation in our case). In addition, we can rely on a sensible geographical diversity in the pace of evolution of the banking sector over time.

Certainly we are not the first ones to investigate the real consequences of changes in the financial system at the local level. Several recent contributions have greatly enhanced our understanding in this area.[3] However, this is the first paper that investigates the complex link between development of the banking sector and innovation at the firm level, either within countries or across countries. Evidence

[3] Petersen and Rajan (1995) look at the effect of concentration in US local markets on lending relationships. Jayaratne and Strahan (1996) analyze the effect of banking deregulation in the US on growth, while Black and Strahan (2002) focus on its effect on entrepreneurship and credit availability, and Cetorelli and Strahan (2006) on the relationship between bank competition and industry structure. There are several contributions for Italy. Angelini and Cetorelli (2003) study the effect of regulatory reform on banks' markups. Bonaccorsi di Patti and Gobbi (2001) investigate the effect of competition on the availability of credit. Bonaccorsi di Patti and Dell'Ariccia (2004) focus on firms' creation. Guiso, Sapienza and Zingales (2004a) present evidence of the effect of local financial development on a wide set of outcomes, such as business formation and firm entry and growth. Guiso, Sapienza and Zingales (2004b) study the effect of banking regulation on the cost and access to credit.

on this issue is potentially very important in understanding one of the main channels through which financial development affects growth.

The structure of the paper is as follows. In Section 2 we will describe the data sets we will use and provide descriptive evidence on the evolution of the banking sector in Italy in the 90's and on the innovative activities of Italian firms. In Section 3 we will discuss the potential channels through which banking development may affect the introduction of innovations. In Section 4 and 5 we present the econometrics results. Section 6 concludes.

2 Data and Descriptive Statistics

The data used in this paper come from two main sources. Provincial data on local financial development come from the Bank of Italy, whereas firm level data come from the surveys "Indagine sulle Imprese Manifatturiere" published every three years by Capitalia's Observatory of SMEs. In this section we first briefly describe the cross sectional dispersion of banking development in Italy and its evolution overtime in the 90's. We then present some stylized facts on firms' innovative activity, using firm level data on product and process innovation and on R&D. We also discuss the financing sources of fixed investment and of R&D spending.

2.1 Banking Development

We will rely on branch density (number of branches divided by population) by province as a measure of the level of development of the local credit markets (see Table 1). This is a plausible measure of banking development, and it is available on a homogeneous basis for long periods of time. There are instead breaks in the series for total deposit or total loans by province, due to the reclassification, of "Istituti di Credito Speciale" that makes these two series less useful. The mean and the median of branch density both display large increases during the 90's, with the median increasing from 0.361 in 1991 to 0.509 in the 1998-2000 period (see columns 2 through 5). These increases are made possible by the process of banking deregulation that has allowed entry of new domestic actors in each local market, starting from the second part of the 80's. The density variable displays a large interprovincial dispersion, as measured by the standard deviation or the interquartile range. Moreover, the dispersion has been increasing with time. In the last column we describe the distribution of the rate of change of branch density between 2000 and 1991. The data show that there is dispersion in the level of banking development: the median rate of increase in branch density is 42.1%, while the first and third quartiles are 29.1% and 55.7% respectively. Looking at the period 1991-2000 as a whole, the data suggest that the between (provinces) variation is more important than the within (over time) variation (see column 6).

In the last but one line of the table we report the correlation between branch density in the 90's and branch density in 1936, the year in which the Italian banking system was reorganized and regulation put in place that basically determined the structure of the banking market until the beginning of deregulation. The correlation between bank distribution in 1936 and in the nineties is rather large (above 0.628) and significant and has changed rather slowly over the years, although one notices a small decrease as time goes by. The correlation of the rate of increase during the 90's with the initial value is negative (and significant), suggesting that banking development was faster in provinces where the banking sector was initially less developed.

The evolution of concentration in local credit markets, using the Herfindhal index for branches, is described in Table 2. The data suggest that the level of average concentration, measured by the mean or the median, was rather stable, showing only a small decrease over time. Again, there is dispersion across provinces in the degree of concentration.

2.2 Firms and Innovation

The firm level information on innovation we use in this paper comes from the 6th, 7th and 8th survey "Indagine sulle Imprese Manifatturiere" by Capitalia's Observatory of SMEs (OSMEs from now).[4] The

[4] The surveys are run by the "Osservatorio sulle Piccole e Medie Imprese" (*Observatory over SMEs*), an institution associated with Capitalia, an Italian bank. More detailed information about the surveys can be found at the web site www.capitalia.it.

surveys, conducted in 1995, 1998, and 2001 on a sample of manufacturing firms, contain information on innovation activities for the previous three year periods (1994-1992, 1997-1995, and 2000-1998) and are supplemented by standard balance sheet data. In each wave the sample is selected (partly) with a stratified method for firms with up to 500 workers, whereas firms above this threshold are all included. Strata are based on geographical area, industry, and firm size. It is not clear however, that the stratification criteria have remained constant over time. Moreover some firms are added to the sample outside the stratification criteria. This may explain why one observes a large decline in the average size of the firms included in the sample, which makes it impossible to use aggregate wave statistics to track the evolution of relevant variables at the economy level. Each survey contains respectively 5415, 4497, and 4680 manufacturing firms, although many of them do not provide complete information on some of the variables relevant to our research. For this reason we were forced to exclude from the sample firms with incomplete information or with extreme observations for the variables of interest. Details of the sample selection procedures are contained in the Data Appendix.

Table 3 summarizes information about the introduction of innovations by our sample of Italian firms and about the nature of the innovations. The first four rows report, separately for each wave, the frequencies of product innovations, of process innovations, of either a process or a product innovation, or of both. In the next two rows, the frequency of product (process) innovation is instead calculated conditional on having introduced a process (product) innovation. The last two rows report the probabilities of introducing a product (process) innovation conditional on performing R&D activity.

Some interesting stylized facts emerge.[5] First, the descriptive statistics show that process innovation is more frequent than product innovation. Pooling the three waves, only 36.7% of firms declare to have introduced at least one product innovation. The share of firms introducing process innovation is instead higher (58%).

Second, the probability of introducing a product innovation is higher for firms that have also

[5] See Parisi, Schiantarelli, and Sembenelli (2005) for an analysis of Italian firms' innovation activity and of its impact on productivity, using the 6^{th} and 7^{th}wave of the Capitalia's survey. Moreover, see Herrera and Minetti (2005) for an analysis of the effect of the length of the relationship with the main bank on innovation using the 8^{th} wave of the Capitalia survey.

introduced a process innovation in the same time period. This is not surprising since the introduction of a new product may well require a new production technique or at least the updating of an existing one. However, process innovation does not necessarily imply product innovation. In fact, conditional on having introduced a new process, only around 47% of firms introduce a new product over the three waves.

Third, a large percentage of firms are not engaged in formal R&D activity: more than half of the firms are characterized by zero R&D spending in most periods. Fourth, the last two rows report the probabilities of introducing a product (process) innovation conditional on performing R&D activity. As it can be seen, the conditional probabilities are higher than the corresponding unconditional probabilities for both types of innovations. This suggests that R&D spending is positively correlated with both types of innovation. However, the share of firms introducing a process innovation is higher than the share of firms engaged in at least some R&D activity. This suggests that there are other determinants of the probability of introducing a new process, besides the own R&D conducted by the firm. For instance, new technologies may be embodied in the new capital goods purchased by the firm, in which case the firm avails itself of the technological improvements achieved in the domestic or foreign investment goods sectors.

Finally, the data imply an apparent decrease of the innovative activities of Italian firms, particularly in the 1998-2000 period. However, this is probably due to the fact that the nature of the sample has changed and smaller firms have received a greater weight, particularly in the last wave. For instance, the percentage of firms with less than 250 employees has increased from 84.33% in 1992-1994 to 87.64% in 1995-1997, to 93.25% in 1998-2000 (see Table A1). Similarly the average size of the total capital stock has decreased by approximately 24% between the first and second wave, and by almost 37% between the first and third wave of the survey (see last line of Table 3). Moreover, innovation activity and size are positively correlated for the firms in this sample, as shown in the econometric results of Section 4.[6]

[6] See also Parisi, Sembenelli and Schiantarelli (2005).

In Table 4 we provide some evidence on how investment in R&D is financed. For comparison purposes, information on fixed capital financing is also reported. The first thing to note is that internal funds are the main source of financing both for fixed investment and R&D spending. However, internal sources are even more important for R&D, representing 81.64% of the total, versus 51.48% for fixed investment, using the figures for the three surveys taken together. Conversely, bank lending is more important for fixed investment (22.38%) than for R&D spending (9.44%). This might suggest that the development of the banking sector may be particularly important for fixed investment and, perhaps, for process innovation, if investment in new machinery is a key mechanism through which firms absorb process innovation. We cannot learn much from the evolution over time of the financing ratios, since they are affected by the changing nature of the sample and by the increasing presence of smaller firms, as we have already noted.

