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Driving Innovation in Europe?

European Investment Bank
60 years
The EU bank

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Young SMEs: Driving Innovation in Europe?

September 2018

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Young SMEs: Driving Innovation in Europe?

Reinhilde Veugelers (KU Leuven, Bruegel, CEPR), Annalisa Ferrando (ECB), Senad Lekpek (EIB), Christoph Weiss (EIB)

September 2018

Abstract

Using large scale EIB Investment Survey evidence for 2016 covering 8,900 non-financial firms from all size and age classes across all sectors and all EU Member States, we identify different innovation profiles based on a firm's R&D investment and/or innovation activities. We find that "basic" firms – i.e. firms that do not engage in any type of R&D or innovation – are more common among young SMEs, while innovators –i.e. firms that do R&D and introduce new products, processes or services- are more often old and large firms. This hold particularly for "leading innovators", ie those introducing innovations new to the market. To further explore why young SMEs are not more active in innovation, we explore their access to finance. We confirm that young small leading innovators are the most likely to be credit constrained. Grants seem to at least partly addressing the external financing access problem for leading innovators, but not for young SMEs.

Keywords: Young small companies, innovation, access to finance

JEL-Classification: G24, O31, O38

1. The role of (young) SMEs in economic performance and innovation

There is an on-going debate in policy and academic circles about which firms matter most for job creation and growth, with answers ranging from a few large stars versus the glitter of many small firms (for an overview of the different positions, see e.g. Haltiwanger, Jarmin and Miranda, 2010, and Calvino, Criscuolo and Menon, 2016). The interest in small firms for economies' growth performance is of no surprise. SMEs are not only a large part of the economy but also, almost by definition, are at the heart of the Schumpeterian process of creative destruction, since most new firms entering are small (as are most of the exiting firms) (see e.g. Bravo-Biosca, 2017).

However, high shares of SMEs and entry and exit do not by themselves guarantee a functioning Schumpeterian growth process. What is needed is the right type of churning, where the successful entrants can grow out of SME status to become large incumbents and the failing firms restructure or exit. There are concerns that this churning process may be hampered in the EU. Bravo-Biosca (2017) shows that EU countries have a larger share of static firms – i.e. firms that do not grow or shrink –

compared to the US and that this correlates with lower aggregate productivity growth for EU economies.

The heart of the growth potential of a Schumpeterian business fabric lies in the presumption that small entrants bring to the market new and better processes or products, displacing firms with older and/or less efficient products or technologies. Innovation is at the core of the Schumpeterian growth process and young small firms are the most promising actors in the Schumpeterian dynamics, as they are considered to have a key role in creating new ideas and developing them into successful innovations. Joseph Schumpeter in his first contributions emphasized the role of new entrepreneurs entering niches of markets. By introducing new ideas and by innovating, these entrepreneurs challenged existing firms through a process of "creative destruction", which he regarded as the engine behind economic progress (Schumpeter, 1939). This was later labeled as Schumpeter's Mark I model (Malerba and Orsenigo, 1995). In later contributions, Schumpeter (1942) shifted attention to the key role of large incumbent firms as engines for economic growth, as these firms can thrive on their accumulated non-transferable knowledge in specific technological areas and markets: Schumpeter's Mark II (see also Ortega-Argiles, Vivarelli and Voigt, 2009).

The advantage of small new firms holds particularly for more radical innovations that disrupt existing positions – for which incumbent firms are more reluctant to be engaged in, avoiding the cannibalization of their existing profits and being trapped in incumbent expertise (e.g. Henderson, 1993). A lack of small new innovators may thus reduce particularly the introduction of radical breakthrough innovations, which lay the foundations of completely new markets. Missing small new innovators may also reduce the innovativeness of incumbent firms, lacking the challenge to adopt the latest innovations to escape competition and lacking the opportunity to acquire small firm ideas to further improve on (e.g. Colombo et al., 2017).

Concerns abide that the creative destruction Mark I model is less at play in the EU innovation landscape, with a larger share of innovation activities concentrated in older firms and sectors. Missing a concentration of innovators in new sectors and new firms, particularly in digital technologies, goes a long way to explain the persistent business R&D deficit gap of the EU compared to the US (e.g. Cincera and Veugelers, 2014).

There are also concerns that the adoption of latest innovations may be hampered in Europe. For instance, Andrews, Criscuolo and Gal (2016) show an increasing divide in productivity performance between leading and following firms, consistent with a lack of incentives or capabilities to adopt the latest innovations by non-leading firms.

Although innovating firms face a myriad of obstacles, the most frequently discussed explanation for the differences in dynamic structure between Europe and the US is a greater willingness on the part of US financial markets to fund the growth of new companies with more radical projects (O'Sullivan, 2005). With innovation investments typically invoking large and uncertain sunk costs, availability of internal and external finance is a critical issue for innovating firms (e.g. Czarnitzki, 2006). Small and young firms with less collateral and less reputation will face more financial barriers. A large literature confirms the importance of access to finance as the major hampering factors for innovation; for all types of firms, but more for small than for large firms (e.g. Hall, 2002; Beck and Demirguc-Kunt, 2006) and more for young highly R&D intensive firms, which are introducing more radical innovations (e.g. Schneider and Veugelers, 2010; Gaspar et al., 2009, Revest and Sapio, 2012).

