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Innovation and Investment Funding in the Post-Crisis Period: Have Financing Patterns and Financial Constraints of German Firms Changed?

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Innovation and Investment Funding in the post-crisis period: have financing patterns and financial constraints of German firms changed?

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Summary: This study examines the actual funding behavior of German innovative firms in the pre- and post-crisis period. Specifically, we investigate if and how the funding patterns and financial constraints of German small and medium enterprises (SME) changed during and since the financial crisis. The purpose of our analysis is to assess whether the aims of the European CMU action plan, funding innovation and investment activities, complements the behavior of German SMEs. We find fairly stable funding patterns over the years and there is no indication that financial constraints have become tighter in the post-crisis period. Consequently, realizing the CMU's central goal of broadening the funding mix could leave the funding behavior of German SMEs largely unaffected.

Zusammenfassung: Diese Studie untersucht das aktuelle Finanzierungsverhalten deutscher innovativer Unternehmen vor und nach der Finanzkrise. Speziell untersuchen wir, ob sich die Finanzierungsstruktur und finanzielle Restriktionen der deutschen kleinen und mittleren Unternehmen (KMU) seit der Finanzkrise verändert haben. Der Zweck unserer Analyse ist es, zu beurteilen, ob die Ziele des europäischen CMU-Aktionsplans, insbesondere das Ziel der Förderung von Innovations- und Investitionstätigkeit, die Finanzierungssituation von deutschen KMU tatsächlich verbessern kann. Wir finden über den Untersuchungszeitraum hinweg stabile Finanzierungsstrukturen, und wir finden keine Evidenz, dass finanzielle Restriktionen nach der Krise zugenommen hätten. Vor diesem Hintergrund wird der CMU-Aktionsplan mit der Zielsetzung, den Finanzierungsmix von KMU zu erweitern, das aktuelle Finanzierungsverhalten deutscher KMU kaum beeinflussen.

→ JEL Classification: G32, G38, G01
→ Keywords: Capital Markets Union, SMEs, funding behaviour, financial structure

1 Introduction: Capital Markets Union and financing of innovations

When the European Commission launched the Innovation Union in 2010 poor availability of financial access was considered to be a main reason for *"private investment in research and innovation being held back and ideas prevented from reaching the market ... [The Innovation Union] aims to improve conditions and access to finance for research and innovation in Europe, to ensure that innovative ideas can be turned into products and services that create growth and jobs"* (European Commission 2010).[1]

Five years later, the Capital Markets Union (CMU) action plan was initiated (European Commission 2015). Actions to promote financing of innovation, start-ups and non-listed companies have been a central focus of the CMU Initiative (European Commission 2017). The plan is based on the diagnosis that corporate funding, in particular SME funding, in the European Union is too bank centered. Proponents of CMU argue that during the financial crisis stronger and more diverse capital markets would have enabled SMEs to replace funding from banks that had reduced their lending due to own difficulties in funding and "mountains" of non-performing loans.[2]

The European Commission believes that the negative effects of the 2007–2009 global financial crisis were aggravated by the bank dependence of European SMEs (European Commission 2015). Deep reliance on bank borrowing is also suspected to have prevented innovative firms from easy access to specialized and particularly suitable financing sources, such as bond financing, venture capital, or crowd funding. Thus, increasing the number of financing options available to SMEs in general, and innovative firms in particular, is one central goal of the CMU action plan. Another central goal is fostering cross-border funding of SMEs. The CMU is expected to enable more SMEs to sell their bonds directly to EU-investors and, also, to revive the cross-border distribution of securitized SME loans: *"Capital markets union contributes to diversify sources of finance for our economies and creates a risk-sharing channel that helps smooth out incomes and consumption via cross-border holdings of financial assets."*[3]

So far, no conclusive evidence exists with respect to the optimal menu of financing options for firms in general, and innovative ones in particular. Theory suggests that on the demand side a clear hierarchy of funding instruments exists. According to the financial "pecking order" firm owners prefer to draw on internal funds before resorting to borrowing, and opt for external equity financing only as a last choice (Myers 1984). The preference for insider financing is due to an information deficit of outsiders. This information asymmetry drives a wedge between internal and external costs of capital (Stigler 1967). With own funds, the issue of information asymmetry is absent. Thus, internal cash flow is the cheapest and most preferred source of capital. Borrowing is the second cheapest financing source, but lenders require a premium to offset the risk of

1 http://europa.eu/rapid/press-release_MEMO-10-473_en.htm?locale=en; https://ec.europa.eu/info/sites/info/files/factsheet-cmu-mid-term-review-june2017_en.pdf

2 The ratio of non-performing loans is particularly high in Cyprus, Greece, Italy and Portugal, see Schäfer (2016), Mesnard and Katopodi (2017).

