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Authors:

Annalisa Ferrando, European Central Bank, Annalisa.ferrando@ecb.eu.int

Senad Lekpek, European Investment Bank sndlkpk@gmail.com

The mission of the EIB's Economics Department is to provide economic analyses and studies to support the bank in its operations and in its positioning, strategy, and policy. The department, a team of 30 staff, is headed by Debora Revoltella, Director of Economics.

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Abstract

The way firms finance their investments can potentially explain the heterogeneity of firms in terms of their innovation. We use a novel firm-level survey of the European Investment Bank (EIBIS) which provides information about a wide range of financing sources that firms use to fund their investment activities. The aforementioned survey also reveals a firms' degree of innovativeness. By applying a cluster analysis to group firms using information on their financing decisions, we investigate the link between finance and innovation of EU firms. We identify seven financing clusters to show that the degree of innovativeness (defined in terms of R&D or software investment, R&D and software turnover ratios, and the introduction of new products) increases with the diversification of financial instruments. Firms that use several financing instruments are more likely to invest in R&D and software activities and develop new products compared to firms that use a more limited number of financing instruments.

JEL Classification: D22, G32, O31

Keywords: innovation, R&D, internal and external finance, cluster analysis.

1. Introduction

The generation of innovation requires significant efforts by entrepreneurs in all stages of the process from basic research, to the development of new products and techniques, to market penetration. One important element of the overall process is the opportunity for firms to utilize either internal or external sources of funding.

There are several studies that analyse how financial constraints affect innovation from a theoretical and empirical point of view (Hall et al. 2016). These studies focus on the challenges that firms face while trying to raise funds due to the particular exploratory nature of investments in intangible assets which are often accompanied by higher payoff risks, non-excludability of the outcome, and hardly predictable total costs ex ante (Bond et al., 2003; Aghion et al., 2012; Thum-Thysen, 2017). As a consequence, firms tend to rely mainly on their own internal finance, following a pecking order of funding sources as Meyers and Majulf (1984) theorize.

Furthermore, the literature indicates that the use of equity, debt, and other financing options depends on a number of firm and country-level characteristics. Firm size, age, asset structure, profitability, growth opportunities, and ownership structure are shown to have an impact on a firm's funding sources (Chittenden, Hall, and Hutchinson, 1996; Michaelas, Chittenden, and Poutziouris, 1999; Knyazeva et al. 2009; Ferrando and Griesshaber, 2011). Country-specific variables such as macroeconomic and financial environment or legal enforcement are also shown to affect usage of different financing instruments (La Porta, Silane, Shleifer, and Vishny, 1997; Beck, Demirguc-Kunt, and Maksimovic, 2008).

However, most studies in this area focus on a single type of finance. Studies that investigate complementary and substitutive effects of different financing options are rare (Casey and O'Toole, 2014; Chavis et al. 2011; Deloof et al., 2007). More recently, Moritz et al. (2016) and Masiak et al. (2017) use cluster analyses to identify financing patterns of European SMEs using the survey on the access to finance of enterprises (SAFE). Their findings have shown that micro firms rely more on internal finance and less on external finance such as debt, trade credit, asset-based finance, and public support.

We add to this scarce literature by considering several types of external finance (bank and market-based finance), internal finance as well as grants and intra-group finance as preliminary choices for firms wishing to finance their investment in innovative projects.

As mentioned, such projects are more likely to experience problems obtaining external finance due to higher complexity, specificity, and degree of uncertainty compared to tangible assets investments (Mateut, 2017; Schneider and Veugelers, 2010). Empirical studies have highlighted the importance of internal financing for innovative firms, and such studies have documented the excessive cost and limited availability of external finance for those firms. Himmelberg and Petersen (1994) and Mulkay, Hall, and Mairesse (2001) outline the importance of internal finance for innovation by documenting the link between cash flow and R&D investment. Hall (2002) and Brown, Martinsson, and Petersen (2012) show that high R&D investment is associated with lower levels of debt due to the high cost related to low collateralisation.