3 The Link between Innovation and Banking Development: A Framework

A useful way to organize our analysis of the link between banking development and innovation is to think in terms of an innovation production function.[7] In this context, the probability of introducing an innovation depends upon inputs internal to the firm (such as R&D and fixed investment) and external to the firm. The degree of development of the banking sector is one of the external inputs that can affect the innovation output, for a given quantity of internal inputs. This is because banking development may affect the nature of the selected project, the quality of internal inputs and their effectiveness in generating innovations. Moreover, it has a direct effect on the quantity of R&D and investment spending. Finally, a more developed and advanced banking sector may be particularly beneficial in relaxing financial constraints for informationally opaque firms that are more dependent upon local financial intermediaries, and for activities that require greater access to external finance.

[7] See for instance the seminal contribution by Griliches (1979).

The idea that the development of financial intermediaries reduces the cost of acquiring information and it allows a better assessment, selection, and monitoring of investment projects is central in explaining the role of banks in the growth process. The ability of financial intermediaries to improve information collection, with the resulting increase in the efficiency of resource allocation and hence growth, lies at the center of the theoretical contribution of Greenwood and Jovanovic (1990). More importantly for our purpose, King and Levine (1993a) emphasize the role of intermediaries in reducing the resource cost of identifying those entrepreneurs who are more capable of generating an innovation. The fostering of innovations is therefore the key channel through which financial development affects growth.

We have seen that there are variations at the provincial level both in the level and the pace of banking development. Following banking deregulation in Italy, one can think of several channels through which local banking development may affect firms' innovative activities. To start with, it is likely that banking development generates an outward shift in the supply of credit and a decrease in the markup in the banking sector, leading to a more ample supply of funds and lower rates for all investment projects, including those involving product or process innovations. The evidence contained in Angelini and Cetorelli (2003) suggests indeed that banking deregulation in Italy has led to a decrease in the mark-up applied by banks over the cost of funds. Moreover, Guiso et al. (2004b) show that the tightness of banking restrictions in 1936 increased the cost and lowered the availability of credit.

It is also likely that changes over time in our measure of banking development reflects in large part the entry of new intermediaries in local markets. It is possible that new entrants, in order to gain market shares, may be willing to finance riskier and more informationally opaque projects that were not being financed by the incumbents. To the extent that the introduction of process or product innovations is an inherently riskier business than a mere expansion of existing activities, the innovation activities in a province may benefit. There is, however, the possibility that activities such as product innovation are so risky and so uncollateralizable, consisting mainly in expenditures for human capital, that neither incumbents nor entrants in the banking sector are willing to provide substantial funding for them. Finally, the new entrants may introduce better and more advanced practices in the screening, selection, evaluation, and monitoring of projects and entrepreneurs. Competitive pressure will also create an incentive for the incumbents to adopt such practices.

Obviously all these considerations matter more for firms that are more dependent upon local banks for financing. There is indeed evidence that distance matters in lending relationships, particularly for small firms that may find greater difficulties in establishing relationships with credit suppliers in other provinces or in accessing funds in the open market.[8] Moreover, the contributions by Berger and Udell (2002) and Carpenter and Petersen (2002) highlight the importance of "relationship lending" according to which banks acquire information through contacts with the firm, its owner and its local communitiy and use this soft information in their decision on the availability and cost of credit for a firm. As suggested by Rajan and Zingales (1998), it is also likely that banking development will matter more for firms in sectors that are more dependent upon external financing for technological reasons, such as efficient scale of operations, requirement for continuing investment, etc. Finally, it is possible that advances in information gathering and processing by intermediaries may have limited effects on more traditional, low tech, and less dynamic sectors that banks had become more accustomed in evaluating, while they may have a greater impact in more high tech and dynamic sectors.

However, it has been argued that the turmoil brought about by the entry of new banks in the local markets may hurt small firms. Petersen and Rajan (1995), for instance, suggest that more competitive and less concentrated credit markets may make it more difficult for borrowers and lenders to intertemporally share surplus and present evidence for small US firms that the cost of credit indeed decreases with concentration, while its availability increases.

The overall empirical evidence on the effect of bank competition is somewhat mixed. Cross country evidence suggests that bank concentration decreases the likelihood of bank finance, with the impact decreasing in firm size (see Beck, Demirguc-Kunt, and Maksimovic (2003)). Bonaccorsi di Patti and Gobbi (2001) find that measures of concentration are positively and significantly associated with the

[8] On the role of distance see Petersen and Rajan (2002) for the US and Bofondi and Gobbi (2006) for Italy.

quantity of credit going to small firms in local provincial markets in Italy, while the association with measures of entry is negative for all firms. Branch density exerts, instead, a positive effect on the credit flow to all firms. Bonaccorsi di Patti and Dell'Ariccia (2004) find that bank competition is less favorable to the emergence of new firms in sectors where informational asymmetries are greater. Be that as it may, the extent to which the the positive impact of banking development is counteracted by the effects emphasized by Petersen and Rajan is ultimately an empirical issue.

4 Econometric Results: Probability Models for Process and Product Innovation

In assessing the effect of local banking development on innovation, we will first model the probability of introducing product or process innovations as a function of local (provincial) financial development, measured by branch density. We will start from a simple specification that includes also the firm's size, industry dummies, region dummies, and wave dummies. We then add in turn to this specification provincial GDP, other province level variables that capture the availability of human capital, social capital, public infrastructure, quality of the court system, and potential for externalities and economies of scope, or provincial dummies. Next, we generalize the model by including firm level variables capturing R&D and investment intensity and allowing for the effect of banking development to differ across different types of firms. We experiment both with logit and linear probability models, the former with and without provincial dummies, the latter estimated by Instrumental Variables, using banking structure variables from 1936 as instruments, as in Guiso et al. (2004a). We also discuss results from conditional logit models that control for both provincial and firm level components of the error term that are constant over time. In this context we address the possibility that our local banking development variable and the idiosyncratic component of the error term are correlated on the basis of a control function approach.[9] Finally, in section 5 we will present results on the effect of banking

[9] See Rivers and Vuong (1988), Wooldridge (2002), and Lewbel (2005).

development on fixed investment and R&D.

4.1 Simple Pooled Logit Models

We will first estimate a simple logit model separately for process innovations (see Table 5) and product innovations (see Table 6) on the pooled firm level data. Initially we control only for firm size, sector, region and a time (wave) dummy, which are always jointly very significant in all the equations.In this specification we cannot distinguish whether banking development affects the quantity or the effectiveness of firm level inputs into the innovative process, and we can only capture its total effect. Moreover, we are implicitly assuming that the firm level inputs in the innovation production function are adequately captured by branch density, firm size, and sector, region, and time dummies. Firm size is measured as the log of the capital stock (fixed capital plus R&D capital at the beginning of the first year of each wave). In column 1 of Table 5 and 6 our measure of banking development is branch density and it is measured as the average number of branches per capita over the three year period covered by each wave. From column 2 onward we, instead, use the number of branches in the year preceding the three year period covered by each wave (1991 for 1992-1994, 1994 for 1995-1997, 1997 for 1998-2001). This reduces the probability of a spurious association between branch density and innovation due to the fact that a favorable shock in period t specific to each province may lead to the opening of new branches. In the calculation of the standard errors we allow for heteroskedasticity and for spatial correlation between the error term for firms within the same province. This correlation may reflect the presence of province level unobservables that may affect the probability of introducing an innovation.

The results suggest that, independently from the timing of the branch density variable, the probability of introducing a process or product innovation is significantly and positively associated both with firm size and with the degree of banking development. The branch density variable is significant at the 1% level in the process innovation equation and at around the 5% level in the product innovation equation.[10] Since the significance and size of the branch density coefficient is very similar regardless of whether its contemporaneous or lagged value is used, in the remaining logit specifications we concentrate on the results obtained using its lagged values. Branch density remains very significant for process innovation also when we introduce provincial GDP per capita (column 3) or a set of time invariant provincial controls including human capital, social capital, public infrastructure, the quality of the court system, and potential for externalities and economies of scope (column 4).[11] The results for product innovation do not change with the introduction of provincial GDP, but the marginal significance of banking development is reduced to around 9%, when the set of provincial control variables detailed above is introduced. Note, however, that in all cases provincial GDP or the set of provincial controls are not individually or jointly significant.

The effect of banking development is sizeable. For instance, going from the first quartile (0.305) to the third quartile (0.533) of branches per capita in 1991-2000 period, the logit model generates an approximate increase in the probability of introducing a process innovation between 3.7 (column 1) and 4.4 percentage points (column 4). The effect on the probability of product innovation resulting from this change ranges instead between 2.4 (column 4) and 3.1 (column 3).