3 Synergies between banking union and capital markets union. Keynote speech by Vítor Constâncio, Vice-President of the ECB, at the joint conference of the European Commission and European Central Bank on European Financial Integration, Brussels, 19 May 2017, www.ecb.europa.eu/press/key/date/2017/html/ecb.sp170519_1.en.html

a borrower behaving opportunistically. Because of the embedded equity premia compensating new shareholders for the risk of overvaluation of shares, external equity is the most expensive and least preferred source of capital. Based on the perspective of the pecking order theory, one would expect firm owners to prefer funding sources with the lowest degree of information asymmetry and lowest embedded risk premia.

Firms might also attempt to ease the informational disadvantage of outsiders and reduce the cost of information asymmetry by becoming more transparent. The theory of relationship lending proposes that cost reduction is viable if a firm builds close ties to non-anonymous loan officers of their house bank(s) (e. g. Ongena and Smith 2001, Cosci, Meliciani, and Sabato 2016). However, building relationships to reduce costs is rather difficult or impossible if the bank uses transaction-based lending based on collateral, or if the funding comes from many anonymous capital markets' investors. Both the pecking order theory and the theory of relationship lending propose that market-based finance is not a complete substitute for bank-based finance if firms are highly opaque and use primarily intangible instead of tangible assets. Informational opaqueness depends on firm size, with the smallest firms being the most opaque. Accordingly, the cost of tapping the capital market should be the highest for small firms and the lowest for large firms.

Newly formed innovative firms are also ascribed a particularly high degree of informational opaqueness. In addition, because innovative firms invest primarily in human capital they lack the collateral essential for transaction-based lending (Cecchetti and Kharroubi 2015, Schäfer et al. 2017). This, in turn, increases the cost of financing from capital markets, and innovative firms may only demand it if other funds are exhausted or not available. In the light of these theoretical considerations the question arises whether the ambitions of the Capital Markets Union match sufficiently with the funding behavior of small and innovative firms.

In an attempt to improve the evidence about the actual funding behavior of innovative firms, we conduct a case study for Germany. First, we explore the explanatory power of the pecking order theory for observable financing patterns of innovative firms. Second, we study how funding patterns differ before and after the financial crisis, and whether firms face harsher constraints in financing investments and innovation activities in the post-crisis period. The data for our case study are from the Mannheim Innovation Panel (MIP).

2 Financing patterns of innovative German firms

2.1 Data

The MIP is a representative firm survey on innovation activity. Commissioned by the German Federal Ministry of Education and Research (BMBF), the Center for European Economic Research (ZEW) has used the MIP survey to collect data on innovation in Germany since 1993.[4] Among other things, the data base allows us to examine the funding behavior of innovative corporations. We use the 2007 and 2014 wave in our case study. The waves cover the years 2004–2006

4 MIP is the German contribution to the annual European-wide Community Innovation Surveys (CIS), which provide essential information about new products, services, and processes, innovation input, and ways to achieve economic success with new products, services, and improved processes.

and 2011–2013, respectively. The 2007 wave is representative for about 243,000 companies with sales of more than 3.750 billion euros and some 14.5 million employees, and the 2014 wave is a representative sample for about 278,000 companies with sales of approximately 5,200 billion euros and some 15.2 million employees (Rammer und Schmiele 2008, Rammer und Peters 2015).

Among other innovation issues such as, type of innovation (product or process innovation), innovation expenditure and number of R&D employees, the MIP addresses the firms' funding patterns and issues that arise when conducting innovation and general investment projects. The MIP survey attempts to establish existing patterns by offering the respondents a choice between ten different funding sources, with the possibility of multiple appointments. In addition, the survey poses two questions intended to identify financial constraints via a so-called "ideal test". The test is supposed to measure funding gaps for innovation and investment by observing what a company would do if offered additional funds (Hall 2005). The first question asks how the company would use unexpectedly given, additional own funds of 10 percent of the last annual turnover. The other question asks what a company would do with an additionally available cheap loan of the same size. If a firm indicates it would use one or both sources for either innovation or investment projects, that firm can be seen as financially constrained. We use both pieces of information, the menu of funding sources in use and the indicators of financial constraints, to explore the question of whether the solutions offered by the CMU action plan (reducing firms' bank-dependence and expanding the menu of available funding options from capital markets) match the observable funding patterns and financial constraints of firms, before and after the financial crisis.