The contribution of this paper is to use recent large scale survey evidence to characterize the Schumpeterian creative destruction process in Europe, whether it is more of Mark I or Mark II and with which type of firms EU's deficits reside: old or young SMEs, large or young incumbents? The 2016 EIB

investment survey which covers 8,900 non-financial companies from all sectors and all countries in the EU provides a unique opportunity to characterize the involvement of the whole spectrum of businesses on their investment in innovations in Europe. We characterize both how active firms are in adopting the latest innovations, as well as how active they are in creating new innovations, which can be either incremental improvements to their existing offerings or more drastic innovations that are new to the market. The EIB survey data allow us to look not only at SMEs versus large firms, but within each group, to single out the younger versus older firms. This contrasts with the Eurostat-CIS survey which, although widely used for innovation analysis (see e.g. Mairesse and Mohnen, 2010), does not collect the age profile of the firms for all participating countries. In addition, the EIB investment survey allows us to further look at the barriers that different types of firms face when investing. It provides particularly rich information on the extent which the different types of firms are credit constrained.

The analysis finds that young SMEs are less likely to be leading innovators in the EU. Firms that do not engage in any type of R&D or innovation are more common among young SMEs than on average. Innovators, especially leading innovators, are more often old and large firms. Exploring further obstacles to investment faced by EU firms, we find that young small firms with leading innovation projects are the most likely to be credit constrained. Leading innovators are more likely to receive grants. Young SMEs however, are not more likely to receive grants, suggesting that grants could be more efficiently employed as instrument for innovation policy in the EU

2. Characterizing the EIB Investment Survey respondents and their innovative strategies

To examine the innovation profile of firms by size and age in Europe, we make use of the EIB Investment Survey (EIBIS) 2016 results. EIBIS covers non-financial firms from all sizes and ages in all sectors and all EU Member States. Using a stratified sampling methodology, EIBIS is representative across all 28 Member States of the EU, for four firm size classes (micro, small, medium and large) and for four macro-sectors (manufacturing, services, construction and infrastructure) within countries. All aggregated data are weighted by value added to better reflect the contribution of different firms to economic output.

The sample we use for the analysis contains 8,900 firms, of which 7,450 (or 84%) are **SMEs** (identified as firms with less than 250 employees). 16% of our sample firms are **young** (identified as less than 10 years old).[1] There are more young firms among SMEs: 18% of them are young, while only 7% of large firms are less than 10 years old. This is consistent with young vintages being more likely to be (still) small scale, and new, young firms being typically SMEs. It also reflects the difficult road for young firms to grow fast out of SME status, leaving only few large firms with more than 250 employees to be younger than 10 years old. Countries with a below average share of young cohorts within their SME population include Spain, Ireland, Austria, Belgium and Germany (see Table A.1 in the Appendix).

[1] There are very few firms in the sample that are start-ups: less than 1% are younger than 2 years old, 4.5% are between 2 and 5 years old. The low number of very young firms in EIBIS is partly due to the sampling design of the survey, which is based on firms that provided information on their balance sheet and profit and loss account in the year before the interview.

The sectoral distribution of firms in the sample is spread across manufacturing (29%), construction (22%), infrastructure (26%), and services (23%). 46% of firms are from innovation leading countries, 54% from innovation lagging countries.[2]

Using survey questions on firms' investment to develop and introduce innovations, we identify different profiles based on their R&D investment and innovation activities.

- *R&D active firms* are defined as firms reporting substantial R&D (i.e. at least 0.1% of firm turnover).
- *Innovation active firms* are defined as firms reporting investment for developing or introduction new products, processes or service. The type of innovations are further characterized as whether the new products, processes or services were (i) new to the company; (ii) new to the country; (iii) new to the global market.

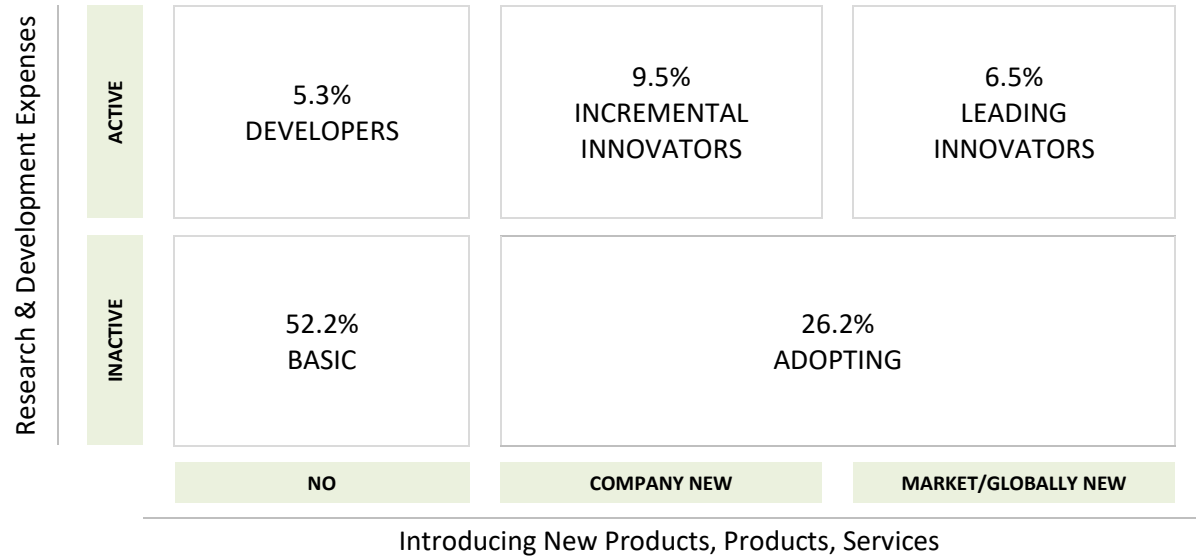
The EIBIS survey results confirms the highly skewed innovation profile of businesses in the EU: 78.5% of firms report no (substantial) R&D; 58% did not introduce any innovation; and of those that introduced innovations, only 30% introduced innovations that were new to the market. We use the EIBIS evidence on these two dimensions to classify firms in 5 innovation profiles: basic, adopting, developer, incremental innovator, and leading innovator.