The effect of banking development for either process or product innovation is not robust, however, to the introduction of provincial dummies in the equation (see column 5). This may reflect the fact that the between provinces variation in branch density is more important than the within province variation, so that, after controlling for province and wave dummies, there is not enough action left to pin down the branch density coefficient precisely. However, contrary to regional and industry dummies, the provincial dummies are not jointly significant in the equation for process innovation. This may reflect the fact that many of the potentially relevant unobserved factors are likely to have a stronger regional dimension, as opposed to a provincial dimension.[12] We will revisit the issue of the robustness

[10] Herrera and Minetti (2005) find instead that the measure of financial development proposed by Guiso, Sapienza and Zingales (2004a, 2004b) is not a significant determinant of product or process innovation, using the 8^{th} wave of the Capitalia survey. Their measure reflects the effect of regional dummies on the probability that households are credit constrained.

[11] See the Data Appendix for details on the provincial controls.

[12] The empirical evidence on firms' innovative activity (surveyed in Cohen, 1995) suggests that industry-level factors play a very important role whereas the impact of local-level factors (in our case, provincial-level) is unclear.

of the results to the inclusion of provincial dumies in the context of the more general model described in the next section.

4.2 More General Logit Models with Fixed Investment and R&D Intensity and Differential Response to Banking Development

The positive association between branch density and the probability of an innovation in the specifications controlling for unobserved region effect and observed provincial factors is intriguing, but it would be premature to draw definitive conclusions, since the association is not significant when controlling for unobserved province effects, although the latter are not jointly significant themselves for process innovation.

In this section we will extend the model in two dimensions. First, we will include in the specification additional firm level variables such as fixed investment intensity and R&D intensity (measured, respectively, as the average value of fixed investment or R&D spending over total fixed and R&D capital). These variables can be thought as firm level inputs in the innovation production function. We have included fixed investment intensity, in addition to R&D intensity because, particularly for process innovation, new processes may be embodied in new machines. This, in principle, should allow us to assess whether the effect of banking development on innovation operates through its effect on the quantity of firm-level inputs in the innovation production function, or whether there is a quality effect that goes beyond that. In the next section we will, instead examine the effect of financial development on the quantity of fixed investment and R&D spending.

Second, we will allow the effect of financial development to differ according to firm size, as one would expect, since small firms are more likely to be dependent upon local banks compared to larger firms. The effect of local banking development may also vary according to whether a firm is in more (less) high tech sectors or in sectors characterized by a different degree of dependence on external financing. The classification of sectors according to the nature of technology is derived from Parisi et al. (2005) and is reported in the Data Appendix. We continue to use the size of the total capital stock as a measure of size, and we rely on the proxy for financial dependence suggested by Rajan and Zingales (1998).[13]

The logit results in column (1) through (4) of Tables 7 and 8 are obtained allowing for industry, region, and wave effects and they suggest that lagged branch density is a significant determinant of both product and process innovation, even after we control for fixed investment and R&D intensity.[14] Its size is even larger than in the case in which the firm level variables are not included. This is somewhat puzzling since by including firm level inputs one would expect that the branch density variable should capture only the increase in the quality/effectiveness of these firm level inputs in generating an innovation. Interestingly, both investment and R&D intensity are positively and significantly associated with the probability of introducing process or product innovation. The magnitude of the coefficient of fixed investment intensity is greater in the equation for process innovation compared to its value in the equation for product innovation. This is consistent with the idea that process innovations are embodied in new machines and that they are absorbed into the production process through fixed investment spending.

For process innovation, the response of process innovation to banking development is greater for firms in high tech sectors compared to those in low tech sectors. The marginal significance level for the test on the hypothesis that the coefficients for high tech and low tech sectors are identical is 7%. Moreover, the interaction between the degree of external financial dependence and branch density is positive, as one would expect, and significant the 5% level. Note that there is a degree of overlap between the technology and external financial dependence need, in the sense that many (but not all) of the more technologically advanced sectors also require more external finance. The interaction between branch density and firm size is negative, as one would expect, and significant at the 10% level. For product innovation there is no difference in response depending upon the technological nature of the sector or upon the degree of financial dependence. The effect of banking development on product innovation appears to be significantly greater for larger firms.

[13] Basically the percentage of external financing in the corresponding US sector.

[14] Wave, industry, and regional controls are included in all the specifications in Tables 7 and 8.

In the last four columns of Tables 7 and 8 we control for provincial dummies. They continue to be jointly not significant for process innovation, but not for process innovation. Interestingly, even allowing for province specific fixed effects, branch density continues to be significant at the 5% level for firms in the high tech sector. Moreover, the interaction between branch density and the degree of financial dependence is almost significant at the 5% level. Considering together the main effect and the interaction term, the marginal significance level of the effect of banking development is around 10% at the 50th percentile of the distribution for external financial development, 7% at the 75th percentile, and 4% at the 90th percentile. The marginal significance level for banking development in the model that allows for an interaction for size is around 10% at the 25th percentile of the size distribution, 7% at the 10th percentile, and 5% at the 5th percentile. Summarizing, even after controlling for provincial dummies, there is evidence that local financial development matters for process innovation, at least for firms in high-tech sectors, in sectors more dependent on external finance, and for smaller firms. The same cannot be said about product innovation (see columns (5) through (8) of Table 8). Only the interaction between branches and size is significant (and positive), but the introduction of province dummies renders the total effect of branch density insignificant for all specifications and all types of firms.

4.3 Instrumenting for Banking Development in Linear Probability Models

We have also experimented to see what happens when we instrument the branch density variable with its values from the distant past, in the context of a linear probability model with regional, industry and wave dummies. One interesting possibility is to follow the strategy in Guiso et al. (2004a, 2004b) and instrument bank branches with variables that reflect the nature of the banking system in 1936, the year in which a fundamental reorganization of the banking system occurred and a set of rules and regulations were set in place that determined the structure of the banking system until the beginning of deregulation in the second half of the 80's. More specifically the instruments used for the average level of branch density are the 1936 values of branches per inhabitant, the share of bank branches owned by local banks over total branches, the number of saving banks, and the number of cooperative banks per capita. Guiso et al. explain in details why these variables have predictive power for the level of banking development in the more recent past, but the basic idea is that different types of banks faced different constraints in opening new branches (national banks were more tightly regulated, and among local banks, cooperative banks faced tighter constraints). Moreover they argue that the way regions vary in their banking structure in 1936 is unrelated to the level of economic development at that time and that the differential treatment of different types of banks in the 1936 law were not driven by different regional economic factors, as opposed to political factors. Note that we use the provincial value of these variables, while Guiso et al. (2004a, 2004b), given the nature of their dependent variables, use their regional values.

The use of these instruments captures fundamentally the cross sectional heterogeneity in degrees of financial development, but cannot capture the effect of its evolution over time.[15] This means that they cannot be used in conjunction with province dummies. Finally, whereas the use of the 1936 instruments addresses the issue of the correlation between branch density and both the firm and province specific component of the error term, biases may derive from the correlation between the firm-specific variables and these components. In particular, the extent of the problem for the estimates of the coefficient of banking development depends upon the correlation between the instruments and the firm-level variables.[16]

The results for the specification including fixed investment and R&D intensity and using average branches instrumented with the 1936 variables are reported in Table 9 for both process and product innovation. For process innovation, the coefficient of branch density becomes insignificant when it is not allowed to vary across types of firms, although is similar to the one obtained by OLS (equal to 0.298 with a standard error equal to 0.079). It is however significant at the 1% level for firms in high

[15] We have experimented by allowing the coefficient of the first stage regression to vary by wave. The results are qualitatively similar to the ones presented below.

[16] We regressed firm size, investment, and R&D intensity on our 1936 variables augmented by wave, region, and industry dummies. In all equations, instruments are not individually significant at conventional statistical levels. In addition, they are not jointly significant in the size (p-value=0.48) and in the investment intensity (p-value=0.52) equations. They are however jointly signicant in the R&D intensity equation (p-value=0.02).

tech sectors. The interaction with the degree of external finance dependence or size is not significant. For product innovation the coefficient is now significant at the 5% level, when it is not allowed to vary by firm size or sector. Again it is higher and very significant for firms in high tech sectors, but not in low tech sectors The interaction with external finance dependence is not significant, while the one with size is significant and positive. This seems to suggest that banking development allows only larger firms to overcome the information asymmetries associated with product innovation.

The Sargan test suggests that no major mis-specifications are present in the product or process equations. The overall conclusion is that, even using instruments from the distant past still leaves the effect of branch density significant both for process and product innovation, at least for firms in high tech sectors.

4.4 Controlling for Firm-Specific Effects and Endogeneity in Conditional Logit Models

In this section we will present results obtained when we control both for unobserved firm characteristics (including, but not limited to province effects) that are relatively constant through time by using an appropriate transformation that eliminates the time invariant effects. Conditional logit models allow us to do just that. Given the legitimate worries about the correlation between the regressors and firm and province level unobserved characteristics that are relatively time invariant, this estimation strategy is very appealing. The drawback is that now one needs multiple observations on each firm and only switchers contribute to the likelihood function, while the largest fraction of our panel is made up of firms that are observed only at one point in time. Still, we are left with a sizeable sample of almost five hundred of observations on switchers for product innovation and almost four hundred observations for product innovation. Another problem is that endogeneity can arise not only because of the presence of a firm-specific time invariant effect but also because there might be a province-specific idiosyncratic shock to the technological frontier that leads to an increase in both the probability of observing an innovation and in the incentive for banks to open new branches. We will discuss and address this last issue below.