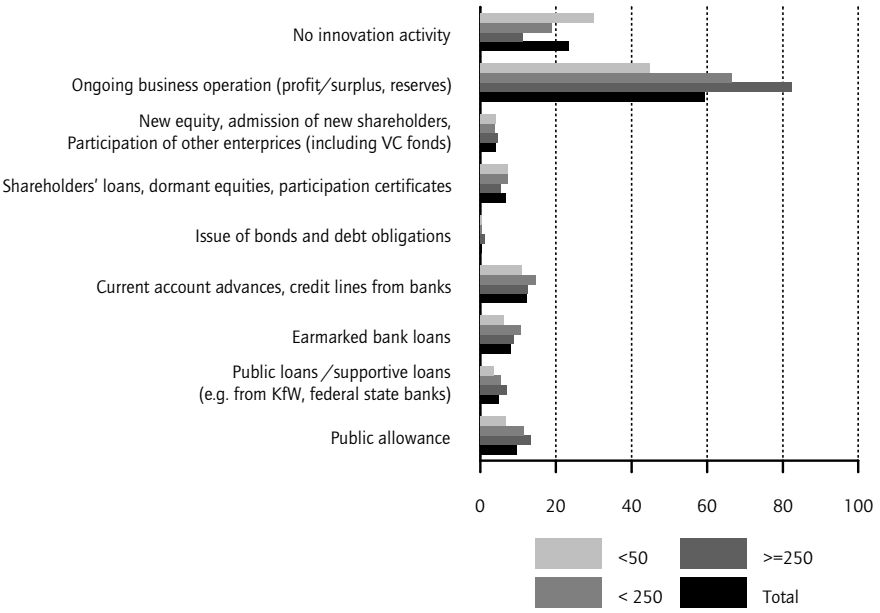
2.2 Sources in use for funding

2.2.1 Innovation activities

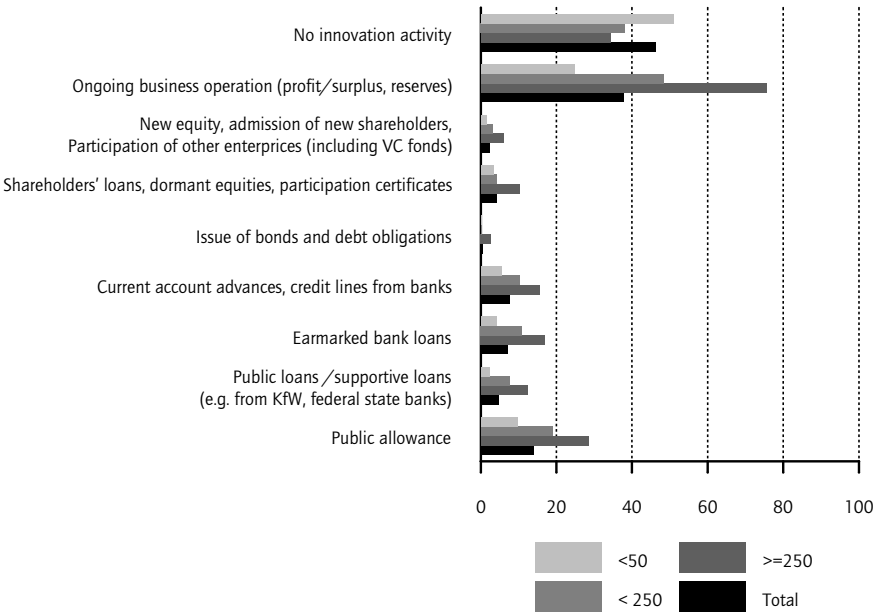
We differentiate between small, medium-sized and large firms. Small firms are those with less than 50 employees, medium-sized firms those with equal or above 50 employees and large firms those with more than 250 employees. During the 2004–2006 period (before the crisis), about 45 percent of small, 67 percent of medium-sized and about 82 percent of large firms indicated they used own internal funds to finance innovation activities. When answering the equivalent question in the 2014 wave (after the crisis), own funds were used by only about 25 percent of small, 48 percent of medium-sized and 75 percent of large firms. Despite lower percentages in the post-crisis period, internal funds maintained its top rank across all firm sizes as the first choice from among all possible funding sources (Figure 1 and 2). Following internal funds, the second and third choices are subsidized financial instruments (public allowances/grants and public/supportive loans) and borrowing from banks (credit lines and ear-marked bank loans) (Figure 1 and 2). This ranking is consistent with the pecking order theory. Bank lending lost its second rank held in the pre-crisis period to subsidized instruments. In particular, the presumably more expensive credit lines lost importance in the post-crisis period. Only about 8 percent of all firms indicated that they employed this source compared with more than 12 percent before the financial crisis. The difference between the pre-crisis and post-crisis period is lower for ear-marked bank loans than for credit lines. Remarkably, plain public subsidies are much more important in the post-crisis period for large and, to a lesser extent, for small firms. After the financial crisis, a higher political willingness to support firms and extremely low interest rates (Laaser and Rosenschon 2016) has increased both the supply and demand of public allowances/grants.

