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Young SMEs as a Motor of Europe's Innovation Machine

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, the authors identify different innovation profiles based on a firm's R&D investment and/or innovation activities. 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 holds particularly for 'leading innovators', which introduce innovations new to the market. To further explore why young SMEs are not more active in innovation, the authors explore their access to finance. It is concluded that young small leading innovators are the most likely to be credit constrained. Public grants seem to at least partially address the external financing access problem for leading innovators, but not for young SMEs.

There is an ongoing 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.[1] The interest in small firms for economies' growth performance is of no surprise. Small and medium-sized enterprises (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).[2]

However, high numbers 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 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.[3]

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

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 emphasised the role

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1 For an overview of the different positions, see e.g. J.C. Haltiwanger, R.S. Jarmin, J. Miranda: Who creates jobs? Small vs. large vs. young, No. w16300, National Bureau of Economic Research, 2010; and F. Calvino, C. Criscuolo, C. Menon: 'No Country for Young Firms?: Start-up Dynamics and National Policies', OECD Science, Technology and Industry Policy Papers, No. 29, 2016.

2 See A. Bravo-Biosca: Firm growth dynamics and productivity in Europe, in: R. Veugelers (ed.): Remaking Europe: the new manufacturing as an engine for growth, Bruegel Blueprint, pp. 79-101, 2017.

3 Ibid.

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of new entrepreneurs entering niche 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.[4] This was later labelled as Schumpeter's Mark I model.[5] In later contributions, Schumpeter 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.[6]

The advantage of small new firms holds particularly for more radical innovations that disrupt existing positions, which incumbent firms are more reluctant to be engaged in as they avoid the cannibalisation of their existing profits and are trapped in incumbent expertise.[7] A lack of small new innovators may thus reduce the introduction of radical breakthroughs, which lay the foundations for completely new markets. Missing small new innovators may also reduce the innovativeness of incumbent firms that are not challenged to adopt the latest innovations so as to escape competition and also lack the opportunity to acquire small firm ideas to further improve on.[8]

Concerns abound 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. The lack of innovators in new sectors and new firms, particularly in digital technologies, explains the persistent business research and development (R&D) deficit gap of the EU compared to the US.[9]

There are also concerns that the adoption of the latest innovations may be hampered in Europe. For instance, Andrews, Criscuolo and Gal 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.[10]

Although innovating firms face a myriad of obstacles, the most frequently discussed explanation for the differences in the dynamic structure between Europe and the US is a greater willingness of US financial markets to fund the growth of new companies with more radical projects.[11] With innovation investments typically invoking large and uncertain sunk costs, the availability of internal and external finance is a critical issue.[12] Small and young firms with less collateral and less reputation will face more financial barriers. A large body of literature confirms the importance of access to finance as the major hampering factor for innovation for all types of firms, but especially for small firms[13] and for young, highly R&D intensive firms, which are introducing more radical innovations.[14]

The contribution of this paper is to use recent large-scale survey evidence to characterise the Schumpeterian creative destruction process in Europe, whether it is more of Mark I or Mark II and to identify the type of firms with which the EU's deficit resides: old or young SMEs, large or young incumbents? The 2016 European Investment Bank (EIB) investment survey, which covers 8,900 non-financial companies from all sectors and all countries in the EU, provides a unique opportunity to characterise the involvement of the whole spectrum of businesses on their investment in innovations in Europe. We characterise both how active firms are in *adopting* the latest innovations, as well as how active they are in *creating* new innovations, which may 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

4 J.A. Schumpeter: Business cycles, Vol. 1, New York 1939, McGraw-Hill, pp. 161-74,

5 F. Malerba, L. Orsenigo: Schumpeterian patterns of innovation, in: Cambridge Journal of Economics, Vol. 19, No. 1, 1995, pp. 47-65.

6 J. Schumpeter: Creative destruction. Capitalism, socialism and democracy, 825, 1942. See also R. Ortega-Argilés, M. Vivarelli, P. Voigt: R&D in SMEs: a paradox?, in: Small Business Economics, Vol. 33, No. 1, 2009, pp. 3-11.

7 See e.g. R. Henderson: Underinvestment and incompetence as responses to radical innovation: Evidence from the photolithographic alignment equipment industry, in: The RAND Journal of Economics, 1993, pp. 248-270.

8 See e.g. L. Colombo, H. Dawid, M. Piva, M. Vivarelli: Does easy start-up formation hamper incumbents' R&D investment?, in: Small Business Economics, Vol. 49, No. 3, 2017, pp. 513-531.

9 For example, see M. Cincera, R. Veugelers: Differences in the rates of return to R&D for European and US Young Leading R&D firms, in: Research Policy, Vol. 43, 2014, pp. 1413-1421.