Table 10 contains the conditional logit result for process innovation. The coefficient on average branch density is positive and significant at approximately the 3% level when the intensity variables are not included and approximately at the 5% level when the intensity variables are included. Furthermore, the coefficient on branch density is significant (and larger) for firms in the high tech sector, although the difference between high tech and low tech sectors is not statistically significant. The interaction with external financial dependence is also significant and positive at approximately the 5% level. For product innovation the parameter on branch density is always estimated very imprecisely, whether or not one includes R&D and fixed investment intensity, and whether or not one allows the coefficient to differ across sectors or firms according to size (see Table 11).

As we have mentioned above, one potential problem of the conditional logit estimates is that endogeneity of the branch density variable may arise not only because of the presence of a firm-specific time invariant effect (the conditional logit model addresses this problem), but also because there might be a province-specific idiosyncratic shock to the technological frontier that leads to an increase in both the probability of observing an innovation and in the incentive for banks to open new branches. To address this issue, we apply a simple control function approach that consists of two steps (see Rivers and Vuong (1988), Wooldridge (2002), and Lewbel (2005)). In the first step we estimate a dynamic panel data model for the number of branches by using the GMM-system approach developed by Blundell and Bond (1998). As explanatory variables in this reduced form we include the number of branches lagged one period, the contemporaneous and once lagged provincial GDP, and a set of wave dummies. In the second step, we estimate conditional logit models for product and process innovation with the residuals obtained in the first-step as additional regressor.[17]

[17] More specifically, we model the idiosyncratic component of the error term in the conditional logit as $\varepsilon_{ijt} = \gamma u_{jt} + v_{it}$ where u_{jt} and v_{it} refer respectively to the province and the firm component of the idiosyncratic error. u_{jt} can therefore be thought of as a province specific idiosyncratic shock to the technological frontier. u_{jt} and v_{it} are assumed to be serially uncorrelated and independent of each other. We assume that ε_{ijt} has a logistic distribution. u_{jt} is defined to be the idiosyncratic shock in the equation that generates branch density, z_{jt}, i.e. $z_{jt} = \beta x_{jt} + \lambda_t + \mu_j + u_{jt}$, where x_{jt} is assumed to be independent of v_{it}. x_{jt} includes the once lagged value of branch density together with contemporaneous and once lagged value of provincial GDP per capita. We estimate this last equation on data averaged over three years non-overlapping intervals using the GMM-system estimator (Blundell and Bond (1998)) and recover the residuals $\widehat{u}_{jt}$, which are then included as additional regressor in the conditional logit. Note that, in spite of the generated regressor

We report for all models the pvalue associated to the usual t statistics on the coefficient of the first-step residuals, which provides a simple test for the endogeneity of the branch density variable. The coefficient of the residuals is never significant in the conditional logit model, suggesting that there are no important endogeneity issues associated with branch density, coming from its correlation with idiosyncratic province specific components of the error term. Hence the estimates reported in the Table 10 and 11 can be relied upon in assessing the effect of banking development on innovation. Moreover, and not surprisingly, the conclusions derived from them coincide with those based on the branch density coefficient obtained when the first-step residuals are included as an additional regressor in the conditional logit model. For instance, for the specification in the first column of Table 10, the branch density coefficient becomes 8.28 with a pvalue based on (bootstrapped) standard error of 0.027, compared to a value of 7.41 (pvalue = 0.026) reported in the table.[18]

Finally, as mentioned in section 3, the degree of competition in the industry is also expected to affect the availability and the cost of bank credit and therefore firms' innovation decisions. In particular, existing theories point out that competition might have both a positive and a negative effect. For this reason we have estimated three sets of additional equations where different competition measures are separately included as additional explanatory variables to our basic models of columns (1) and (2). Our first measure is the provincial concentration level, as measured by the Herfindhal index. Alternatively, since it might be argued that concentration may be an inadequate measure of the competitive climate, we have also experimented with a direct mark-up measure constructed as the provincial spread between the interest rate on loans and the interest rate on deposits normalized by the latter. Finally, we have included as a control variable the rate of change in the number of branches per inhabitant. This variable is likely to be strongly positively associated with the entry of new players in each local banking market. In all specifications the coefficients of these variables are not significantly different from zero. Furthermore the sign and significance of the effect of the number of branches is

problem, the standard t statistic on the coefficient of $\widehat{u}_{jt}$ is a valid test of the null hypothesis that the number of branches is not endogenous.

[18] Conventional standard errors are not correct in this case because of the well-known generated regressor problem. The bootstrapped standard errors are based on 2000 replications.

not affected.[19] We interpret this evidence more as a robustness check of the role played by our crucial variable than as a full-fledged analysis of the role of bank competition on industrial innovation which clearly deserves a more in-depth analysis.

5 Econometric Results: Fixed Investment and R&D Spending and Banking Development

In many of the models estimated in the previous section we have included fixed and R&D investment intensity as controls. In this case one gets closer to estimating the effect of banking development that goes beyond its effect on the quantity of R&D and on fixed investment. Obviously, in order to assess the total effect of banking development on the probability of introducing an innovation, one must investigate whether financial development has an effect on fixed and R&D investment spending, and this is the issue we will discuss in this section. Banking development may have an effect on spending mainly through a cost of capital effect or through a relaxation of financing constraints effect, or both.

5.1 Fixed Investment Equations

In this sub-section we present the results of simple fixed investment equations where our branch density variable is directly included in a model containing also the lagged dependent variable, output divided by total capital, and cash flow divided by total capital. To control for macro effects common to all firms we will include also year dummies, so that we will be able to pick up an effect of banking development only if the evolution over time of the cost of capital varies across provinces. In the more general specification, the cash flow sensitivity of investment will be allowed to vary by firm size or by technological intensity or dependence upon external finance of the sector that a firm belongs to. Moreover, the coefficient for each firm type will also be allowed to depend upon the degree of banking development.

[19] Detailed results are available from the authors upon request.

Since we now can rely on yearly observations on balance sheet variables, we will be able to control for firm (and province) time invariant effects. Moreover, we will recognize that our regressors will be correlated with the idiosyncratic component of the error term. We will use the GMM system estimator proposed by Blundell and Bond (1998) in which values lagged two or three times of output, cash flow, and branch density (or of the appropriate interactions) are used as instruments for the equation in differences and once lagged differences of the same variables as instruments for the equation in levels. In all cases, we will limit ourselves to firms that have at least six consecutive observations.

Our results are summarized in Table 12. Both the Sargan and the AR(2) test statistics do not signal major specification problems in most specifications. The latter is however a little on the low side in some columns (and particularly in columns 1-2 and 6). As expected, both the output to capital and the cash-flow to capital ratios are positive and often significant. However, in our simpler specifications (from column 1 to column 4), the number of branches is mostly not significantly different from zero.[20] One possible explanation is that after controlling for year dummies there is not enough variability in the branch density variable to pin down its coefficient precisely in this equation. Interestingly, in column (5) the coefficient on the cash-flow variable is positive and significant and its interaction with branch density is negative and significant, thus suggesting that local financial development reduces the cash-flow sensitivity of investment. Moreover, we have allowed the cash flow coefficient and its interaction with branch density to differ across firm size (column 8). After some experimentation, the sharper results are obtained when we allow the coefficients to differ between firms in the bottom three quartiles of the firm size distribution and firms in the top quartile.[21] We now observe that the cash flow coefficient is significant (and larger) only for small firms. Furthermore the estimated parameters on the interaction between branch density and cash flow suggest that banking development reduces significantly the size of the cash flow coefficient only for small firms, as one would expect, since these firms are more dependent on local sources of finance. On the contrary, when we permit the effect to

[20] The coefficient is actually negative and significant when the cash flow and branch density coefficient is allowed to differ between small and large firms.

[21] Size is still measured by the total capital stock.

differ according to the technological level (column 6) or the degree of external financial dependence (column 7) of the sectors, we do not find any significant effect.

5.2 R&D Investment Equations

As we have already mentioned in section 2, R&D spending is characterized by an empirical distribution with a mass probability at zero in our sample of firms. For this reason we have modelled the R&D investment decision as a two stage process. In the first stage firms decide whether to invest in R&D or not, whereas in the second stage the decision on the amount of the investment is taken, conditional on positive spending.