Figure 1*

Innovation activity: firms' financing source 2004–2006



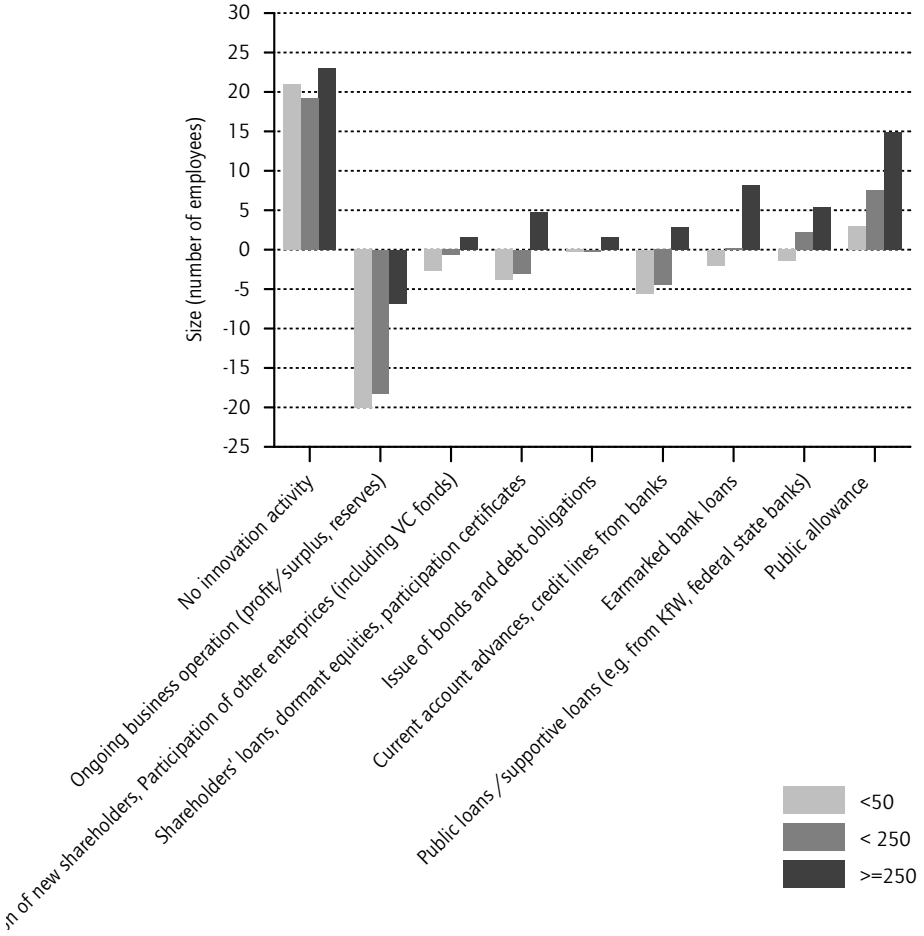
2011–2013



* The Figures do not show factoring/leasing/loans from suppliers since selecting this option was only possible in the 2014 survey but not in the 2007 survey.
Source: ZEW—Mannheimer Innovation Panel, waves 2007 and 2014, own calculations.

Figure 2

Differences in funding innovation activity 2011–2013 versus 2004–2006



Source: ZEW—Mannheimer Innovation Panel, waves 2007 and 2014, own calculations. Bars in the negative territory indicate that the percentage of respondents stating to have employed the specific source is lower in the 2014 wave than in the 2007 wave.

A variety of external funding sources became more important for large firms during the 2011–2013 period when compared to the 2004–2006 period. Larger firms usually have more resources to spend for improving accounting, auditing and balance sheet transparency. Therefore, in principle, lower opaqueness enables large firms to better access the capital markets. Despite this advantage, usage of these instruments was rather modest in the post-crisis period compared to own funds and subsidized instruments. Among small firms all funding sources lost importance in the post-crisis vis a vis the pre-crisis period except public allowances and grants. In sum, the revealed funding patterns for innovation activities imply that market-related financing such as

increases in equity inclusive VC, dormant equity and loans from shareholders and issuance of bonds remain niche-financing tools in the post-crisis period.

2.2.2 Investment activities

Although firms follow largely similar funding patterns when investing in replacement and expansion as used to finance innovations, there is one important difference (Figure 3 and 4). Across all firms, bank sources (current account advances, credit lines from banks, ear-marked bank loans) are more important for funding general investment than for funding innovation activities. Remarkably, bank sources used for financing investment activities are more frequently referred to in the post-crisis period than in the pre-crisis period.

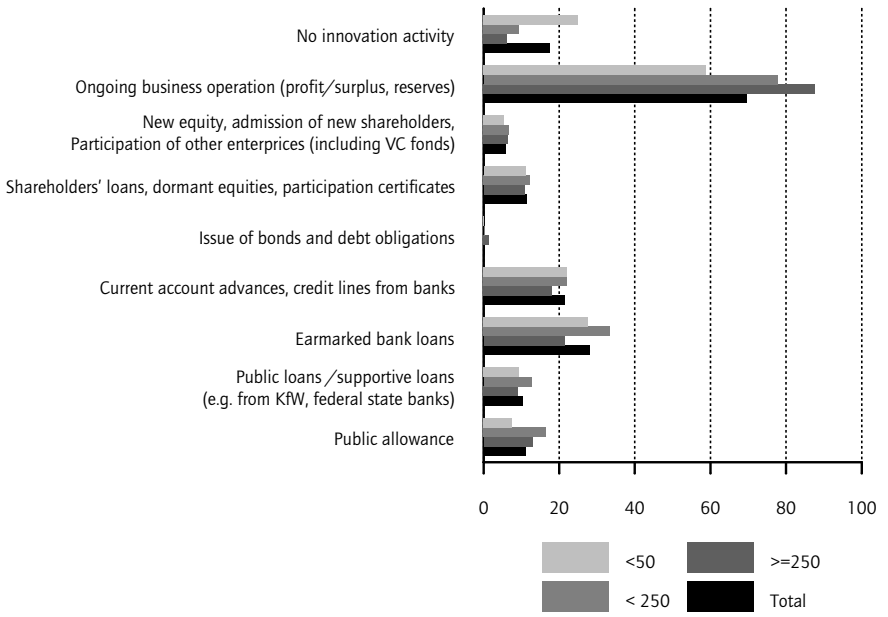
Using cash flows from ongoing business operation to fund innovation activities is the source most frequently mentioned in both the pre-crisis and the post-crisis surveys. The surveys also indicate a substantial increase in the use of subsidized funding sources for innovation activities. Issuing bonds is the least important financial instrument, mentioned by less than one half percent of small and medium-sized firms. For small and medium-sized firms, new equity is less important in the 2011–2013 period than in 2004–2006. Shareholder loans and dormant equity lost importance for small firms, but gained importance for medium-sized and large firms. By and large, during both the pre-crisis and post-crisis wave, market-related instruments, such as loans, shareholder equity or issuance of bonds, play a minor role when compared to own funds, subsidized sources and bank financing. The only exception is with large firms, who state market-related instruments more often in the post-crisis period.