10 D. Andrews, C. Criscuolo, P. Gal: The global productivity slowdown, technology divergence and public policy: a firm level perspective, Brookings Institution Hutchins Center Working Paper No. 24, 2016.

11 M. O'Sullivan: Finance and Innovation, in: J. Fagerberg, D. Mowery, R. Nelson (eds.): Oxford Handbook of Innovation, Oxford 2005, Oxford University Press, pp. 240-265.

12 For example, D. Czarnitzki: Research and development in small and medium-sized enterprises: The role of financial constraints and public funding, in: Scottish journal of political economy, Vol. 53, No. 3, 2006, pp. 335-357.

13 For example, see B.H. Hall: The financing of research and development, in: Oxford review of economic policy, Vol. 18, No. 1, 2002, pp. 35-51; and T. Beck, A. Demirguc-Kunt: Small and medium-size enterprises: Access to finance as a growth constraint, in: Journal of Banking & Finance, Vol. 30, No. 11, 2006, pp. 2931-2943.

14 For example, see C. Schneider, R. Veugelers: On young highly innovative companies: why they matter and how (not) to policy support them, in: Industrial and Corporate Change, Vol. 19, No. 4, 2010, pp. 969-1007; V. Gaspar, S. Bovha-Padilla, R. Veugelers: Financing SMEs in Europe, in: M. Balling, E. Gnan (eds): SUERF, 2009; V. Revest, A. Sapio: Financing technology-based small firms in Europe: What do we know?, in: Small Business Economics, Vol. 39, No. 1, 2012, pp. 179-205.

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, does not collect the age profile of the firms for all participating countries.[15] 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 to which 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 average. Innovators, especially leading innovators, are more often the older and larger 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 an instrument for innovation policy in the EU.

Characterising 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). Sixteen percent of our sample firms are young (identified as less than ten years old).[16] There are more young firms among SMEs: 18% are young, while only 7% of large firms are less than ten 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 quickly grow out of SME status, leaving only few large firms with more than 250 employees to be younger than ten years old. Countries with a below-average share of young cohorts within their SME population include Spain, Ireland, Austria, Belgium and Germany (see Table 1). The sectoral distribution of firms in the sample is spread across manufacturing (29%), construction (22%), infrastructure (26%) and services (23%).

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

	Old large	Young large	Old SME	Young SME	No.
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

Source: Authors' own elaboration based on EIBIS data.

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

15 For example, see J. Mairesse, P. Mohnen: Using innovation surveys for econometric analysis, Handbook of the Economics of Innovation, Vol. 2, North-Holland 2010, pp. 1129-1155.

16 There are very few firms in the sample that are start-ups: less than 1% are younger than two years old, 4.5% are between two and five 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.

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 to develop or introduce new products, processes or services. The type of innovations are further characterised as whether the new products, processes or services were (i) new to the company, (ii) new to the country, or (iii) new to the global market.

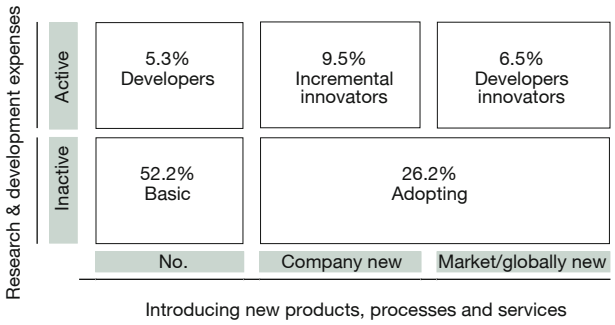
The EIBIS results confirm the highly skewed innovation profile of businesses in the EU: 78.5% of firms report no (substantial) R&D; 58% did not introduce any innovation; and of those that introduced innovations, only 30% introduced innovations that were new to the market. We use the EIBIS evidence on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

The first base category is 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. We list these companies 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, are called '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'; otherwise they are called 'developers'. The latter are R&D-active firms that have not (yet) successfully introduced new products, services or processes. Among 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.

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. Sixteen percent of the firms are considered 'innovators' and are 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 sample population is determined 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 they are pivotal actors in the innovation growth story, as they lay the foundations for new markets and technologies, which other firms can adopt and further improve. The remaining 5% of firms are 'developers', i.e. they are engaged in R&D but have not (yet) introduced successful innovations.

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, processes 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).