Table 13 reports the results for conditional logit estimates of the first stage where the binary decision is regressed against firm size as measured by total capital at the beginning of the period, the contemporaneous cash-flow to total capital ratio, the lagged output to total capital ratio, and the number of branches. Since the output to capital ratio was never significant it has been excluded from the equations we report. We find that both the coefficient of cash flow and of the number of branches are positive and significantly different from zero in the basic specification reported in column 1. When we allow the coefficients to be different according to the technological level of the sector (column 2), we find that the cash flow effect is much larger in size and significantly so for the sample of firms operating in high-tech sectors. The effect of cash-flow and of the number of branches are found, instead, not to vary with the degree of financial dependence. Finally, when we split our sample according to firm size, we find a positive and significant relation between the number of branches and the probability of non zero R&D spending only for small firms. The cash flow coefficient is significantly different from zero at conventional levels only for small firms, although the point estimate is greater for large firms (but not very precisely estimated).[22] Also in this case we have performed an endogeneity test by including as an additional regressor the residuals from an equation that explains financial development as a function of its own lagged value and contemporaneous and lagged values of provincial GDP. In all cases its

[22] We have also experimented with including an interaction term between branches and cash flow, but its coefficient was not significant.

coefficient is not significant, suggesting that there is not an endogeneity problem deriving from the potential correlation between branch density and a province specific idiosyncratic component of the error term in the logit model.

Finally, for the firm/year observations characterized by positive R&D spending, we have estimated by GMM a set of linear equations similar to the ones used for fixed investment. In all our specifications, financial development turns out to have no significant effect on the amount of R&D spending.[23] This happens to be the case independently of how we measure the dependent variable. In particular, we have experimented with the R&D to total capital ratio, the R&D to production ratio and the log of R&D spending. More generally, the model does not seem to be well specified and the Sargan test statistics lead to the rejection of the instrument validity assumption in all specifications.[24]

6 Conclusions

What is the final verdict on the effect of local (provincial) banking development on innovation? There is clear evidence from pooled logit models of a positive and significant effect of banking development on the probability of introducing a process or product innovation, even after controlling for regional unobserved heterogeneity, observable time invariant provincial variables, and provincial per capita GDP. This result is robust to the inclusion of R&D and fixed investment spending in the equation. For process innovation, the effect is larger for small firms and for firms in more high tech sectors or in sectors characterized by a greater need for external finance. For process innovation, moreover, the results for firms in the lower tail of the size distribution and for sectors more dependent upon external finance are robust to the inclusion of provincial dummies in the specification. The results for product innovation do not survive the addition of provincial dummies.

The results using the 1936 banking structure variables as instruments are somewhat weaker, but even in that case the significance of banking development for both process and product innovation

[23] A similar result is obtained by Rotondi (2006) who estimates a standard R&D equation augmented with the financial development variables introduced by Guiso et al. (2004a).

[24] To save on space we do not report these additional results which are available from the authors upon request.

for firms in high tech sectors survives unscathed. The results for process innovation are also largely robust to using only the information for the switchers in a conditional logit model that controls also for unobservable firm specific effects. Branch density remains a significant variable and its coefficient is larger for high tech sectors and for sectors with a higher degree of dependence on external finance. The results for product innovation do not survive estimation by conditional logit.

On the whole, there is strong evidence from the discrete choice model that banking development has a significant and important effect on process innovation. The evidence is weaker for product innovation. Perhaps the degree of risk and low collateralizability of activities related to product innovation makes banking intermediaries not the ideal ones in its financing. In this case, it is probably necessary to rely on internal finance or on specialized sources such as venture capital with a greater degree of involvement with and control on firm's activities (Da Rin et al. (2005)). The low level of development of this type of intermediaries in Italy constitutes a potential impediment to the introduction of product innovation.

Finally, there is some evidence that banking development has lessened the severity of financing constraints faced by small firms when they invest in fixed capital. Small firms are indeed those that are likely to rely more heavily on local banks for their financing needs. Analogously, we also find that financial development affects the probability of carrying out R&D especially for small firms. To the extent that investment in fixed and R&D capital are internal inputs of the innovation production function, the effect of the relaxation for a subset of firms of financing constraints on fixed capital spending and on the probability of a positive R&D spending constitute additional channels through which banking development can affect innovation.

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Table 1: Bank Branches to Population Ratio

	(1) 1936	(2) 1991	(3) 1992-94	(4) 1995-97	(5) 1998-00	(6) 1991-00	(7) Δ%00-91
Observations	91	91	91	91	91	910	91
Mean	0.204	0.346	0.391	0.444	0.489	0.432	47.1
Standard Deviation	0.109	0.123	0.131	0.155	0.164	0.156	34.5
- within	..	..	..	..	..	0.058	..
- between	..	..	..	..	..	0.146	..
First Quartile	0.130	0.255	0.291	0.308	0.345	0.305	29.1
Median	0.182	0.361	0.408	0.470	0.509	0.432	42.1
Third Quartile	0.256	0.419	0.469	0.533	0.591	0.533	55.7
Correlation with 1936	..	0.679 (0.00)	0.664 (0.00)	0.641 (0.00)	0.628 (0.00)	..	−0.168 (0.11)
Correlation with 1991	..	..	..	..	..	..	−0.310 (0.00)

Note: The ratio is constructed by dividing the number of branches in each province by population in thousands. Columns (3) to (5) refer to the three year period average ratio; column (6) refers to the pooled sample over the 1991-2000 period; column (7) refers to the percentage variation in the 1991-2000 period. Pvalues of the null hypothesis that the correlation coefficient is 0 in round brackets.

Table 2: Herfindhal Index for Bank Branches

	1991	1992-94	1995-97	1998-00
Observations	91	91	91	91
Mean	0.148	0.143	0.139	0.141
Standard Deviation	0.066	0.063	0.058	0.078
First Quartile	0.100	0.094	0.096	0.095
Median	0.135	0.132	0.131	0.129
Third Quartile	0.178	0.170	0.160	0.162

Note: The Herfindhal Index is computed at provincial level using the number of branches. It ranges from 0 (atomistic market) to 1 (fully concentrated market)

Table 3: Share of Innovative Firms by Type of Innovation (%)

	1992-94	**1995-97**	**1998-00**	**Total**
Observations	2055	2088	1882	6025
Process	64.23	68.49	39.64	58.02
Product	49.00	34.34	25.72	36.65
Process or Product	75.67	75.72	48.72	67.27
Process and Product	35.57	27.11	16.63	27.40
Process | Product	76.66	78.94	64.67	74.77
Product | Process	58.48	39.58	41.96	47.23
Share of Obs. with R&D average > 0	51.19	36.49	41.50	43.07
Process | R&D average > 0	78.90	83.20	56.21	73.33
Product | R&D average > 0	68.06	52.49	43.92	56.22
Total Capital	11.5	8.7	5.5	8.6

Note: Row 6, 7, 9, and 10 refer to conditional frequencies. (R&D average > 0) counts all firms which invested in R&D in at least one year in the observed period.
Total Capital includes fixed capital and R&D capital and is in million Euros at 2000 prices.

Table 4: R&D and fixed investment financing

		1992-94	**1995-97**	**1998-00**	**Total**
Fixed investments	Observations	1844	1940	1755	5539
	Shareholders' capital	1.19	1.65	1.17	1.34
	Internal funds	60.69	47.78	45.89	51.48
	Loans	22.70	24.46	19.76	22.38
	Public funds	3.03	5.21	5.24	4.49
	Tax incentives	1.46	6.45	6.77	4.89
	Leasing	9.92	13.01	19.91	14.17
	Other	1.00	1.43	1.25	1.23
R&D investments	Observations	1050	760	764	2574
	Shareholders' capital	1.60	1.41	1.09	1.39
	Internal funds	83.78	82.44	77.90	81.64
	Loans	10.46	8.92	8.55	9.44
	Public funds	2.58	3.51	5.64	3.76
	Tax incentives	0.85	1.63	4.74	2.23
	Other	0.72	2.09	2.09	1.53

Table 5: Basic Logit Models for Process Innovation

	(1)	(2)	(3)	(4)	(5)
Number of firms	6025	6025	6025	6025	6008
Estimation method	Logit	Logit	Logit	Logit	Logit
Dependent variable	Process	Process	Process	Process	Process
$(\text{Firm Size})_{it}$	0.256 (0.000)	0.256 (0.000)	0.255 (0.000)	0.255 (0.000)	0.253 (0.000)
$(\text{Branches})_{jt}$	1.073 (0.005) [0.260]	..	..	..	..
$(\text{Branches})_{jt-1}$	..	1.043 (0.009) [0.253]	1.115 (0.004) [0.270]	1.209 (0.001) [0.293]	1.701 (0.193) [0.412]
Pseudo R^2	0.080	0.080	0.080	0.081	0.088
Industry dummies	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)
Regional dummies	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	No
Provincial GDP	No	No	Yes(0.16)	No	No
Provincial controls	No	No	No	Yes(0.19)	No
Provincial dummies	No	No	No	No	Yes(0.69)

Note: $(\text{Branches})_{jt-1}$ is branch density the year preceding the three year period covered by each wave. All regressions include a constant and two wave dummies. Standard errors in columns from 1 to 4 are robust to within province heteroskedasticity whereas standard errors in column 5 are robust to heteroskedasticity of unknown form. Pvalues of the null that each coefficient (or each set of coefficients) is equal to 0 in round brackets. Marginal effects computed at the sample means of the explanatory variables in square brackets below the coefficients.