Financial constraints exist if a firm owning profitable investment or innovation projects does not have enough own funds to conduct those projects and is unable to get the needed funds from outside, either from banks or from capital markets. The MIP allows us to assess whether firms face different financial constraints in the post-crisis than in the pre-crisis period (Hottenrott and Peters 2012). The firms in both waves were asked what they would do if they had "at their disposal an unexpected additional profit or additional equity capital of 10 percent of last year's turnover". The respondents could select among *Implementation of (additional) general investments, Implementation of (additional) innovation projects, Retention/accumulation of reserves, Payout of proprietors (incl. repayment of shareholders' loans), Payment of liabilities (e.g. payment of bank credits, supplier credit) or No estimation possible*. Choosing one of the four latter alternatives would indicate that the firm did not have financial constraints, and the respondents have no innovation or investment project at hand worthy of being realized. In contrast, respondents selecting one of the first two options reveal that they own such projects and that they are financially constrained.

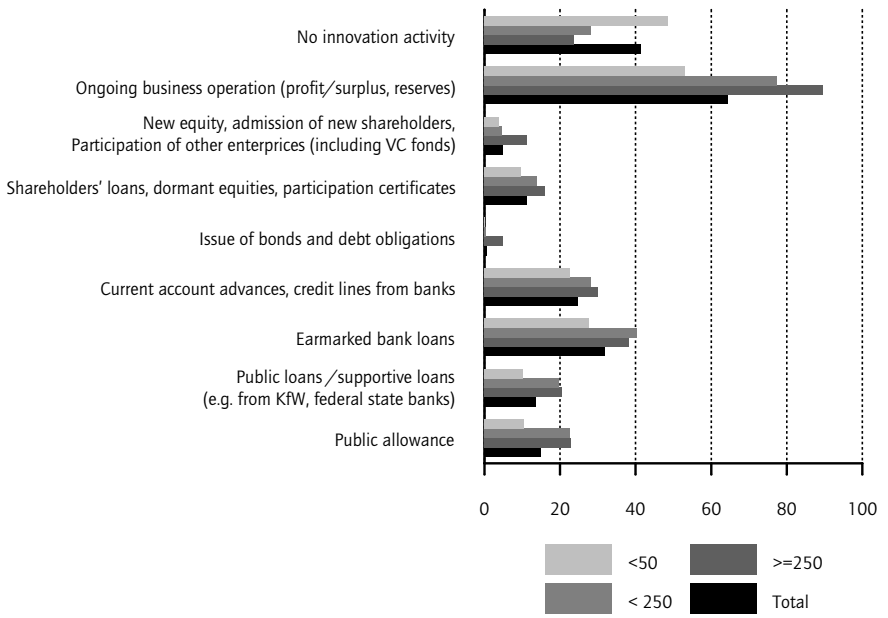
For the pre-crisis period about 50 percent of small, 45 percent of medium-sized and 41 percent of large firms indicated a willingness to invest additional internal funds in investment projects, and more than 19 percent, 22 percent and 28 percent, respectively, wanted to spend such funds for innovation. The percentages were remarkably lower in the 2014 wave, after the financial crisis (Figure 5 and 6). This evidence indicates that the financial crisis did not exacerbate constraints in financing investment and innovation projects. On the contrary, a higher percentage of firms appear to have no profitable investment or innovation project waiting to be realized with the offered additional internal funds.