A first base category are the firms that report no (substantial) R&D and are not engaged in any type of innovation, neither developing own innovations nor adopting innovations already developed elsewhere. These companies we list as "**basic**". Firms that are not engaged in substantial R&D investments, but that nevertheless invest to introduce already existing innovations into their firm for the first time, we list as "**adopters**". Examples of important process innovations that firms can adopt evolve around digital technology innovations.

A more active part of the business innovation ecosystem includes firms that have substantial investments in research and development. If they have also introduced innovations at the same time, we list them as "**innovators**"; else they are "**developers**". The latter are R&D active firms that have not (yet) successfully introduced new products, services or processes. For the "innovators" we differentiate between those who introduced innovations that were new to the global market, which we list as "**leading innovators**" and those that introduce more incremental innovations that are new to the firm or the country, but not to the global market. These are the "**incremental innovators**". Figure 1 shows the distribution of firms in our sample across these innovation profiles.

[2] Innovation leading and innovation lagging countries are defined based on the European Innovation Scoreboard of the European Commission. Innovation leading include 'Innovation Leaders' and 'Strong Innovators' (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, Netherlands, Slovenia, Sweden, and United Kingdom) while Innovation lagging include 'Moderate Innovators' and 'Modest Innovators' (Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, and Spain).

Figure 1: Innovation Profiles



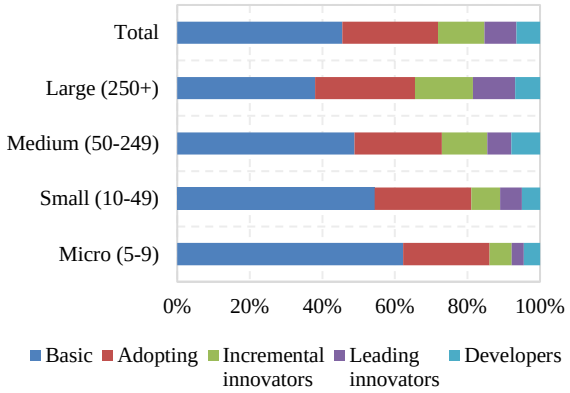
Note: The introduction of new innovation is based on questions 18 and 19 of EIBIS, namely "Q18. What proportion of the total investment was for developing or introducing new products, processes or services?" and "Q19. Were the new products, process or services (A) new to the company, (B) new to the country, (C) new to the global market?" R&D activity is defined as firm reporting substantial R&D (i.e. at least 0.1% of firm turnover).

The majority of firms (52%) are "**basic**" as they are not involved in any R&D or innovation activities. Another quarter of firms (26%) are "**adopters**": they are not themselves engaged in costly and risky R&D investments, but nevertheless introduce into their firm existing innovations developed elsewhere. 16% of firms are "**innovators**" involved in R&D investments and introducing innovations that are improvements over existing technologies and products. Most of these improvements are incremental (9.5% of the sampled population to be "**incremental innovators**"). But R&D investments are also occasionally laying the foundations for completely new innovations. 6.5% of sampled firms are "**leading innovators**". These may only be a handful of firms, but these are pivotal actors in the innovation growth story, as they lay the foundations for new markets and technologies, which other can adopt and further improve. The remaining 5% of firms are "**developers**", i.e. engaged in R&D but did not (yet) introduce successful innovations.

3. Descriptive analysis of the innovative strategies of young and/or small firms

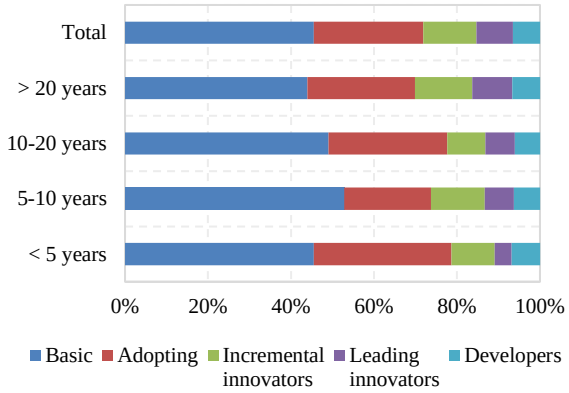
We next look at the different innovation profiles for various size and age profiles of firms. To uncover the power of the Schumpeterian Mark I innovation growth process in Europe, we are particularly interested to see the innovative profile of the young SMEs. Figure 2 shows that the share of basic firms is much higher among *SMEs*, particularly among the small and micro firms, who also have a low share of leading innovators. Leading innovators are overrepresented in the group of *large* firms. This is a first piece of evidence in favour of Mark II rather than Mark I of Schumpeterian dynamics in the EU.

Figure 2: Innovation Profiles and Firm Size *(weighted percentages)*



Note: Innovation Profiles are defined as in Figure 1.

Figure 3: Innovation Profiles and Firm Age *(weighted percentages)*

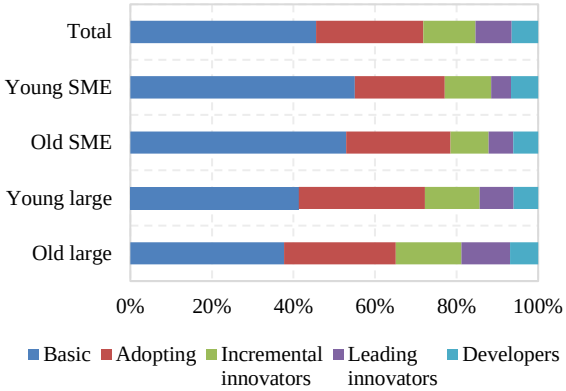


Note: Innovation Profiles are defined as in Figure 1.