As in the case of internal finance, intra-group loans are preferred by firms as inside investors are in a better position than outsiders to evaluate the stakes of innovative projects (Czarnitzki and Hottenrott, 2011). Moreover, innovative projects funded by the mother or

holding company are selected not only for economic reasons but also because of the spin-offs for the company from successful innovative projects (Rivaud-Danset, 2002)

As a special type of external finance related to innovative activity, grants have received a great deal of interest in the literature. Grants are a typical public policy which offers the advantage of providing a multiplier effect to the amount provided to the innovative firms. For instance, Howell (2015) states that receiving a grant is a positive signal on the quality of firms' R&D projects and therefore it could attract additional funds. Generally, several country-level studies have shown that public support has a positive effect on R&D investment (Almus and Czarnitzki, 2003; Czarnitzki, Ebersberger, and Fier, 2007; Aerts and Schmidt, 2008; Czarnitzki and Lopes-Bento, 2014; Hottenrott and Lopes-Bento, 2014).

Our paper utilizes direct knowledge from the firms themselves on the manner in which they finance their investment projects and combines that with information on their innovative behavior. We do so by using a novel survey data of European Investment Bank covering around 12,500 European firms (EIB, 2017). This allows us to develop our argument that the way firms finance their investment – i.e. the combination of the different types of funds – potentially explains the heterogeneity of firms along their innovativeness dimension.

Looking at the same dataset, a recent paper by Ferrando and Preuss (2017) examines the link between corporate financing and investment decisions of European firms. By using a multinomial fractional response model the authors estimate the finance-investment link. Their findings indicate that SMEs' tangible asset investment is positively related to the use of bank finance, whereas internal finance is the preferred option for intangible asset investments.

Our empirical analysis is instead based on a cluster analysis approach akin to the research of Moritz et al. (2016) and Masiak et al. (2017). We are interested in grouping firms with similar financing patterns to establish a taxonomy on the degree of innovativeness (defined in terms of R&D or software investment, R&D and software turnover ratios, and the introduction of new products).

Our main conclusion is that firms that use several financing instruments are more likely to invest in R&D and software activities and develop new products compared to firms that use a more limited number of financing instruments.

In the next section, we describe the data and the methodology. In Section 3, the empirical findings are presented. Finally we present our conclusions.

2. Data and Methodology

2.1. The EIB Group Survey of Investment and Investment Finance

The EIB Group Survey of Investment and Investment Finance is a unique, EU-wide, annual survey of 12,500 firms. It collects data on firm characteristics and performance, past investment activities and future plans, sources of finance, financing issues and other challenges that businesses face (EIB, 2017). Using a stratified sampling methodology, EIBIS is representative across all 28 Member States of the EU, as well as for firm size classes

(micro to large), and four main sectors. It is designed in a way that can be linked to firm balance sheets and profit and loss data.

The survey is composed of questions regarding financing choices for firms in the EU. First, the firms were asked what percentage of their investment was financed: (1) internally, (2) externally, and/or (3) using intra-group funding. Second, firms were asked whether their external financing included one or more of the following options: (1) bank loans excluding subsidized bank loans, overdrafts, and other credit lines, (2) other terms of bank finance including overdrafts and other credit lines, (3) newly issued bonds, (4) newly issued equity, (5) leasing or hire purchase, (6) factoring/invoicing discounting, (7) loans from family/friends/business partner, (8) grants, or (9) other types of finance not otherwise specified. By combining the two questions, we get eleven financing instruments that are used as variables for identifying different firm clusters.

The empirical analysis is based on data from the 2016 wave of the EIBIS survey which refers to investment decisions in 2015. Out of 12,500 interviewed enterprises, 9,067 answered the relevant questions for cluster identification.

2.2. Descriptive statistics

Table 1 presents the percentages of firms using each of the eleven sources of finance, and the average shares of investment financed by each source. Most investments in the EU are financed internally (using internal funds or retained earnings, e.g. cash, profits): 87% of firms use internal finance with an average of 69% of their total investment coming from this source. Bank loans are used by 39%, leasing/hire purchase is used by 22%, other bank finance by 12%, and grants by 5% of firms. Although some instruments are used less than others, they still represent an important tool for the firms that utilize them. For instance, intra-group financing is used by 6% of firms; however, this type of financing was used for an average of 59% of those firms' investments. Similarly, grants are used by only 5% of firms, but grants represent 24% of investment for those firms.