Figure 3*

Investment activity: firms' financing source 2004–2006



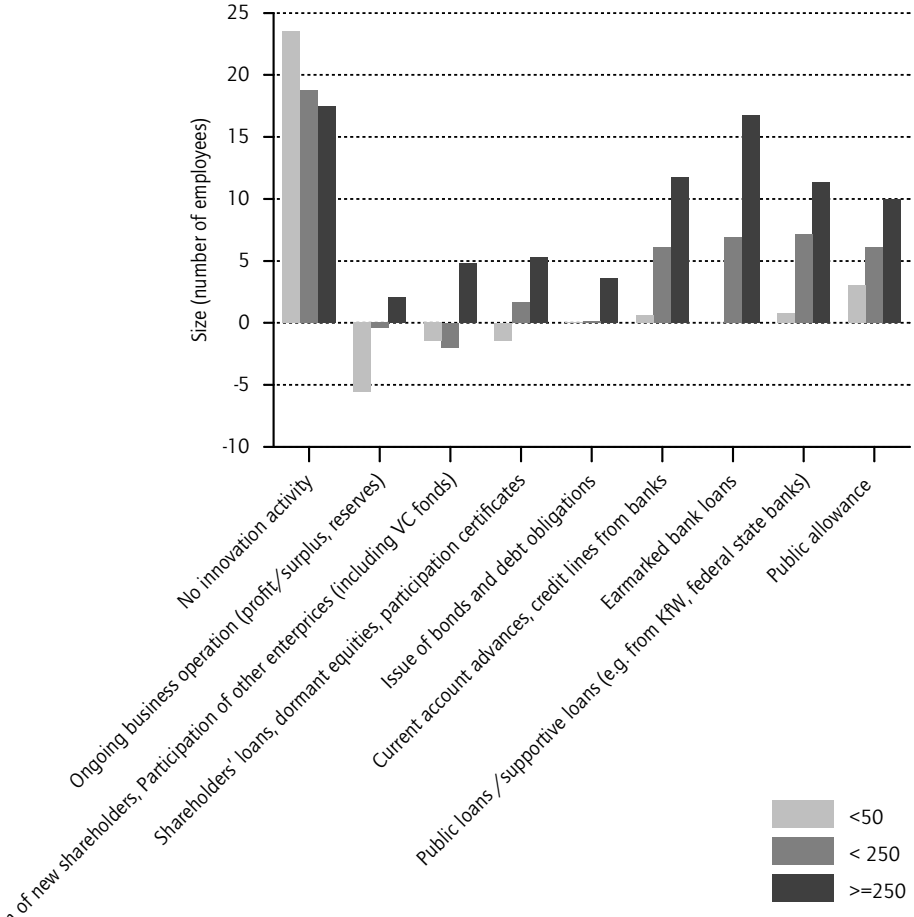
2011–2013



* The Figures do not show factoring/leasing/loans from suppliers since selecting this option was only possible in the 2014 survey but not in the 2007 survey.
Source: ZEW—Mannheimer Innovation Panel, waves 2007 and 2014, own calculations

Figure 4

Differences in funding investment activity 2011–2013 versus 2004–2006

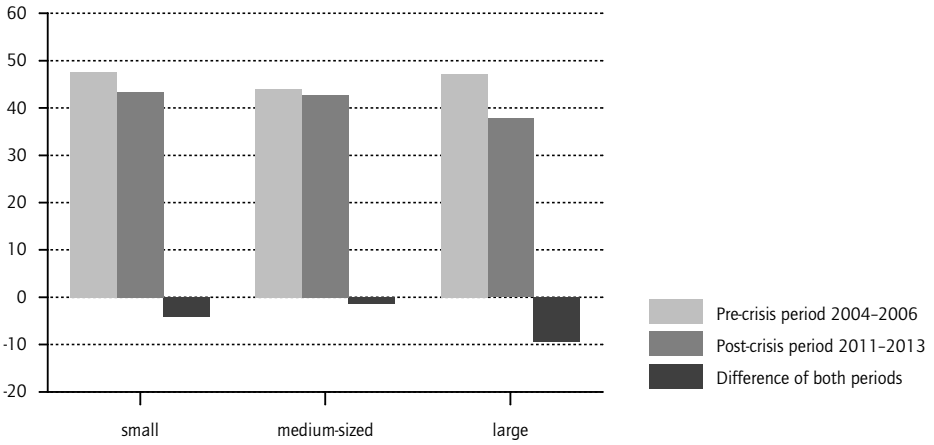


Source: ZEW—Mannheimer Innovation Panel, waves 2007 and 2014, own calculations. Bars in the negative territory indicate that the percentage of respondents stating to have employed the specific source is lower in the 2014 wave than in the 2007 wave.

A closer look at the various firm sizes reveals that, in particular, the share of small and medium-sized firms suffering from unrealized, but profitable investments projects has gone down in the post-crisis period (Figure 5). The data for innovation projects, however, tells a different story. While the share of large firms showing financial constraints is considerably smaller in the post-crisis period when compared to the pre-crisis period, a slightly higher percentage of small and of medium-sized firms indicate owning profitable, but unrealized innovation projects in the post-crisis period (Figure 6).

Figure 5

Willingness to invest additional internal funds in investment projects
2004–2006 versus 2011–2013, in percent



Source: ZEW – Mannheimer Innovation Panel, waves 2007 and 2014, own calculations.