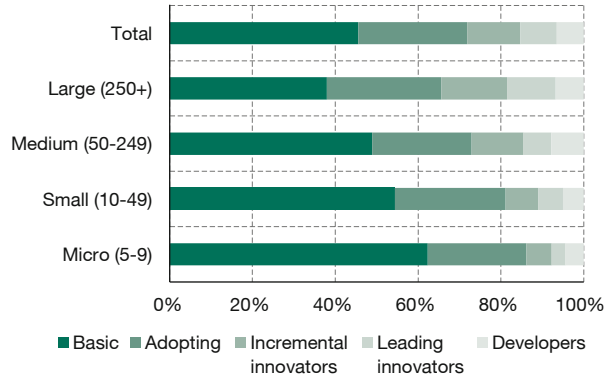
Source: Authors' own elaboration based on EIBIS data.

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

We next look at the different innovation profiles for firms of various sizes and ages. To uncover the power of the Schumpeterian Mark I innovation growth process in Europe, we are particularly interested to see the innovative profile of 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 the first evidence in favour of Mark II rather than Mark I of Schumpeterian dynamics in the EU.

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.

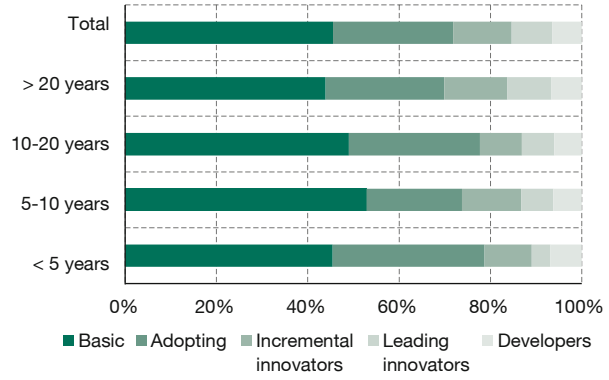
Figure 2
Innovation profiles and firm size
Weighted percentages



Note: Innovation profiles are defined as in Figure 1.

Source: Authors' own elaboration based on EIBIS data.

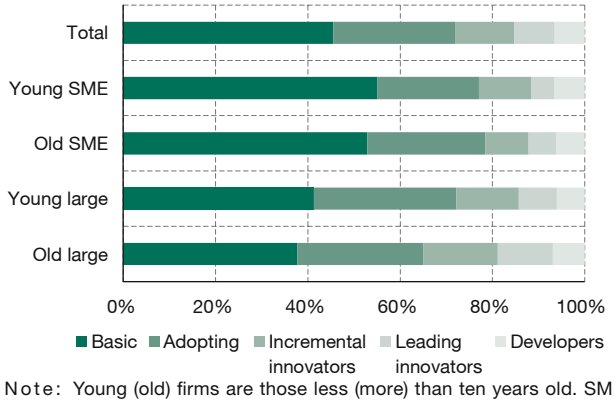
Figure 3
Innovation profiles and firm age
Weighted percentages



Note: Innovation profiles are defined as in Figure 1.

Source: Authors' own elaboration based on EIBIS data.

Figure 4
Innovation profiles and size-age groups
Weighted percentages



Note: Young (old) firms are those less (more) than ten 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.

Source: Authors' own elaboration based on EIBIS data.

Table 2
Innovation profiles and size-age group: Multinomial logit analysis

	Adopting	Incremental innovators	Leading innovators	Developers
Young large	0.04 (0.05)	-0.03 (0.03)	-0.04 (0.02)	-0.02 (0.02)
Old SME	-0.03* (0.01)	-0.04*** (0.01)	-0.04*** (0.01)	-0,01 (0.01)
Young SME	-0,03 (0.02)	-0.03** (0.01)	-0.04*** (0.01)	-0,01 (0.01)
No.	8,900	8,900	8,900	8,900

Notes: 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.

Source: Authors' own elaboration based on EIBIS data.

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, as compared to the average, but also 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 also less likely to be leading innovators compared to older large firms.

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

Table 2 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.[17] The multivariate results confirm that both young SMEs and 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.

Overall, Table 2 confirms the descriptive results that firm age does not seem to matter significantly to characterise

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

Table 3
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 R^2	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.

Source: Authors' own elaboration based on EIBIS data.

the innovation profile of firms. Young firms (most of them being small firms but even when they are large) are not more likely to be adopting the latest innovations, nor creating or introducing own developed innovations – particularly more drastic innovations – 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 characterised 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.