2.3. The Methodology

Our first step in the empirical analysis is to group firms according to their use of the eleven financing instruments to establish a taxonomy. The cluster algorithm uses binary variables that take the value of one if the financing instrument was used, and zero otherwise.

An appropriate method is the cluster analysis. This method divides data into homogenous groups (small within-cluster variance) while the groups are very distinct from each other (large between-cluster variance) (e.g. Hair, Black, Babin, and Anderson, 2010; Hollenstein, 2003).

In a nutshell, the idea is to start with a number of objects and split them into homogenous groups. To do so, it should first be decided what variables are relevant for the groupings. Then, a specific clustering procedure has to be chosen depending on the total number of

objects and the types of variables used for forming the clusters. For our analysis, we have used an agglomerative hierarchical[1] cluster procedure as depicted in Figure 1.

This algorithm starts with every object serving as its own cluster, and stops when all objects are combined into one single cluster. It is obvious that the first and last steps of the algorithm are not useful cluster solutions. Rather, it is the intermediary steps that are meaningful in highlighting homogenous groups of data.

When using an agglomerative hierarchical cluster algorithm, one must choose (1) a measure of similarity between objects, (2) a measure to be used for merging clusters at successive steps of the algorithm, and (3) one has to decide the number of clusters once the cluster output has been made.

While choosing a measure for similarity between objects, we explored different measures suggested for use with binary variables (see Kaufman and Rousseeuw, 2009 for a comprehensive discussion on similarity methods) and decided to use Dice similarity measure. The measure is based on a 2-by-2 table of association between two objects (Table 2) where *a* shows the number of variables (object properties) that equal 1 for both objects, *b* shows the number of variables that equal 1 for object *i* and 0 for object *j*, and so on.

The values of *a*, *b*, *c*, and *d* are then used to calculate a statistic showing the similarity of the two objects. In our case, our binary variable (use/not use of a specific source of finance) has an asymmetric importance in the sense that the two outcomes are not equally important. For example, the likelihood of a firm using equity as a financing option is not the same as the likelihood of not using equity financing. Then, the Dice measure is calculated as in equation 1:

$$s(i,j) = \frac{2a}{2a+b+c} \qquad (1)$$

As the equation suggests, outcome *a* is given more importance (the case when both objects have certain property) while outcome *d* (the absence of property for both objects) is given zero weight.

Next, as a measure for merging clusters at successive steps we use the Ward clustering algorithm which combines clusters in a way that minimizes the error sum of squares (or maximizes the R-square)[2]. Finally, we evaluate the cluster solution at different steps of the algorithm to identify the optimal solution using the Elbow criterion. This is based on plotting the percentage of variance explained after each step of the algorithm against the number of clusters. As the number of clusters increases the explained variance also increases but at some point the marginal increase will diminish, appearing as an elbow in the graph. Following this procedure, we identify seven distinct clusters, which are presented in Section 3.1.

[1] All clustering procedures can be broadly categorized into two groups: (1) *partitioning* cluster procedures where one predefines the number of clusters to be formed using a certain criterion and (2) *hierarchical* cluster procedures where all objects are dealt with in the same run of the algorithm, and the number of clusters is part of the output (flexible).

[2] The algorithm works in following steps. First, the algorithm calculates averages for all variables in all clusters. Second, for each object, the algorithm calculates squared Euclidean distance from the cluster average. Then, these distances are summed for all objects in all clusters. Finally, the two clusters that are combined are those that minimize the increase in the overall sum of the squared within-cluster distances.

3. Empirical Findings

3.1. Identifying clusters of financing instruments for EU firms

Table 3 presents the seven cluster solution obtained by following the procedure described in the previous section. The different clusters are presented by starting with those using several finance instruments and moving towards clusters that use fewer financing options.