Figure 3 looks at the innovation profiles by age category. *Young* firms are not significantly more likely to be introducing innovations that are new to the market, nor incremental improvements, compared to older cohorts. All this is further evidence against Mark I in the EU.

Figure 4 combines firm age and firm size and further illustrates the weakness of the Mark I regime in the EU. *Young SMEs* are more likely to be basic and less likely to be leading innovators, compared to the average, but even compared to old SMEs. They are only marginally more likely to be R&D active compared to old SMEs. Although *young large firms* are less likely to be basic compared to the average, they are less likely to be leading innovators compared to older large firms.

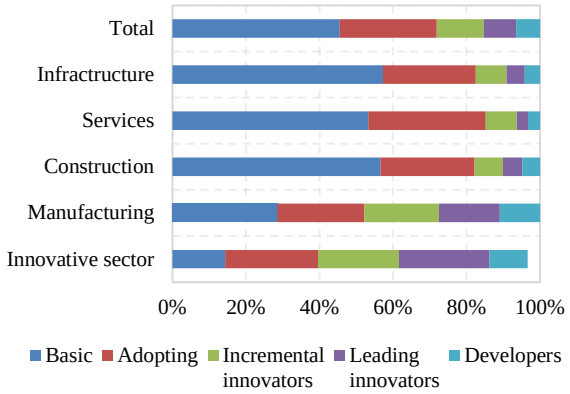
Figure 4: Innovation Profiles and Size-Age Groups *(weighted percentages)*



Note: Young (old) firms are those less (more) than 10 years old. SME (large) firms are those with less (more) than 250 employees. The four size-age categories are formed by combining the age and size splits. Innovation Profiles are defined as in Figure 1.

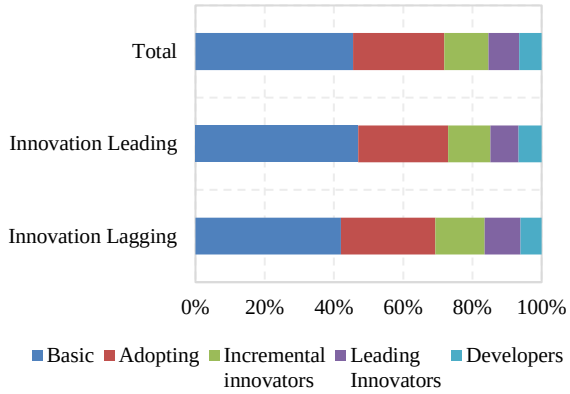
Whether or not and how firms will be innovation active is sensitive to the opportunities and challenges from the sectoral and national innovation system in which they operate. Figure 5 shows that firms in manufacturing are more likely to be R&D active. This holds particularly in the high-tech segments of manufacturing. Firms from the infrastructure, construction and services sectors are more likely to be basic. Firms in services are more likely to be adopters rather than being R&D active. Figure 6 shows no marked differences among innovation leading and innovation lagging countries in the innovative profiles of their firms. But this is because there is substantial heterogeneity across countries within each group, as shown in Figures 7a and 7b.

Figure 5: Innovation Profiles and Sectors *(weighted percentages)*



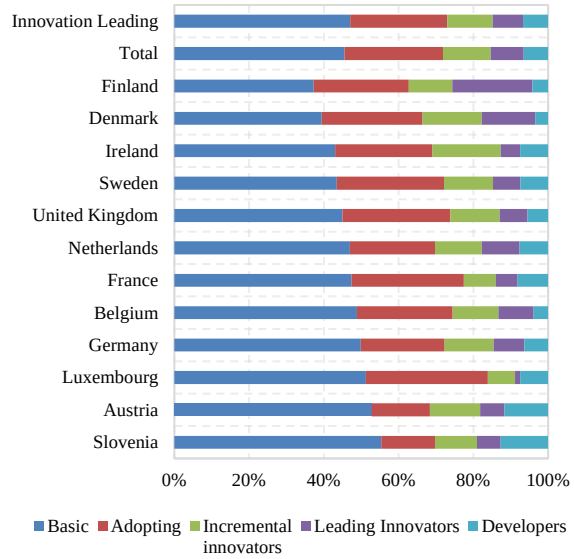
Note: Innovative sectors are identified based on the OECD definition of innovative sectors. The classification is based on NACE Rev. 2 at four-digit level (See Appendix A.2 for a list of innovative sectors). Innovation Profiles are defined as in Figure 1.

Figure 6: Innovation Profiles and Innovation Leading/Lagging Countries *(weighted percentages)*



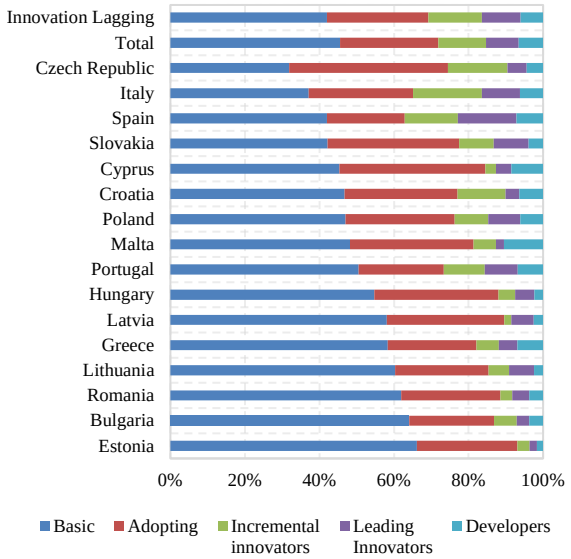
Note: Innovation leading and innovation lagging countries are defined based on the European Innovation Scoreboard. Innovation Profiles are defined as in Figure 1.