Table 6: Basic Logit Models for Product Innovation

	(1)	(2)	(3)	(4)	(5)
Number of firms	6025	6025	6025	6025	5997
Estimation method	Logit	Logit	Logit	Logit	Logit
Dependent variable	Product	Product	Product	Product	Product
$(\text{Firm Size})_{it}$	0.283 (0.000)	0.283 (0.000)	0.282 (0.000)	0.282 (0.000)	0.285 (0.000)
$(\text{Branches})_{jt}$	0.827 (0.057) [0.188]	..	..	..	..
$(\text{Branches})_{jt-1}$	..	0.895 (0.043) [0.204]	0.920 (0.037) [0.209]	0.716 (0.089) [0.163]	−1.149 (0.399) [−0.261]
Pseudo R^2	0.087	0.087	0.087	0.087	0.093
Industry dummies	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)
Regional dummies	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	No
Provincial GDP	No	No	Yes(0.62)	No	No
Provincial controls	No	No	No	Yes(0.51)	No
Provincial dummies	No	No	No	No	Yes(0.00)

Note: as in Table 5

Table 7: Logit Models for Process Innovation with Firm-Level Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of firms	6025	6025	6025	6025	6008	6008	6008	6008
Estimation method	Logit	Logit	Logit	Logit	Logit	Logit	Logit	Logit
Dependent variable	Process	Process	Process	Process	Process	Process	Process	Process
$(\text{Firm Size})_{it}$	0.335 (0.000)	0.335 (0.000)	0.335 (0.000)	0.469 (0.000)	0.331 (0.000)	0.332 (0.000)	0.332 (0.000)	0.481 (0.000)
$(\text{Branches})_{jt-1}$	1.400 (0.001) [0.338]	..	0.966 (0.042)	3.588 (0.010)	2.124 (0.114) [0.512]	..	1.703 (0.211)	4.363 (0.019)
$(\text{High Tech})_{it}(\text{Branches})_{jt-1}$	..	1.998 (0.000) [0.482]	..	..	..	2.783 (0.049) [0.670]	..	..
$(\text{Low Tech})_{it}(\text{Branches})_{jt-1}$	..	1.132 (0.011) [0.273]	..	..	..	1.895 (0.161) [0.456]	..	..
$(\text{Fin. dep.})_{it}(\text{Branches})_{jt-1}$	..	..	1.661 (0.050)	..	..	..	1.776 (0.054)	..
$(\text{Size})_{it}(\text{Branches})_{jt-1}$	..	..	..	−0.299 (0.094)	..	..	..	−0.333 (0.071)
$(\text{Inv. Int.})_{it}$	2.754 (0.000)	2.756 (0.000)	2.757 (0.000)	2.741 (0.000)	2.743 (0.000)	2.745 (0.000)	2.747 (0.000)	2.729 (0.000)
$(\text{R\&D Int.})_{it}$	8.953 (0.000)	8.950 (0.000)	8.927 (0.000)	8.942 (0.000)	9.328 (0.000)	9.330 (0.000)	9.304 (0.000)	9.319 (0.000)
Pseudo R^2	0.126	0.127	0.127	0.127	0.134	0.135	0.135	0.135
Industry dummies	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)
Regional dummies	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	No	No	No	No
Provincial dummies	No	No	No	No	Yes(0.22)	Yes(0.23)	Yes(0.23)	Yes(0.22)
Wald high vs low tech	..	(0.073)	..	..	..	(0.109)	..	..

Note: $(\text{Branches})_{jt-1}$ is branch density the year preceding the three year period covered by each wave. All regressions include a constant and two wave dummies. Standard errors in columns 1 to 4 are robust to within province heteroskedasticity whereas standard errors in columns 5 to 8 are robust to heteroskedasticity of unknown form. Marginal effects computed at the mean of the explainatory variable in square brackets. Pvalues in round brackets.
Sargan is a test of the validity of overidentifying orthogonality conditions.

Table 8: Logit Models for Product Innovation with Firm-Level Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of firms	6025	6025	6025	6025	5997	5997	5997	5997
Estimation method	Logit	Logit	Logit	Logit	Logit	Logit	Logit	Logit
Dependent variable	Product	Product	Product	Product	Product	Product	Product	Product
$(\text{Firm Size})_{it}$	0.288 (0.000)	0.288 (0.000)	0.288 (0.000)	0.015 (0.831)	0.288 (0.000)	0.288 (0.000)	0.288 (0.000)	−0.005 (0.956)
$(\text{Branches})_{jt-1}$	1.201 (0.009) [0.273]	..	1.313 (0.010)	−3.486 (0.010)	−0.843 (0.542) [−0.192]	..	−0.789 (0.575)	−5.337 (0.004)
$(\text{High Tech})_{it}(\text{Branches})_{jt-1}$	..	1.180 (0.014) [0.268]	..	..	..	−0.761 (0.595) [−0.173]	..	..
$(\text{Low Tech})_{it}(\text{Branches})_{jt-1}$	..	1.213 (0.017) [0.276]	..	..	..	−0.882 (0.527) [−0.200]	..	..
$(\text{Fin. dep.})_{it}(\text{Branches})_{jt-1}$	..	..	−0.388 (0.649)	..	..	..	−0.194 (0.837)	..
$(\text{Size})_{it}(\text{Branches})_{jt-1}$	..	..	..	0.622 (0.000)	..	..	..	0.663 (0.000)
$(\text{Inv. Int.})_{it}$	0.614 (0.000)	0.614 (0.000)	0.613 (0.000)	0.629 (0.000)	0.563 (0.001)	0.563 (0.001)	0.562 (0.001)	0.580 (0.001)
$(\text{R\&D Int.})_{it}$	9.812 (0.000)	9.812 (0.000)	9.816 (0.000)	9.877 (0.000)	9.975 (0.000)	9.976 (0.000)	9.977 (0.000)	10.041 (0.000)
Pseudo R^2	0.112	0.112	0.112	0.113	0.117	0.117	0.117	0.119
Industry dummies	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)
Regional dummies	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	No	No	No	No
Provincial dummies	No	No	No	No	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)
Wald high vs low tech	..	(0.936)	..	..	..	(0.822)	..	..

Note: As in Table 7

Table 9: IV Linear Probability Models for Product and Process Innovation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of firms	6025	6025	6025	6025	6025	6025	6025	6025
Estimation method	IV Lin Pr.	IV Lin Pr.	IV Lin Pr.	IV Lin Pr.	IV Lin Pr.	IV Lin Pr.	IV Lin Pr.	IV Lin Pr.
Dependent variable	Process	Process	Process	Process	Product	Product	Product	Product
$(\text{Firm Size})_{it}$	0.068 (0.000)	0.068 (0.000)	0.068 (0.000)	0.096 (0.000)	0.058 (0.000)	0.058 (0.000)	0.058 (0.000)	0.009 (0.590)
$(\text{Branches})_{jt}$	0.256 (0.136)	..	0.158 (0.375)	0.747 (0.048)	0.318 (0.043)	..	0.352 (0.023)	−0.440 (0.112)
$(\text{High Tech})_{it}(\text{Branches})_{jt}$	..	0.488 (0.006)	..	..	..	0.428 (0.031)	..	..
$(\text{Low Tech})_{it}(\text{Branches})_{jt}$	..	0.156 (0.402)	..	..	..	0.254 (0.119)	..	..
$(\text{Fin. dep.})_{it}(\text{Branches})_{jt}$	..	..	0.357 (0.115)	..	..	..	−0.197 (0.346)	..
$(\text{Size})_{it}(\text{Branches})_{jt}$	..	..	..	−0.059 (0.184)	..	..	..	0.102 (0.003)
$(\text{Inv. Int.})_{it}$	0.548 (0.000)	0.549 (0.000)	0.548 (0.000)	0.546 (0.000)	0.120 (0.000)	0.121 (0.000)	0.120 (0.000)	0.123 (0.000)
$(\text{R\&D Int.})_{it}$	1.716 (0.000)	1.718 (0.000)	1.711 (0.000)	1.719 (0.000)	2.118 (0.000)	2.119 (0.000)	2.120 (0.000)	2.118 (0.000)
R^2	0.159	0.159	0.159	0.159	0.140	0.140	0.140	0.140
Industry dummies	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)
Regional dummies	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)	Yes(0.00)
Wald high vs low tech	..	(0.007)	..	..	..	(0.285)	..	..
Sargan	(0.120)	(0.123)	(0.309)	(0.089)	[0.155]	[0.345]	[0.218]	[0.181]

Note: All regressions include a constant and two wave dummies. Standard errors are robust to heteroskedasticity of unknown form. The instrument set includes the 1936 values of branches per inhabitant, the share of bank branches owned by local banks over total branches, the number of saving banks, and the number of cooperative banks per capita. Marginal effects computed at the mean of the explainatory variable in square brackets. Pvalues in round brackets. Sargan is a test of the validity of overidentifying orthogonality conditions.