MIXED FINANCED (INTRA-GROUP): the first cluster consists of 270 (3%) firms that use a mix of up to ten different financing instruments with a particular reliance on intra-group financing (used by all firms in the cluster). Besides intra-group finance, 54.1% of firms in this cluster use internal financing, 31.9% use bank loans, 20.4% use leasing or hire purchase, 12.2% use other bank finance, while other financing instruments are used to a lower extent.

MIXED FINANCED (GRANTS); the second cluster includes 482 (5.3%) firms that use all eleven financing instruments with a special focus on grants (support from public sources) which are used by all firms in this cluster. 89.2% of firms in this cluster use internal funding, 50.4% use bank loans, 23.2% use leasing or hire purchase, 20.1% use bank loans, and to a lower extent the remaining six financing options.

MIXED FINANCED: the third cluster includes 1165 (12.8%) firms that use all eleven financing instruments: internal financing is used by 83.9% of firms in this cluster, other bank finance by 67.6% of firms, bank loans by 44.7% of firms, leasing or hire purchase by 37.7% of firms, factoring or invoicing by 21.3% of firms, family or friends by 19.5% of firms, while other instruments are used by a fewer number of firms.

DEBT/ASSET-BACKED FINANCING: the fourth cluster consists of 1000 (11%) firms that rely on asset-backed financing. Specifically, all firms in this cluster use leasing or hire purchase. Besides this source of finance, 35% of firms in this cluster use bank loans, while 80.8% use internal funding.

INTERNAL/BANK FINANCING: the fifth cluster includes 1325 (14.6%) firms that use internal funding and bank loans to finance their investment activities.

BANK FINANCING: the sixth cluster includes 271 (3%) firms that rely solely on bank financing.

INTERNAL FINANCING: the last cluster is the largest one in our study, consisting of 4554 (50.2%) of firms that finance their investment activities using internal funding.

It is interesting to note that our cluster algorithm has identified three different mixed finance profiles which are actually different in many aspects, mainly due to the specificity of grants and intra-group finance. The purely mixed financed cluster is more related to independent companies which are not part of business groups and which do not rely on public support through grants. However, one major finding is that only a little more than one-fifth of firms in the sample shows a high level of diversification of sources of finance.

The literature shows that the use of different financing instruments depends on a number of firm-level characteristics. This is what we investigate in the next section where we present the composition of the seven clusters along several dimensions.

3.2. What are the main characteristics of firms belonging to different clusters?

Table 4 reports the distribution of firms in the seven financing clusters across some of those dimensions, in particular: size, age, industry, country groups, profitability, and investment opportunities.

It can be seen that micro and small firms are more likely to use internal and bank financing while these types are very rare in the mixed financed (intra-group and grants) clusters. The reverse also holds as large firms are rare in the internal and bank financing cluster and more likely to rely on a mix of financing instruments.

Firm age does not vary significantly among the seven clusters. Manufacturing firms are more likely to use mixed (intra-group and grants) financing and less likely to use the purely mixed finance. This gives some indication that manufacturing firms are more likely to belong to business groups and at the same time the manufacturing sector is more often a target of public policies. There are very few construction firms in the mixed financed (intra-group and grants) clusters. Service firms are also less likely to use mixed financed (grants) and asset/- backed financing. The latter is not surprising as service firms have a lower level of tangibles. Therefore, they may use leasing and/or hire purchases less often. The asset/- backed cluster includes many firms from the infrastructure industry.

Table 4 displays also the distribution of the different financing clusters among three EU country groups: periphery, cohesion, and others. Firms in the periphery group of countries are more common in mixed financed (grants), mixed financed, and internal/bank loans clusters but less common in mixed financed (intra-group) and debt/ asset-backed financing clusters. Cohesion group firms are heavy users of grants and very unlikely to finance their investment with bank financing only. Firms from the remaining European countries are slightly more likely to use a mix of finance relying on intra-group funds, and very rarely rely on public support in terms of grants.

Profitability of firms is similar for the seven financing clusters. The exception is the mixed financed (intra-group) cluster where the share of firms that operate with profit is significantly lower than in the remaining clusters.