Figure 7a: Innovation Profiles in Innovation Leading Countries *(weighted percentages)*



Note: Innovation leading and innovation lagging countries are defined based on the European Innovation Scoreboard. Innovation Profiles are defined as in Figure 1.

Figure 7b: Innovation Profiles in Innovation Lagging Countries *(weighted percentages)*



Note: Innovation leading and innovation lagging countries are defined based on the European Innovation Scoreboard. Innovation Profiles are defined as in Figure 1.

4. Multivariate analysis of the innovative strategies of young and/or small firms

Table 1 presents the results of a multinomial analysis assessing the likelihood that the different age-size groups of firms belong to any of the innovation profiles (adopting, incremental innovator, leading innovator, developer) relative to a basic innovation profile. The multivariate analysis controls for sector and country effects driving the innovation profiles[3]. The multivariate results confirm that both young SMEs as well as old SMEs are less likely to be involved in innovation compared to old large firms (the base category). This holds for any innovation profile, but is most significant for incremental and leading innovators. The results also show that young SMEs are not significantly more involved in innovation than old SMEs.

[3] Note that the multivariate analysis is no attempt to assess causality, only to further characterize associations, correcting for sectoral and country specific effects that may drive the innovation profile of firms.

Table 1: Innovation Profiles and Size-Age Group: Multinomial Logit Analysis

	Adopting	Incremental Innovators	Leading Innovators	Developers
Young large	0.04	-0.03	-0.04	-0.02
	(0.05)	(0.03)	(0.02)	(0.02)
Old SME	-0.03*	-0.04***	-0.04***	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Young SME	-0.03	-0.03**	-0.04***	-0.01
	(0.02)	(0.01)	(0.01)	(0.01)
N	8,900	8,900	8,900	8,900

Note: The table reports marginal effects after multinomial logistic regression. Standard errors are reported in parenthesis. The base outcome is "basic". The reference category for size-age groups is old large (size-age groups are defined as in Figure 4). Country and sector fixed effects are included (but not reported). The regression is based on non-weighted firm level data. *** p<0.01, ** p<0.05, * p<0.1.

Overall, Table 1 confirms the descriptive results that firm age does not seem to matter significantly to characterize the innovative profile of firms. Young firms (most of them being small firms but even if they are larger) are not more likely to be adopting the latest innovations, nor creating or introducing own developed innovations – particularly more drastic innovations which are new to markets than their older counterparts in the same size category. Old large firms are the most likely innovators, especially leading innovators, suggesting that the EU innovative system is more characterized as a Schumpeter "accumulative" Mark II rather than a "creative destruction" Mark I, on average. The analysis confirms the missing role of young firms with more drastic innovations for new markets in the EU innovation landscape.

5. Impediments for innovative young and/or small firms

We further explore with the EIBIS data the various obstacles to investment faced by firms of the various size and age categories and across the different innovation profiles. EIBIS asks firms to rate 9 factors as long-term obstacles to investment, ranging from missing demand, regulations, access to skills to access to finance. Table 2 shows the results of a multivariate logit analysis assessing which size-age category of firms, and which type of innovation profile, is most likely to rate a factor as an obstacle.

Table 2: Obstacles to Investment and Innovation Profiles: Logit Analysis

	Demand for products or services	Availability of staff with the right skills	Energy costs	Access to digital infrastructure	Labour market regulations	Business regulations and taxation	Adequate transport infrastructure	Availability of finance	Uncertainty about the future
Young large	-0.03	0.02	-0.01	-0.03	0.07	0.09*	0.04	0.09*	-0.03
	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Old SME	-0.02	-0.01	0.02	0.01	0.04***	0.05***	-0.01	0.07***	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Young SME	-0.08***	0.00	-0.02	-0.02	0.02	0.04**	-0.02	0.10***	-0.08***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Adopting	0.04***	0.06***	0.05***	0.05***	0.06***	0.04***	0.07***	0.04***	0.02**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Incremental Innovators	0.08***	0.08***	0.08***	0.07***	0.09***	0.08***	0.07***	0.03*	0.05***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Leading innovators	0.05**	0.09***	0.02	0.06***	0.08***	0.09***	0.04*	0.08***	0.03*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Developers	-0.02	0.04	0.01	-0.01	0.02	0.04*	-0.01	0.00	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Observations	8,755	8,846	8,839	8,744	8,775	8,812	8,788	8,801	8,752
(Pseudo) R2	0.0531	0.0459	0.0796	0.0597	0.0536	0.0689	0.0629	0.0554	0.0822

Note: The table reports marginal effects after logistic regression. Standard errors are reported in parenthesis. The dependent variables are indicator variables equal to 1 if the firm considers a category to be a minor or major obstacle to investment, 0 if no obstacle ("Q38: Thinking about your investment activities, to what extent is each of the following an obstacle? Is a major obstacle, a minor obstacle or not an obstacle at all?"). The reference category for size-age groups is old large (size-age groups are defined as in Figure 4). The reference category for innovation profiles is basic. Innovation Profiles are defined as in Figure 1. Country and sector fixed effects are included. The regression is based on non-weighted firm level data. *** p<0.01, ** p<0.05, * p<0.1.

Table 2 shows that the three profiles of firms that develop new products – adopters, incremental and leading innovators – are more likely to report all 9 factors as obstacles to investment compared to basic firms.