Table 10: Conditional Logit Models for Process Innovation

	(1)	(2)	(3)	(4)	(5)
Number of firms	469	469	469	469	469
Number of observations	1017	1017	1017	1017	1017
Estimation method	Cond. Logit	Cond. Logit	Cond. Logit	Cond. Logit	Cond. Logit
Dependent variable	Process	Process	Process	Process	Process
$(\text{Firm Size})_{it}$	−0.484 (0.048)	−0.010 (0.976)	−0.000 (0.999)	−0.059 (0.855)	0.043 (0.938)
$(\text{Branches})_{jt}$	7.401 (0.026)	6.576 (0.053)	..	3.472 (0.361)	7.486 (0.375)
$(\text{High Tech})_{it}(\text{Branches})_{jt}$	..	..	8.583 (0.021)	..	..
$(\text{Low Tech})_{it}(\text{Branches})_{jt}$	..	..	5.142 (0.150)	..	..
$(\text{Fin. dep.})_{it}(\text{Branches})_{jt}$	..	..	..	10.069 (0.053)	
$(\text{Size})_{it}(\text{Branches})_{jt}$	..	..	..		−0.108 (0.906)
$(\text{Inv. Int.})_{it}$	..	1.559 (0.031)	1.508 (0.037)	1.471 (0.043)	1.554 (0.032)
$(\text{R\&D Int.})_{it}$	..	10.045 (0.000)	10.302 (0.000)	10.153 (0.000)	10.024 (0.000)
Endogeneity test for Branches	(0.647)	(0.700)	(0.641)	(0.653)	(0.688)
Wald high vs low tech	..	..	(0.173)	..	..

Note: All regressions include two wave dummies.
Pvalues in round brackets.

Table 11: Conditional Logit Models for Product Innovation

	(1)	(2)	(3)	(4)	(5)
Number of firms	398	398	398	398	398
Number of observations	867	867	867	867	867
Estimation method	Cond. Logit	Cond. Logit	Cond. Logit	Cond. Logit	Cond. Logit
Dependent variable	Product	Product	Product	Product	Product
$(\text{Firm Size})_{it}$	−0.202	0.424	0.418	0.417	−0.121
	(0.356)	(0.171)	(0.179)	(0.178)	(0.811)
$(\text{Branches})_{jt}$	0.437	0.241	..	−0.414	−9.361
	(0.893)	(0.942)		(0.909)	(0.231)
$(\text{High Tech})_{it}(\text{Branches})_{jt}$	..	..	−1.736	..	..
			(0.638)		
$(\text{Low Tech})_{it}(\text{Branches})_{jt}$	..	..	1.198	..	..
			(0.724)		
$(\text{Fin. dep.})_{it}(\text{Branches})_{jt}$	..	..	..	2.049	..
				(0.655)	
$(\text{Size})_{it}(\text{Branches})_{jt}$	..	..	..	..	1.122
					(0.175)
$(\text{Inv. Int.})_{it}$	..	2.207	2.234	2.193	2.238
		(0.004)	(0.004)	(0.004)	(0.003)
$(\text{R\&D Int.})_{it}$	..	3.810	3.766	3.855	4.053
		(0.104)	(0.108)	(0.100)	(0.086)
Endogeneity test for Branches	(0.905)	(0.897)	(0.891)	(0.901)	(0.816)
Wald high vs low tech	..	..	(0.228)	..	..

Note: As in Table 10

Table 12: Fixed Investments Equations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of firms	899	899	899	899	899	899	899	899
Number of observations	4903	4903	4903	4903	4903	4903	4903	4903
Estimation method	GMM Sys	GMM Sys	GMM Sys	GMM Sys	GMM Sys	GMM Sys	GMM Sys	GMM Sys
Dependent variable	$(I/TK)_{it}$	$(I/TK)_{it}$	$(I/TK)_{it}$	$(I/TK)_{it}$	$(I/TK)_{it}$	$(I/TK)_{it}$	$(I/TK)_{it}$	$(I/TK)_{it}$
$(I/TK)_{it-1}$	0.357	0.373	0.322	0.307	0.293	0.336	0.243	0.268
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$(Y/TK)_{it-1}$	0.004	0.003	0.004	0.005	0.004	0.003	0.005	0.005
	(0.174)	(0.170)	(0.099)	(0.100)	(0.095)	(0.134)	(0.036)	(0.067)
$(CF/TK)_{it}$	0.057	..	0.009	..	0.232	..	0.145	..
	(0.026)		(0.789)		(0.003)		(0.194)	
$(\text{Branches})_{jt}$	−0.169	..	−0.130	..	0.002	..	−0.034	..
	(0.090)		(0.202)		(0.985)		(0.748)	
$(CF/TK)_{it}(\text{Branches})_{jt}$	..	..	..	..	−0.359	..	−0.256	..
					(0.013)		(0.212)	
$(\text{High Tech})_{it}(\text{Branches})_{jt}$	..	−0.146	..	..	..	−0.060	..	..
		(0.135)				(0.577)		
$(\text{Low Tech})_{it}(\text{Branches})_{jt}$	..	−0.152	..	..	..	−0.026	..	..
		(0.127)				(0.805)		
$(\text{High Tech})_{it}(CF/TK)_{it}$	..	0.034	..	..	..	0.116	..	..
		(0.260)				(0.261)		
$(\text{Low Tech})_{it}(CF/TK)_{it}$	..	0.044	..	..	..	0.131	..	..
		(0.146)				(0.156)		
$(\text{Fin. Dep.})_{it}(CF/TK)_{it}$	..	..	0.148	..	..	..	0.083	..
			(0.134)				(0.764)	
$(\text{Fin. Dep.})_{it}(\text{Branches})_{jt}$	..	..	−0.078	..	..	..	−0.015	..
			(0.574)				(0.938)	
$(\text{Large Firm})_{it}(\text{Branches})_{jt}$	..	..	..	−0.258	..	..	..	−0.113
				(0.015)				(0.248)
$(\text{Small Firm})_{it}(\text{Branches})_{jt}$	..	..	..	−0.201	..	..	..	−0.042
				(0.043)				(0.652)
$(\text{Large Firm})_{it}(CF/TK)_{it}$	..	..	..	0.161	..	..	..	0.144
				(0.003)				(0.268)
$(\text{Small Firm})_{it}(CF/TK)_{it}$	..	..	..	0.045	..	..	..	0.216
				(0.086)				(0.003)
$(\text{High Tech})_{it}(CF/TK)_{it}(\text{Branches})_{jt}$	..	..	..	..	..	−0.120	..	..
						(0.530)		
$(\text{Low Tech})_{it}(CF/TK)_{it}(\text{Branches})_{jt}$	..	..	..	..	..	−0.194	..	..
						(0.245)		
$(\text{Fin. Dep.})_{it}(CF/TK)_{it}(\text{Branches})_{jt}$	..	..	..	..	..	..	0.044	..
							(0.934)	
$(\text{Large Firm})_{it}(CF/TK)_{it}(\text{Branches})_{jt}$	..	..	..	..	..	..	..	0.044
								(0.836)
$(\text{Small Firm})_{it}(CF/TK)_{it}(\text{Branches})_{jt}$	..	..	..	..	..	..	..	−0.350
								(0.009)
Sargan	(0.231)	(0.495)	(0.578)	(0.105)	(0.326)	(0.073)	(0.189)	(0.169)
AR(1)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	(0.089)	(0.047)	(0.105)	(0.151)	(0.186)	(0.080)	(0.318)	(0.230)
Wald high vs low tech (Branches)	..	(0.931)	..	..	..	(0.739)	..	..
Wald small vs large (Branches)	..	..	..	(0.058)	..	..	..	(0.005)
Wald high vs low tech (CF/TK)	..	(0.800)	..	..	..	(0.914)	..	..
Wald small vs large (CF/TK)	..	..	..	(0.045)	..	..	..	(0.589)
Wald high vs low tech (Branches)(CF/TK)	..	..	..	..	..	(0.774)	..	..
Wald small vs large (Branches)(CF/TK)	..	..	..	..	..	..	..	(0.072)

Note: Results are obtained with the one step GMM System estimator with robust standard errors. The estimation sample is restricted to firms with at least 6 contiguous observations. The instrument set includes the regressors dated t-2 and t-3. All equations include year and industry dummies as regressors and instruments. Pvalues is round brackets. Sargan is a Sargan test of the validity of the overidentifying orthogonality conditions. AR(1) and AR(2) test the presence of first (AR(1)) or second order serial correlation (AR(2)) in the transformed error.