Lastly, the share of firms that invested more compared to previous fiscal year increases linearly with the number of financing sources used. Thirty-two percent of internally financed firms increased their investment level versus more than 50% in all three mixed financed clusters. The share of firms that decreased their level of investment is particularly high within the bank financing cluster.

3.3. Financing clusters and the innovativeness of EU firms

Firms with innovative projects are more likely to experience problems obtaining external finance due to higher complexity, specificity, and degrees of uncertainty characterizing innovation projects (Mateut, 2017; Schneider and Veugelers, 2010). While we cannot directly

examine whether firms with innovative projects experience problems obtaining external finance, we can ex-post observe the financing mix used by firms with different degrees of innovative activities.

Table 5 presents several indicators of firm innovativeness for the seven financing clusters. The first row shows that the share of firms investing in R&D activities depends greatly on firm financing. Only 12% of firms in the bank financing cluster and 27.5% of firms in the internal financing cluster invest in R&D activities. On the other hand, the share of R&D investing firms is 39.1% for mixed financed firms, 44.8% for mixed financed (intra-group) firms, and 52.6% for firms in the mixed financed (grants) cluster. Firms that use several financing options are not only more likely to have invested in R&D activities, but also invest more in terms of R&D to turnover ratio (second row). This suggests a possible link between the number of sources of finance used and R&D investment. Also, the use of grants and intra-group financing is associated with higher levels of R&D. In the case of investment in software, data, IT networks, and website activities, firms tend also to be more concentrated in the clusters with more financial instruments. With that said, the highest percentage of firms utilize internal/bank financing.

The fact that firms invest in R&D and/or software and databases cannot be equated with being successful at innovation. For this reason, we look at the fraction of firms that (1) issued products new to the company (fifth row) and (2) issued products new to the market or new globally (sixth row). Firms in the bank-financed cluster are least likely to develop new products with only 22% that managed to do so. Among internally financed firms, 42.5% developed new products. In the mixed financed clusters, firms develop products more often: 55.2% for mixed financed firms, 63.5% for mixed financed (IG) firms, and 67.7% for mixed financed (grants). The share of firms that develop products new to the company or new globally follows a similar pattern: firms that rely on several financing options are more likely to develop such products than firms relying on fewer financing choices.

Next, to further investigate the link between firm innovativeness and finance, we run a logistic regression model. This allows us to control for the differences in firm size, age, industry, and country. We used four innovativeness indicators as dependent variables. Three are dummy variables equal to 1 if 1) a firm has positive R&D expenditures; 2) a firm has introduced products new to the company and 3) a firms has introduced products new to the market or globally. The fourth ratio is a continuous variable and is defined as the ratio of R&D expenditures and turnover. For this variable we use a simple regression model. The main independent variable is a categorical variable showing what finance cluster the firm belongs to. The omitted reference category in the analysis is the internal financing cluster. All specifications use weights based on value added to restore the proportions of the economic weight of each size class, economic activity, and country.

Table 6 presents the marginal effects for the logistic specifications and estimated coefficients for the weighted-least squares specification. The results show that firms in the bank financing cluster are less likely to have invested in R&D activities than those in the internal financing cluster. On the other hand, mixed financed firms are 7% more likely to have R&D activities compared to internally financed firms, whereas the probability triples for firms using a large number of grants. The probability of a firm developing products (new to the company or market/globally new) is also significantly lower for firms in the bank financing cluster but significantly higher in the three mixed financed clusters. Furthermore, the probability of investing in R&D activities and developing a new product is also higher for bigger firms, particularly for the large category of firms. Similar results on the impact of the different clusters on innovation are obtained if we use the ratio of R&D and turnover.

Our findings suggest that firms that use a mix of finance are more likely to invest in R&D activities and develop new products. *At prima facie* this seems somewhat counterintuitive to the findings of the literature that innovative firms experience additional problems in obtaining external finance. However, it is possible that the two findings co-exist as firms in the mixed financed clusters might be still unsatisfied with the quantity and/or the price of the external finance obtained. Furthermore, it seems that adding grants and intra-group finance to the finance mix is what differentiates these firms in terms of their innovativeness. This suggests that innovative firms manage to find alternative sources to finance their activities.