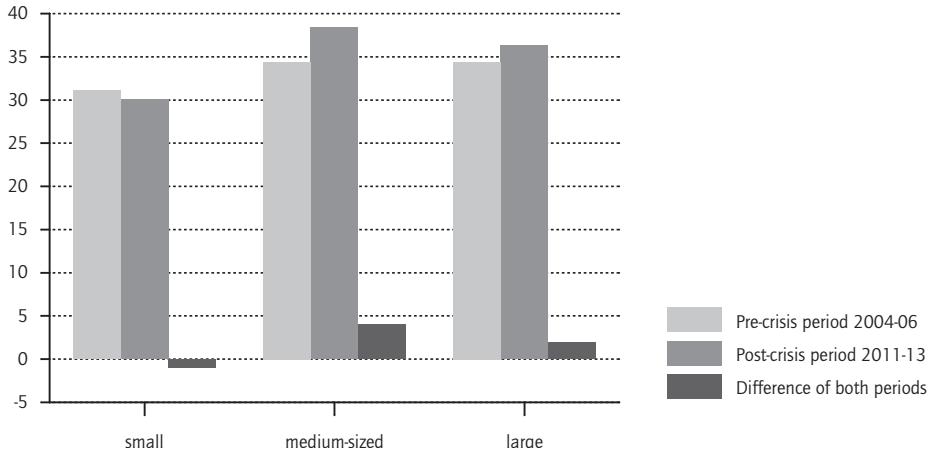
In a second question, the company was asked if it has potential but so far unrealized projects yielding a return above a rather moderate interest rate on a loan.[5] In general, when compared to using cheaper additional own funds, a lower share of firms indicated a desire to use cheap credit to fund innovation and investment projects waiting for realization. This ranking is consistent with the pecking order theory, which suggests that higher costs for available funds reduce demand. It is only when specific funding instruments satisfy other preferences, such as the preference for being independent from investors, that there may be a compensation for higher costs. For example, the fairly high popularity of rather expensive credit lines may have its roots in the desire to avoid interference of investors in the company's decisions.

Across all size classes, the percentage of firms opting to use cheap loans to finance investment or innovation activities is lower in the post-crisis than in the pre-crisis period. This evidence implies that, after the crisis, a lower share of firms is financially constrained. By and large, the descriptive statistics of the "ideal test" propose that financial constraints are less prevalent and less severe in the post-crisis period than they were in the pre-crisis period. This observation could also indicate that the demand side (represented by the firms) and not the supply side (represented by menu of financial instruments offered by banks and capital markets) shapes the observed financing patterns. In this case broadening the menu of financial instruments would not change the firms' financing behavior.

5 The question reads as follows "Assuming, instead of the unexpected additional profit/additional equity capital mentioned above, your company had access to a credit of the same amount and with a comparatively attractive interest rate. Would your enterprise in this case implement the considered investments/innovation projects as well? (1) Yes, implementation of general investments is very probable/Yes, implementation of innovation projects is very probable. (2) No, rather unlikely. (3) Estimation impossible.

Figure 6

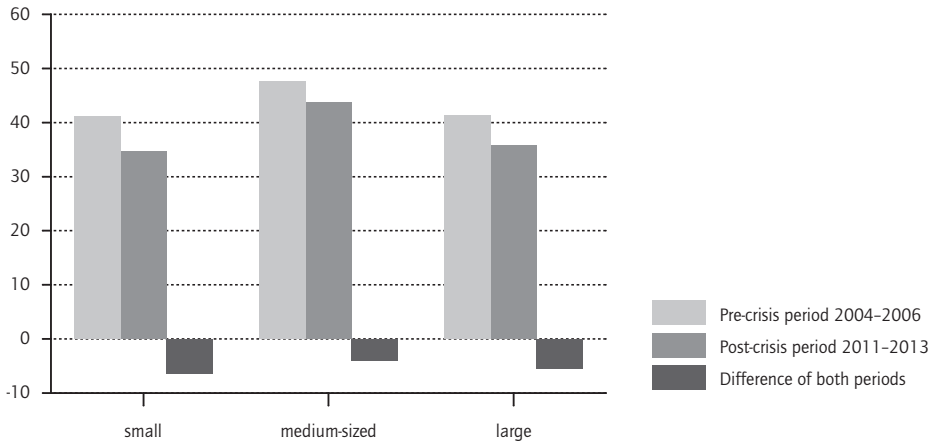
Willingness to invest additional internal funds in innovation projects
2004–2006 versus 2011-2013, in percent



Source: ZEW—Mannheimer Innovation Panel, waves 2007 and 2014, own calculations.