Table 13: Conditional Logit Models for R&D Investments

	(1)	(2)	(3)	(4)
Number of firms	538	538	538	538
Number of observations	2910	2910	2910	2910
Estimation method	Cond. Logit	Cond. Logit	Cond. Logit	Cond. Logit
Dependent variable	R&D Exp.	R&D Exp.	R&D Exp.	R&D Exp.
$(\text{Firm Size})_{it}$	−0.000	−0.000	−0.000	−0.000
	(0.558)	(0.564)	(0.537)	(0.317)
$(CF/TK)_{it}$	0.381	..	0.379	..
	(0.006)		(0.112)	
$(\text{Branches})_{jt}$	3.295	..	1.962	..
	(0.048)		(0.290)	
$(\text{High Tech})_{it}(CF/TK)_{it}$	..	0.765	..	..
		(0.001)		
$(\text{Low Tech})_{it}(CF/TK)_{it}$	..	0.124	..	..
		(0.494)		
$(\text{High Tech})_{it}(\text{Branches})_{jt}$	..	4.185	..	..
		(0.049)		
$(\text{Low Tech})_{it}(\text{Branches})_{jt}$	..	3.094	..	..
		(0.071)		
$(\text{Fin. dep.})_{it}(CF/TK)_{it}$	..	..	0.005	..
			(0.992)	
$(\text{Fin. dep.})_{it}(\text{Branches})_{jt}$	..	..	5.182	..
			(0.103)	
$(\text{Small})_{it}(CF/TK)_{it}$	..	..	..	0.381
				(0.009)
$(\text{Large})_{it}(CF/TK)_{it}$	..	..	..	0.884
				(0.082)
$(\text{Small})_{it}(\text{Branches})_{jt}$	..	..	..	5.130
				(0.003)
$(\text{Large})_{it}(\text{Branches})_{jt}$	..	..	..	−3.046
				(0.139)
Endogeneity test for Branches	(0.552)	(0.545)	(0.496)	(0.604)
Wald high vs low tech (CF/TK)	..	(0.030)	..	..
Wald high vs low tech (Branches)	..	(0.524)	..	..
Wald small vs large (CF/TK)	..	..	..	(0.340)
Wald small vs large (Branches)	..	..	..	(0.000)

Note: All regressions include two wave dummies.
Pvalues in round brackets.

7 Data Appendix

7.1 Sample Selection

The firm level data used in this work are obtained by merging the three most recent waves (1995, 1998, 2001) of a comprehensive survey on Italian manufacturing firms carried out by Capitalia's Observatory on Small Firms every three years. Each wave reports standard balance sheet data for the previous three years (1992-94, 1995-97 and 1998-00 respectively) complemented by additional qualitative and quantitative information on several research issues including R&D and innovation. The three surveys include respectively 5415, 4497 and 4680 firms. As already mentioned in Section 2, all firms with more than 500 employees are included in each wave. Most of the firms with less than 500 employees are selected with a stratified sampling method in each wave. However, some of them (at the discretion of Capitalia) are kept in two consecutive waves. Therefore, even after conditioning on survival, the probability of finding a small firm in two separate waves is small.

We removed from the sample firms with missing or non-manufacturing activity codes, as well as firms with no indication of the location of headquarters. As we use provincial level instrument sets dated 1936 we removed firms located in four provinces (Isernia, Pordenone, Oristano and Caserta) created after 1936. Therefore our sample is composed by firms located in one of the remaining 91 provinces existing at the beginning of the 90's. Furthermore, we removed in each wave those with missing values or inconsistencies for the variables used in the econometric estimates or with extreme values for the variables. The first and last percentiles have been used as lower and upper thresholds for the trimming procedure. The following table describes our sample.

Table A.1. Firms distribution by size and technology in each sample, %

	1992-94	1995-97	1998-00	Total
Number of Firms before Cleaning	5415	4497	4680	14592
Number of Firms after Cleaning	2055	2088	1882	6025
of which Employees$\leq$ 250	84.33	87.64	93.25	88.27
Employees$>$ 250	15.67	12.36	6.75	11.73
of which High-Tech	35.47	31.42	29.91	32.33
Low-Tech	64.53	68.58	70.09	67.67

Note: A firm is defined as "High-Tech" if its main activity is one of the following: Chemicals, Machinery, Computers, Electrical Machinery, TV-Radio, Medical Apparels, Means of Transport. It is "Low-Tech" otherwise.

Some firms are sampled in more than one wave so that they appear more than once in our final sample. The following table describes the panel structure of the sample after the cleaning procedure.

Table A.2. Panel structure of the sample

	Total number of firms	High-Tech firms	Firms with employees$\leq$250
1992-94 only	1476	486	1287
1995-97 only	1189	341	1090
1998-00 only	1236	353	1193
1992-94 & 1995-97	348	146	258
1992-94 & 1998-00	95	41	80
1995-97 & 1998-00	415	113	374
1992-94, 1995-97 & 1998-00	136	56	108

7.2 Variables Definition

Branches: Denotes the number of bank branches in a province divided by its populations, in thousands. Its contemporaneous value is computed as the average value over each of the periods covered by the Capitalia survey (1992-94, 1995-97, 1998-00). Its lagged value refers to 1991, 1994, and 1997 respectively.

Innovation dummies: the process (product) innovation dummy takes the value 1 if the firm has declared to have introduced at least one process (product) innovation in the period covered by the survey (1992-94, 1995-97, 1998-00), and zero otherwise.

Fixed Investment (I): yearly investment in plants and machinery as reported in the questionnaire deflated with the aggregate business investment price index.

R&D Investment ($R\&D$)**:** yearly R&D investment as reported in the questionnaire deflated with a weighted average of the consumer price index (0.8) and the aggregate business investment price index (0.2). Firms are provided with a definition of what has to be considered as R&D investment consistent with the Frascati manual.

Fixed Capital (K)**:** real fixed capital stock (at the end of the period), computed by a perpetual inventory method with a constant rate of depreciation ($\delta = 0.05$). The benchmark at the first year is the accounting value as reported in the balance sheet.

R&D Capital (G)**:** real R&D capital stock (at the end of the period) computed by a perpetual inventory method with a constant rate of depreciation ($\delta = 0.15$). The benchmark for the first year is calculated assuming that the rate of growth in R&D investment at the firm level in the years before the first positive observation equals the average growth rate of industry level R&D between 1980 and 1991. The initial stock at historical costs is revalued using the average inflation rate for the R&D deflator during the same period.

Total Capital (TK)**:** computed as the sum of fixed capital (K) and of R&D capital (G).

Cash-Flow Intensity (CF/TK)**:** ratio of cash-flow over total capital stock at the beginning of the period.

Fixed Investment Intensity (I/TK)**:** ratio of investment in fixed assets over total capital stock at the beginning of the period.

R&D Investment Intensity ($R\&D/TK$)**:** ratio of R&D investment over total capital stock at the beginning of the period.

Production Intensity (Y/TK)**:** ratio of production over total capital stock at the beginning of the period.

Financial dependence: the Rajan-Zingales (1998) industry level variable has been used as a measure of financial dependence.

Size: it is measured by total capital stock.

Small and Large firms: the sets of small and large firms have been identified by using the 75th percentile of the total capital stock distribution as threshold.

Industry Dummies: 21 industry dummies have been included in all equations reported in Tables from 5 to 9 and 12 (15+16 - food, beverages and tobacco; 17 - textiles; 18 - clothing; 19 - leather; 20 - wood; 21 - paper products; 22 - printing and publishing; 23 - oil refining; 24 - chemicals; 25 - rubber and plastics; 26 - non-metal minerals; 27 - metals; 28 - metal products; 29 - non-electric machinery; 30 - office equipment and computers; 31 - electric machinery; 32 - electronic material, measuring and communication tools, TV and radio; 33 - medical apparels and instruments; 34 - vehicles; 35 - other transportation; 36 - furniture). Each dummy takes the value 1 if the firm main activity is in that industry, and zero otherwise.

High Tech and Low Tech industries: The following industries have been considered as high tech ones: 24 - chemicals; 29 - non-electric machinery; 30 - office equipment and computers; 31 - electric machinery; 32 - electronic material, measuring and communication tools, TV and radio; 33 - medical apparels and instruments; 34 - vehicles; 35 - other transportation. The High Tech dummy takes the value 1 for these industries and 0 otherwise.

Regional Dummies: 18 regional dummies have been included in equations reported in Tables from 5 to 9 and 12. To avoid collinearity with the time invariant instruments dated 1936 two regions with only one province (Molise and Valle d'Aosta) have been grouped with the nearest region (Piedmont and Abruzzi).

Provincial Dummies: 91 provincial dummies have been included in equations reported in Tables from 5 and 8. They correspond to the administrative structure of Italy in 1936.

Provincial Controls: 5 provincial level variables have been used in equations reported in Tables 5 and 6. They are: i) the inefficiency of the legal system measured as the number it takes to complete a first degree trial (source: Guiso et al., 2004c); ii) a measure of social capital measured as voter turnout for all referenda before 1989 (source: Guiso et al., 2004c); iii) an index of infrastructures in 1990 (source: Confindustria); iv) the total number of plants in the province in 1991 (source: Istat); v) human capital measured as the level of education for people aged 19-44 in 1991 (source: Istat).