4. Conclusions

We explored the link between finance and innovation for a representative sample of EU firms by using the new survey of the European Investment Bank. We identified seven financing clusters and showed that the degree of innovativeness increases with the diversification of financial instruments. In particular, firms that use several financing instruments are more likely to invest in R&D and software activities and develop new products compared to firms that use a more limited number of financing instruments.

This result has important policy implications. First, the increased access to a diversified pool of funding options is critical for innovation. The recent initiatives in the action plan of the Capital Market Union to strengthen market-based finance (related to venture capital, private placements, and crowdfunding) are heading in the right direction. Second, bank loans and capital markets complement each other to foster innovation. On the one side, our results clearly point out that the sole use of bank loans is not sufficient for innovation. On the other side, we did not find a “purely” market-based cluster, although this is inherently related to the actual underdevelopment of European capital markets.

Another interesting result derived from our analysis is the important role played by grants. Grants are an innovation policy instrument used by several EU countries to alleviate access-to-finance obstacles by innovators. This is confirmed by the higher probability for firms in our sample to be innovators when they belong to the finance cluster with a large number of grants.

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Annexes

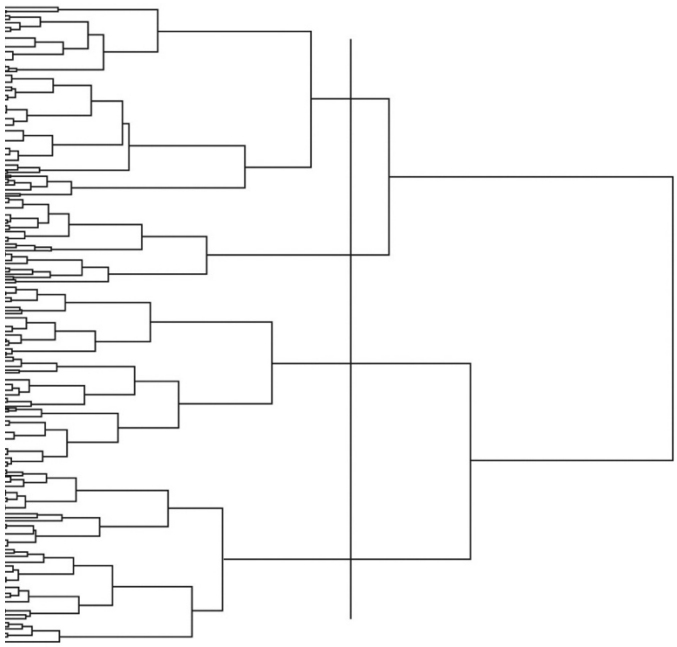
A. Figures and Tables

Table 1: The Use of Financing Instruments

	% of firms using the instrument	Average share of investment financed by the instrument
Internal	87%	69%
Intra-group	6%	59%
Bank loans	39%	52%
Other bank finance	12%	28%
Newly issued bonds	2%	45%
Newly issued equity	1%	23%
Leasing/Hire purchase	22%	40%
Factoring/Invoicing	6%	23%
Family/Friends	2%	24%
Grants	5%	24%
Other	1%	40%

The table above shows the weighted percentage of firms using different sources of finance, and average share of investment financed by the instrument (calculated using data only for firms that used the financing option).

Figure 1: Hierarchical Agglomerative Cluster Algorithm Progression



The image above is an example of a hierarchical clustering dendogram as produced by STATA.