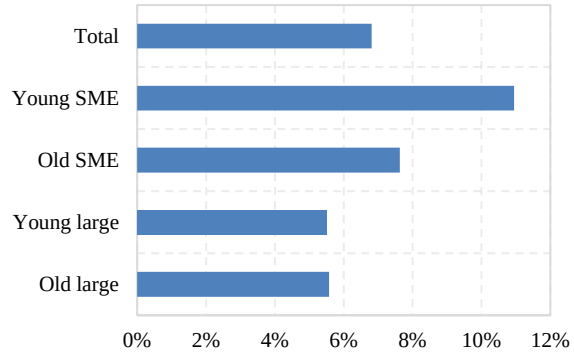
Business regulations are more significant barriers for SMEs. Also access the finance is more likely to be impediment for investing for SMEs. Especially young SMEs are significantly more likely to perceive access to finance as a barrier. The access to finance barrier is also higher for innovators, especially leading innovators. Taken together, the multivariate results suggest that young SMEs who have a leading innovation profile have the highest probability to rate access to finance as a barrier.

6. Access to credit for innovative young or small firms

With the evidence so far showing the importance of access to finance as impediment for firms when investing, especially for young SMEs and leading innovators, access to finance barriers may go a long way to explain why SMEs and particularly young SMEs are less likely to have leading innovating projects. We further look into whether SMEs and particularly young SMEs are more credit constrained – in particular those young SMEs with more radical innovative projects.

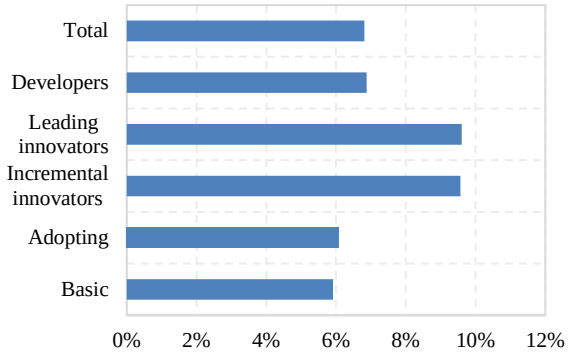
EIBIS contains rich and unique information to identify the extent to which firms are credit constrained. EIBIS can identify when firms are quantity constrained, price constrained, discouraged or outright rejected. We construct a credit constrained variable that takes the value of 1 if a firm falls into any of these categories.[4] In the total sample 7% of the firms are credit constrained. Figure 8a shows that 6% of large firms report being credit constrained (both young and old firms), while the percentage is higher for SMEs, especially young SMEs: 8% for old SMEs and 11% for young SMEs. Looking at the innovation profiles (Figure 8b), basic, adopting, and developers are not that differently credit constrained compared to the overall sample (6%). But innovation active firms have a higher probability to be credit constrained (10%).

Figure 8a: Credit Constraint and Size-Age Groups
(weighted percentages)



Note: The graph shows weighted percentage of credit constrained firms. Size-age groups are defined as in Figure 4.

Figure 8b: Credit Constraint and Innovation Profiles *(weighted percentages)*



Note: The graph shows weighted percentage of credit constrained firms. Innovation Profiles are defined as in Figure 1.

The econometric results in Table 3 confirms that leading innovators are more likely to be credit constrained. This also holds for incremental innovators, but to a lesser extent. Firms that are only adopting innovations are not significantly more credit constrained. Somewhat unexpected, developers are also not more significantly credit constrained, all else equal.

Taking into account the innovation profile of firms, SMEs are significantly more likely to be credit constrained. This holds particularly for young SMEs, confirming the lack of collateral and reputation that hurts young firms on the financial market. But young age only hurts for small sized firms. The few young firms that have made it into large firm status are not more likely to be credit constrained compared to older large firms.

The results thus show that young small firms with more radical innovative projects get a double whammy: one from having radical investment projects and one from being young and small. They thus end up being the most credit constrained category of firms. The good news is that column 2 shows no significant effect for the combination of being a young SME and a leading innovator, which implies that the credit constraint disadvantage for young small leading innovators does not go beyond

[4] Firms that are credit constrained either (i) obtained external finance but not all the quantity expected; (ii) were rejected when they sought external finance; (iii) did not apply because they thought external finance would be too expensive; or (iv) thought they would be rejected and were discouraged from applying.

the double whammy. Column 3 and 4 of Table 3 confirms this analysis for the most objective and biting component of credit constraint, i.e. being rejected.

Table 3: Credit constrained and Innovation Profiles

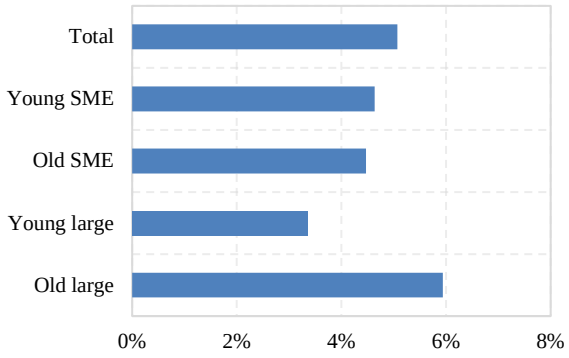
	Credit constraint		Rejected	
	(1)	(2)	(3)	(4)
Young large	0.01	0.01	-0.01	-0.01
	(0.03)	(0.03)	(0.02)	(0.02)
Old SME	0.03***	0.03***	0.02***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)
Young SME	0.08***	0.08***	0.05***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)
Adopting	-0.00	-0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Leading innovators	0.06***	0.07***	0.03***	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)
Incremental innovators	0.03***	0.03***	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Developers	0.02	0.02	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.01)
Leading innovators*Young SME		-0.04		-0.02
		(0.03)		(0.03)
Observations	8,900	8,900	8,900	8,900
Pseudo R-squared	0.0530	0.0533	0.0527	0.0529

Note: The table reports marginal effects after logistic regression. Standard errors are reported in parenthesis. Dependent variable is a dummy variable equal to 1 if a firm is credit constrained and zero otherwise (columns 1 & 2); dummy variable equal to 1 if a firm was rejected when seeking for external finance (columns 3 & 4). Reference category for size-age groups is old large (size-age groups are defined as in Figure 4). Reference category for innovation profiles is basic. Innovation Profiles are defined as in Figure 1. Country and sector fixed effects are included. The regression is based on non-weighted firm level data. *** p<0.01, ** p<0.05, * p<0.1.