Impediments for innovative young and/or small firms

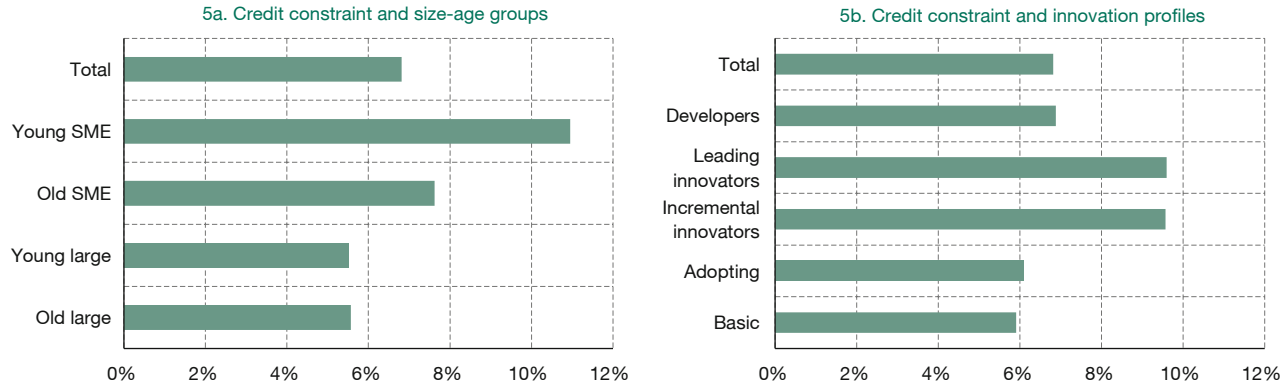
We further explore with the EIBIS data the various obstacles to investment faced by firms of various size and age categories and across the different innovation profiles. EIBIS asks firms to rate nine factors as long-term obstacles to investment, ranging from lacking demand to regulations to access to skills and finance. Table 3 shows the results of a multivariate logit analysis assessing which size-age category of firms, and which type of innovation profile, are most likely to rate a factor as an obstacle.

Table 3 shows that the three profiles of firms that develop new products – adopters, incremental innovators and leading innovators – are more likely to report all nine factors as obstacles to investment compared to basic firms. Business regulations and access to finance are more significant barriers for SMEs. Young SMEs in particular are significantly more likely to perceive access to finance as a barrier. This barrier is also higher for innovators, especially leading innovators. Taken together, the multivariate results suggest that young SMEs with a leading innovation profile are most likely to find access to finance as a barrier.

Access to credit for innovative young or small firms

With the evidence so far indicating the role of the lack of access to finance as an impediment for firms when investing, especially for young SMEs and leading innovators, this 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

Figure 5
Credit constraint and size-age groups/innovation profiles
Weighted percentages



Note: The graph shows weighted percentage of credit constrained firms. Size-age groups are defined as in Figure 4. Innovation profiles are defined as in Figure 1.

Source: Authors' own elaboration.

and especially 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.[18] In the total sample, 7% of the firms are credit constrained. Figure 5a 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 5b), basic, adopting, and developer firms are not that differently credit constrained compared to the overall sample (6%). But innovation-active firms have a higher probability of being credit constrained (10%).

The results in Table 4 confirm 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 unexpectedly, developers are also not more significantly credit constrained.

18 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.

Table 4
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^2	0.0530	0.0533	0.0527	0.0529

Note: The table reports marginal effects after logistic regression. Standard errors are reported in parenthesis. The dependent variable is an indicator variable equal to 1 if a firm is credit constrained and 0 otherwise (columns 1 & 2); indicator 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.

Source: Authors' own elaboration based on EIBIS data.

Table 5
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 R^2	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.

Source: Authors' own elaboration based on EIBIS data.

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

Grants for innovative young and/or small firms

To alleviate access to finance as an obstacle, all EU countries have public grants schemes in place.[19] Table 5 examines the likelihood that firms receive grants for different size-age groups and innovation profiles. The regression results, controlling for sector and country composition, show 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 seem to at least partly address the external financing access problem for leading innovators. But Table 5 does not show a higher probability for SMEs or young SMEs in getting grants for their investment projects. This contrasts with the results on credit constraints reported in Table 4, in which young SMEs in particular were found significantly more likely to be constrained.

Elements of 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 which type of firms are most likely to be involved in R&D and/or innovation investments.

The analysis confirms the lack of young firms with more drastic innovations in 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. This suggests that the EU innovative system can be characterised 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 than large or old firms. In addition, innovators (especially leading innovators) are more credit constrained than basic firms. 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 likely to receive 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.

19 R. Veugelers: Mixing and matching research and innovation policies in EU countries, Bruegel Working Paper No. 2015/16, 2015.

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 results indicate that access to finance is a 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 young small firms with more radical innovation projects experience difficulties raising external finance. Any innovation investment policy intervention that wants to be effective in reducing access to finance problems therefore needs differentiation to address different segments in the business population, 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. 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 favourable environment for innovation investments.

Efficiency and effectiveness are increasingly important for (innovation) policymaking due to tight government budgets. We spend significant resources on ‘cures’, but do not really know which ones 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.