Table 2: Example of association between two objects (contingency table)

		object *j*		
		1	0	
object *i*	1	*a*	*b*	*a* + *b*
	0	*c*	*d*	*c* + *d*
		a + *c*	*b* + *d*	

Source: Kaufman, L., and P.J. Rousseeuw, P. J. (2009), p. 23

Table 3: Cluster Composition

	Mixed Financed (Intra-Group)	Mixed Financed (Grants)	Mixed Financed	Debt/ Asset--backed Financing	Internal/ Bank Financing	Bank Financing	Internal Financing	Pearson Chi^2
Internal	**54.1%**	**89.2%**	**83.9%**	**80.8%**	**100%**	0%	**100%**	3927.40**
Intra-group	**100%**	2.3%	1.7%	0%	0%	0%	0%	8119.64**
Bank loans	31.9%	50.4%	44.7%	35.0%	**100%**	**100%**	0%	5810.21**
Other bank finance	12.2%	20.1%	**67.6%**	0%	0%	0%	0%	5087.14**
Newly issued bonds	0%	1.9%	4.7%	0%	0%	0%	0%	330.00**
Newly issued equity	1.1%	1.2%	3.3%	0%	0%	0%	0%	220.19**
Leasing/Hire purchase	20.4%	23.2%	37.7%	**100%**	0%	0%	0%	6299.66**
Factoring/Invoicing	5.2%	8.7%	21.3%	0%	0%	0%	0%	1450.01**
Family/Friends	1.5%	6.2%	19.5%	0%	0%	0%	0%	1382.27**
Grants	1.1%	**100%**	0.9%	0%	0%	0%	0%	8817.43**
Other	1.1%	0.6%	5.8%	0%	0%	0%	0%	415.39**
N	270	482	1165	1000	1325	271	4554	9067
Percentage of firms	3.0%	5.3%	12.8%	11.0%	14.6%	3.0%	50.2%	

Pearson's chi-square test: **p < 0.01, *p < 0.05.

The table above presents the seven financing clusters and the types of finance used by firms in each cluster. The cells show the percentage of firms in each cluster using each of the eleven sources of finance. For each cluster the highest two percentages are in bold. The Pearson's chi-square test corresponds to the null hypothesis of an instrument being used to the same extent by all seven clusters. These results are based on EIBIS 2016 survey data.

Table 4: Financing Clusters and Firm Characteristics

	Mixed Financed (Intra-Group)	Mixed Financed (Grants)	Mixed Financed	Debt/ Asset-backed Financing	Internal/ Bank Financing	Bank Financing Only	Internal Financing Only	Total
Firm size								
Micro (5-9)	1.1%	3.9%	6.4%	5.3%	6.9%	15.2%	12.6%	8.8%
Small (10-49)	5.5%	16.4%	17.3%	22.4%	21.2%	35.5%	27.1%	22.6%
Medium (50-249)	21.2%	28.7%	18.4%	23.3%	21.8%	22.6%	22.8%	22.2%
Large (250+)	72.2%	51.1%	57.9%	49.0%	50.1%	26.8%	37.5%	46.4%
Firm age								
Less than 5 years	4.2%	2.0%	4.0%	2.1%	2.9%	2.5%	3.1%	3.1%
5 years to less than 10 years	8.9%	7.8%	7.3%	6.2%	6.0%	8.3%	7.9%	7.3%
10 years to less than 20 years	14.9%	19.6%	18.8%	13.3%	18.1%	15.4%	19.4%	17.9%
20 years or more	72.0%	70.7%	70.0%	78.5%	73.1%	73.9%	69.6%	71.7%
Sector								
Manufacturing	45.6%	44.5%	29.6%	40.3%	36.0%	32.2%	35.6%	36.2%
Construction	4.5%	5.8%	8.6%	9.4%	7.9%	9.4%	10.5%	9.0%
Services	23.8%	15.2%	25.8%	9.5%	25.6%	28.7%	30.1%	25.0%
Infrastructure	26.1%	34.6%	36.1%	40.8%	30.5%	29.8%	23.9%	29.9%
Country group								
Periphery	16.8%	32.6%	30.6%	18.3%	30.7%	28.3%	21.9%	24.8%
Cohesion	6.8%	22.8%	8.9%	8.6%	6.9%	2.8%	10.7%	9.5%
Other	76.4%	44.7%	60.5%	73.1%	62.5%	68.9%	67.4%	65.6%
Profitability								
Profit	63.6%	92.0%	91.2%	90.5%	93.0%	89.8%	89.9%	89.4%
Investment level compared to previous year								
Invested more	52.3%	51.3%	51.3%	45.6%	43.9%	43.2%	32.0%	41.2%
Broadly the same	29.2%	36.1%	35.3%	38.5%	41.6%	32.2%	49.9%	42.4%
Invested less	18.5%	12.6%	13.5%	15.9%	14.5%	24.5%	18.1%	16.5%

The table above presents the seven financing clusters and different firm characteristics. The cells show the fraction of firms in each cluster across size, age, industry, country groups, profitability, and investment opportunities. These results are based on EIBIS 2016 survey data.