7. Grants for innovative young and/or small firms

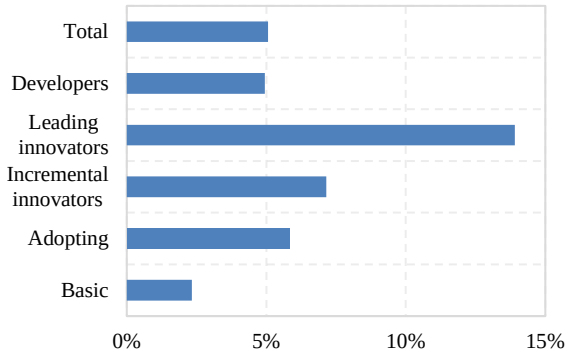
To alleviate the access to finance obstacle, all EU countries have grants schemes in place (Veugelers (2015)). Figures 9a and 9b show the share of firms that receive grants for different size-age groups and innovation profiles. While the size and age profile of firms do not make a big difference for receiving grants, figure 9b shows that leading innovators are much more likely to report receiving grants compared to the average.

Figure 9a: Grants Use and Size-Age Groups ***(weighted percentages)***



Note: The graph shows weighted percentage of firms that use grants as a source of external finance. Size-age groups are defined as in Figure 4.

Figure 9b: Grants Use and Innovation Profiles ***(weighted percentages)***



Note: The graph shows weighted percentage of firms that use grants as a source of external finance. Innovation Profiles are defined as in Figure 1.

The regression results, controlling for sector and country composition, support this finding. Table 4 shows that firms with innovative projects are more likely to get grants. This holds particularly for leading innovators. As these firms were also more likely to be credit constrained, grants therefore seem to at least partly addressing the external financing access problem for leading innovators. But Table 4 shows no significantly higher probability for SMEs and especially not for young SMEs to get grants for their investment projects. This contrast with the results on credit constraints reported in Table 3, where especially the young SMEs were found significantly more likely to be constrained.

Table 4: Grants and Innovation Profiles

	Grants (Yes/No) Logit
Young large	0.01
	(0.03)
Old SME	-0.01
	(0.01)
Young SME	-0.01
	(0.01)
Adopting	0.03***
	(0.01)
Leading innovators	0.07***
	(0.01)
Incremental innovators	0.04***
	(0.01)
Developers	0.04***
	(0.01)
Observations	7,502
(Pseudo) R2	0.103

Note: The table reports marginal effects after logistic regression (coefficient after OLS estimation in column 2). Standard errors are reported in parenthesis. The dependent variable is an indicator variable equal to 1 if the firm uses grants, and 0 otherwise (column 3). The reference category for size-age groups is old large (size-age groups are defined as in Figure 4). The reference category for innovation profiles is basic. Innovation Profiles are defined as in Figure 1. Country and sector fixed effects are included. The regression is based on non-weighted firm level data. *** p<0.01, ** p<0.05, * p<0.1.

8. Concluding with some elements for a good "policy approach" to SMEs and innovation

This paper uses 2016 EIB investment survey evidence covering 8,900 non-financial firms from all sectors and all countries in the EU to study with which type of firms are most likely to be involved in R&D and/or innovation investments.

The analysis confirms the missing role of young firms with more drastic innovations for new markets in the EU innovation landscape. Controlling for country and sector specific effects, young SMEs are found to be less likely to be involved in any type of innovation investment. Old large firms are the most likely innovators, especially leading innovators. All this suggests that the EU innovative system can be characterized as a Schumpeter "accumulative" Mark II rather than a "creative destruction" Mark I.

Diving further into why young SMEs are less likely to be leading innovators in the EU, we find that SMEs and particularly young SMEs are more credit constrained then large or old firms. In addition, innovators (especially leading innovators) are more credit constrained then basic firms. Combined, young small firms with more radical innovation projects are the most likely to be credit constrained. Controlling for country and sector specific effects, SMEs and young SMEs are not significantly more likely to receive

grants, but leading innovators are more likely to receive more grants, confirming the importance of this instrument for innovation policy in the EU to address the bias in access to finance for leading innovators, but not particularly for young SMEs.

The results need further analysis and confirmation before sound policy recommendations can be made. Nevertheless, a number of tentative policy implications can be put forward at this stage of the analysis. Even though our empirical evidence supports the access to finance problem for SMEs (especially young SMEs with leading innovation projects), this does not necessarily imply that public grants are an effective innovation policy tool. Firms face different barriers involving financial market failure depending on their age and size and the ambitions of their innovative projects. Especially the young small firms with more radical innovation projects experience difficulties raising tranches of external finance. Any innovation investment policy intervention that wants to be effective in reducing access to finance problems, therefore needs differentiation, addressing different segments in the business population, more particularly the young SMEs with leading innovation projects.

Despite the importance of access to finance, the evidence also shows that one cannot ignore the importance of other impediments to innovation. These other barriers relate to problems in the demand for innovations, regulatory burdens, and access to skills. Taken together, these barriers reduce the expected rates of return on R&D investments. All this is a strong reminder that the innovation deficit in Europe is systemic. Access to finance cannot be tackled in isolation, but should be embedded in an innovation environment that also addresses the other barriers to innovation. Any innovation financing policy should therefore fit into a systemic innovation policy, creating the framework conditions for a favorable environment for innovation investments.

Efficiency and effectiveness of policy are of increasing importance in general for (innovation) policy making due to tight government budgets. We spend significant resources on “cures”, but do not really know what “cures” work and if they work, under what circumstances. This calls for an explicit build-in of ex ante and ex post evaluation of any policy intervention.