Figure 7

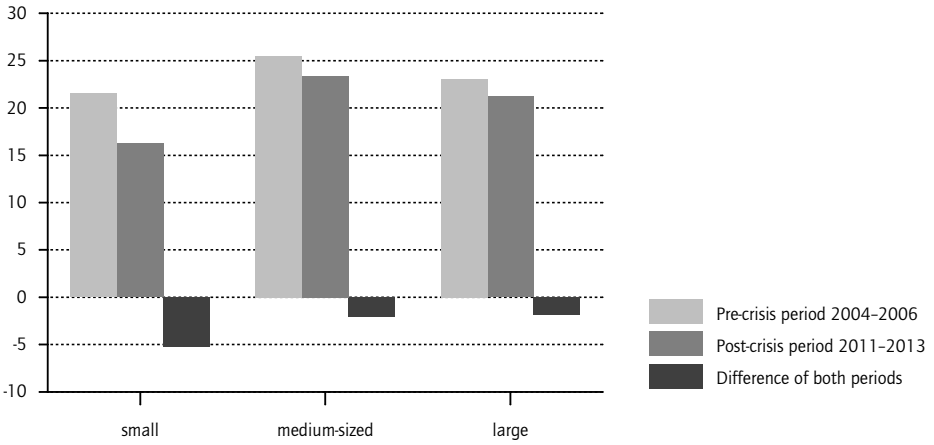
Willingness to invest an additional cheap loan in investment projects
2004–2006 versus 2011–2013, in percent



Source: ZEW—Mannheimer Innovation Panel, waves 2007 and 2014, own calculations.

Figure 8

Willingness to invest an additional cheap loan in innovation projects
2011–2013 versus 2004–2006, in percent



Source: ZEW—Mannheimer Innovation Panel, waves 2007 and 2014, own calculations.

3 Discussion of the impact of CMU on financing innovations and investment in Germany

The funding patterns observed in the MIP suggest that capital market products, or products that are closely related to capital markets, are of low importance in financing general investment and innovation activities of German SMEs. By and large, this finding holds for both the pre-crisis and the post-crisis period, implying that the financial crisis left these patterns unchanged. In principle, an observed funding pattern could be either the result of a firm's choice, or the result of restrictions on the supply side. It is important to note that the CMU action plan is a cure for the latter scenario only.

If the firms' preferences are decisive for determining what specific financing instruments are used, implementing the CMU action plan would not change the fundamentally niche-financing characteristic of alternative sources for German innovative firms. These alternative sources might include: asset-based lending, leasing, factoring, crowdfunding, private placement, private equity, venture capital, or capital from business angels. From this perspective, it is questionable whether better developed capital markets and a *"more diversified set of options"* (European Commission 2017: 4) would have made up for the reduction of bank lending during the financial crisis. If observed patterns reflect the preferences of German firms, CMU would not affect the way SMEs fund their activities. One caveat of our study is, of course, that we provide evidence only for German firms. It is possible that the situation of firms in other EU countries is different, and thus those might benefit more from the CMU action plan than German SMEs.

Because the model for the European plan to establish a CMU is the market-based US system, it is worthwhile to note, that bank credit is considered to be quite special for SMEs in the United

States. *"Bank credit is one of the primary sources of external financing for small businesses—especially Main Street firms—and is key to helping small firms maintain cash flow, hire new employees, purchase new inventory or equipment, and grow their business"* (Mills and McCarthy 2016: 5). The 2015 and 2016 Small Business Credit Survey conducted by seven US Federal Reserve Banks indicate that loans and credit lines are the most sought-after financing products. Ninety percent of the respondents in the 2015 survey, and 86 percent in the 2016 survey, showed an interest in these very sources of financing, followed by credit cards with 30 percent in the 2015, and 31 percent in the 2016 survey (Federal Reserve Banks 2016 and 2017). The 2016 survey also reports that *"Successful applicants were most satisfied with small banks and credit unions"* (Federal Reserve Banks 2017: 17).

The structures of national banking systems are very different across European Union member states. The importance of those specific structures on the particular region's real sector stability, innovative capacity, productivity and growth is poorly understood. More research focusing on determining the complementarity of industrial structures and banking systems in member states and regions is necessary. It is therefore crucial, that CMU is designed as a complement rather than a substitute for existing national banking systems. In addition, the impact of increasing numbers of SMEs using financing channels outside the regulated banking sector on the sector's stability needs to be clarified. Research on this issue is still scarce. As long as there is no conclusive evidence in these areas, the CMU action plan needs to ensure that existing preferred financing channels for SMEs remain unaffected.

4 Conclusion

The purpose of our analysis is to assess whether the aims of the European CMU action plan compliment the funding behavior of German SMEs when they seek financing for innovation and investment activities. Using firm data from the Mannheim Innovation Panel, we observe fairly stable funding patterns over the years and a reluctance of firms to rely on capital market-related financing products. In addition, we find no indication that financial constraints have become more severe in the post-crisis period. In the light of this descriptive evidence, we propose that observed funding patterns are the result of firm owners' preferences rather than a consequence of restrictions from the supply side. Our study suggests that if the CMU achieves its central goal of widening the funding mix (provided that the CMU does not impair traditional financing channels), the funding behavior of German SME will be unaffected. Given that the funding preferences of SMEs will determine whether the substantial efforts made in establishing the European Capital Markets Union are cost beneficial, more research on those preferences and on the specific structure of a region's financial system is key.

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