Table 5: Innovation Indicators and Financing Clusters

	Mixed Financed (Intra-Group)	Mixed Financed (Grants)	Mixed Financed	Debt/ Asset-backed Financing	Internal/ Bank Financing	Bank Financing	Internal Financing	Total
Positive R&D investment	44.8%	52.6%	39.1%	30.1%	35.0%	12.0%	27.5%	32.5%
R&D/Turnover ratio	0.6%	1.1%	0.7%	0.2%	0.4%	0.2%	0.5%	0.5%
Positive software investment	76.8%	81.5%	72.6%	72.2%	81.5%	50.3%	70.6%	73.1%
Software/Turnover ratio	0.8%	0.6%	0.4%	0.4%	0.5%	0.3%	0.6%	0.5%
Products new to the company	63.5%	67.7%	55.2%	38.6%	47.0%	22.5%	42.5%	46.3%
Products new to market /globally new	32.4%	28.8%	18.8%	11.4%	13.8%	4.1%	12.5%	15.1%

The table above presents the seven financing clusters for different indicators of firms' innovativeness activity. The cells show the fraction of firms in each cluster across investments in R&D and software, data, IT networks and website activities as well as on the introduction of products new to the company or to the market or globally. These results are based on EIBIS 2016 survey data.

Table 6: Firm Innovation and Financing Clusters

	R&D	R&D/Turnover ratio	Products new to the company	Products market/globally new
Bank Financing Only	-0.13**	-0.27**	-0.19***	-0.08***
	(0.06)	(0.12)	(0.05)	(0.02)
Internal/Bank Financing	0.05	-0.08	0.03	0.01
	(0.03)	(0.10)	(0.03)	(0.02)
Debt/ Asset-Backed Financing	0.00	-0.32***	-0.05	-0.02
	(0.04)	(0.09)	(0.04)	(0.03)
Mixed Financed	0.07**	0.12	0.09**	0.05*
	(0.03)	(0.16)	(0.04)	(0.03)
Mixed Financed (Grants)	0.20***	0.52**	0.22***	0.12***
	(0.04)	(0.24)	(0.04)	(0.04)
Mixed Financed (Intra-Group)	0.07	0.03	0.16**	0.15***
	(0.06)	(0.17)	(0.06)	(0.05)
Small (10-49)	0.03	0.00	0.07**	0.02
	(0.02)	(0.07)	(0.03)	(0.02)
Medium (50-249)	0.12***	0.03	0.06**	0.00
	(0.02)	(0.08)	(0.03)	(0.02)
Large (250+)	0.24***	0.10	0.16***	0.07***
	(0.03)	(0.10)	(0.03)	(0.02)
Observations	8,139	8,139	8,212	7,827
(Pseudo) R2	0.15	0.05	0.07	0.09

*** p<0.01, ** p<0.05, * p<0.1

Reported are marginal effects estimated after logistic regression with robust standard errors reported in parentheses. Omitted (reference) category is Internal Financing cluster. Controls include firm size, age, country, and industry dummies. These results are based on EIBIS16 survey data.

B. Questionnaire

The EIBIS questionnaire can be found at the following link:

http://www.eib.org/about/economic-research/eibis.htm

Economics Department
economics@eib.org
www.eib.org/economics

Information Desk
+352 4379-22000
+352 4379-62000
info@eib.org

European Investment Bank
98-100, boulevard Konrad Adenauer
L-2950 Luxembourg
+352 4379-1
+352 437704
www.eib.org

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