Appendix

Table A.1: Share of firms by age-size class in each EU country

	OLDLARGE	YOUNGLARG	OLDSME	YOUNGSME	Total
Austria	0.235	0.004	0.675	0.086	268
Belgium	0.204	0.008	0.698	0.090	378
Bulgaria	0.174	0.023	0.482	0.322	311
Croatia	0.130	0.009	0.687	0.174	316
Cyprus	0.030	0.000	0.919	0.051	99
Czech Republic	0.128	0.008	0.698	0.168	400
Denmark	0.148	0.018	0.674	0.161	386
Estonia	0.023	0.008	0.781	0.188	256
Finland	0.164	0.021	0.667	0.148	432
France	0.183	0.009	0.690	0.117	436
Germany	0.222	0.024	0.670	0.084	333
Greece	0.128	0.000	0.749	0.123	219
Hungary	0.162	0.018	0.660	0.160	388
Ireland	0.045	0.003	0.878	0.073	287
Italy	0.198	0.020	0.651	0.131	510
Latvia	0.053	0.000	0.703	0.244	266
Lithuania	0.087	0.013	0.593	0.308	312
Luxembourg	0.144	0.000	0.663	0.192	104
Malta	0.032	0.000	0.888	0.080	125
Netherlands	0.141	0.012	0.709	0.138	412
Poland	0.209	0.015	0.650	0.126	326
Portugal	0.156	0.010	0.708	0.127	308
Romania	0.151	0.004	0.587	0.258	271
Slovakia	0.072	0.006	0.763	0.159	321
Slovenia	0.087	0.006	0.767	0.140	344
Spain	0.262	0.011	0.647	0.080	374
Sweden	0.198	0.005	0.662	0.135	364
United Kingdom	0.201	0.017	0.644	0.138	354
Total	**0.152**	**0.011**	**0.687**	**0.150**	**8,900**

Table A.2.: List of innovative sectors (OECD classification):

- **MANUFACTURING**

- 20.11 Manufacture of industrial gases
- 20.12 Manufacture of dyes and pigments
- 20.13 Manufacture of other inorganic basic chemicals
- 20.14 Manufacture of other organic basic chemicals
- 20.16 Manufacture of plastics in primary forms
- 20.17 Manufacture of synthetic rubber in primary forms
- 20.2 Manufacture of pesticides and other agrochemical products
- 20.3 Manufacture of paints, varnishes and similar coatings, printing ink and mastics
- 20.41 Manufacture of soap and detergents, cleaning and polishing preparations
- 20.42 Manufacture of perfumes and toilet preparations
- 20.52 Manufacture of glues
- 20.53 Manufacture of essential oils
- 20.59 Manufacture of other chemical products (not elsewhere classified)
- 20.6 Manufacture of man-made fibres
- 21.1 Manufacture of basic pharmaceutical products
- 21.2 Manufacture of pharmaceutical preparations
- 26.8 Manufacture of magnetic and optical media
- 26.11 Manufacture of electronic components
- 26.12 Manufacture of loaded electronic boards
- 26.3 Manufacture of communication equipment
- 26.2 Manufacture of computers and peripheral equipment
- 26.4 Manufacture of consumer electronics
- 26.51 Manufacture of instruments and appliances for measuring, testing and navigation
- 26.52 Manufacture of watches and clocks
- 26.6 Manufacture of irradiation, electromedical and electrotherapeutic equipment
- 26.7 Manufacture of optical instruments and photographic equipment
- 27.31 Manufacture of fibre optic cables
- 27.9 Manufacture of other electrical equipment
- 28.11 Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
- 28.23 Manufacture of office machinery (except computers and peripheral equipment)
- 28.29 Manufacture of other general-purpose machinery (not elsewhere classified)
- 28.92 Manufacture of machinery for mining, quarrying and construction
- 28.99 Manufacture of other special-purpose machinery (not elsewhere classified)
- 29.1 Manufacture of motor vehicles
- 29.2 Manufacture of bodies for motor vehicles; manufacture of (semi)trailers
- 29.32 Manufacture of other parts and accessories for motor vehicles
- 30.91 Manufacture of motorcycles
- 32.12 Manufacture of jewellery and related articles
- 32.13 Manufacture of imitation jewellery and related articles
- 32.5 Manufacture of medical and dental instruments and supplies
- 32.99 Other manufacturing (not elsewhere classified)

- **INFORMATION AND COMMUNICATION**

- 60.1 Radio broadcasting
- 60.2 Television programming and broadcasting activities
- 61.1010 Basic fixed circuit switched networks (PSTN)
- 61.1011 Transmission networks (incl. submarine cables)
- 61.1012 Cable access networks (DOCSIS)
- 61.1013 Copper (xDSL) access networks
- 61.1014 Fibre access networks
- 61.2010 Mobile networks
- 61.2011 Mobile broadband networks
- 61.2012 Special wireless networks (TETRA,…)
- 61.3 Satellite telecommunications activities
- 61.9 Other telecommunications activities
- 62.00 Computer programming, consultancy and related activities
- 62.01 Computer programming activities
- 62.02 Computer consultancy activities
- 62.03 Computer facilities management activities
- 62.09 Other information technology and computer service activities
- 63.10 Data processing, hosting and related activities; web portals
- 63.11 Data processing, hosting and related activities
- 63.12 Web portals

- **PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES**

- 72.00 Scientific research and development
- 72.10 Research and experimental development on natural sciences and engineering
- 72.11 Research and experimental development on biotechnology
- 72.19 Other research and experimental development on natural sciences and engineering
- 72.2 Research and experimental development on social sciences and humanities
- 73.00 Advertising and market research
- 73.20 Market research and public opinion polling

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