ATTITUDE TOWARDS INNOVATION AND BARRIERS IN CAPITAL ACCESS

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The goal of the study is to verify whether there is a relation between a company's declared innovation strategy and declared problems with access to capital. The research is based on a survey that covers more than 400 companies operating in Poland. Beside the self-assessment approach to evaluation of financial constraints and level of innovativeness of the company, an analysis of financial data was employed in the study. Chi-squared, Welch's t-test, ANOVA and the ordered logit model were used to test the hypotheses. It was proved that there is relation between innovation strategy and financial constraints. The firms that are moderate innovators are financially constrained more than strong innovators, which can be linked with their better financial condition. Research confirms also that SMEs are still in a worse position compared to large enterprises in the area of access to different sources of capital. Secondly, innovative companies are exposed to additional difficulties in raising funds successfully, which confirms the validity of the used dedicated tools as a subsidy by authorities.

Keywords: innovation; funding; SME; innovation strategy; access to capital
JEL classification: G30, G320, O300

1. Introduction

Innovations are essential to each country. They help to raise the competitiveness of the economy and achieve higher GDP growth. Thus policymakers pay a lot of attention to innovation policy and design tools (e.g. grants) that stimulate the innovativeness of companies, especially those small- and medium-sized ones. Nevertheless, there is evidence, however mixed, in the literature that innovativeness may worsen access to capital for SMEs compared to large entities. Most studies confirmed a "funding gap" for all SMEs; however, the situation is changing all the time, due to policy efforts to improve access to capital for SMEs, especially innovative ones. Substantial funds are allocated in programs alleviating access to capital for SMEs and innovative firms in the European Union, so it is important to monitor whether those groups are really financially constrained, which would justify public expenditure for this purpose.

The goal of this paper is to verify whether innovative companies have worse access to capital than non-innovative ones in emerging markets such as Poland, and then check how the size of a company impacts access to capital for enterprises with different attitudes towards innovation.

This paper is organized as follows. First, a short literature review is presented and hypotheses are formulated. Then, in section 3, the methodology is overviewed and in section 4 results are presented. The relation between innovation strategy and access to

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capital is discussed, also taking into account the financial situation of the examined companies. Finally, concluding remarks are presented.

2. Literature Review

On the theoretical level, possible credit rationing problems have been indicated by Stiglitz and Weiss (1981) and Myers and Majluff (1984), whereas on the empirical level, the first study focusing on financing constraints for capital investment was carried out by Fazzari, Hubbard, Petersen, Blinder, & Poterba (1988). This research has been the impetus for further studies and stream of research has focused on investments in intangible assets, which are a feature of innovative firms and potentially a company with this type of investment is exposed to higher financial constraints. Part of this research gave evidence that R&D activity may be sensitive to cash-flow changes (Cincera & Ravet, 2010). Further studies are ambiguous and part of them confirm definitively the existence of financial constraints, particularly with regard to small and innovative companies (Bartoloni, 2011; Brown, Martinsson, & Petersen, 2012; Hall, 2010; Lee, Sameen, & Cowling, 2015; Madrid-Guijarro, García-Pérez-de-Lema, & Van, 2016; Ughetto, 2008), but some do not (Jia Wang, Paul Robson, & Mark Freel, 2015; Mina, Lahr, & Hughes, 2013).

There are two key issues in these studies – proxy for financial constraints and proxy for innovation. Part of the empirical literature employs the sensitivity of investment in R&D to cash-flow changes (Carreira & Silva, 2010). Other possibilities are cash holding, financial ratios related to liquidity and debt (Czarnitzki, Hall, & Hottenrott, 2014; Lööf & Nabavi, 2016) and approach based on firms' self-assessments (Savignac, 2008). Going to the proxy of innovation should be mentioned inter alia patents granted (Battagion & Tajoli, 2000), yearly R&D expenditure or the share of this type of expense in the operating revenue (Del Monte & Papagni, 2003; Ughetto, 2008), but also type of innovation (Madrid-Guijarro et al., 2016) or strategy (Jordan, Lowe, & Taylor, 1998).

Taking into account the literature review, we formulated two hypotheses.

First, we expect that:

H1. Companies declaring a positive attitude towards innovation are financially constrained compared to their non-innovative peers.

Since the size of firm is an important factor in capital access considering the above cited research, then, we expect that:

H2. Small and medium-sized firms (especially those declaring an innovative attitude) report problems with capital access, compared to their large peers.

3. Methodology

A sample of 409 companies operating in Poland in five industries (Manufacturing, Construction, Trade, Transport and Information) was employed to test the above formulated hypotheses. The survey (interviews) was conducted in 2015. Respondents in charge of the areas of innovation or finance were selected from the upper-management level.[1]

1 The presented research is a broader study on financing innovation in SMEs. The same sample was or will also be used to prove other hypotheses based on other parts of the sample which are presented in previous and forthcoming articles.

The aim of the survey was to collect information on innovative activity from one side, and financing decisions from the other side. Most of the companies are small and medium-sized entities (89%); however, also data on large companies was collected. Finally 162 companies up to 49 employees (40%), and 199 with the number of employees between 50 and 249 (49%) took part in the survey. The control group includes 48 large entities with a number of employees greater than 250 (11%). Because the survey also assumes use of financial data, the respondents were randomly selected from a financial database, but the structure of companies was controlled based on size of company and industry.

In the presented research, two questions from the survey were analyzed. The first refers to the declared attitude towards innovation. Companies could indicate one of three strategies: neutral, occasional and pro-innovative. The first choice, a neutral strategy, means that the company is not inclined to launch innovation at all. The second possibility, the occasional strategy, was chosen by companies in the case when innovations are not priority for them, and they do not run continuous action to bring innovation to the market. Innovations in this strategy are rather introduced “by the way" of various projects, or they are a necessity. Finally the last strategy, called “pro-innovative” was indicated by the companies which are constantly doing research, and innovation is a priority for them and plays an important role in the company's strategy.

The structure of the sample takes into account the size of a company and innovation strategy, and shows that the “innovation on occasion” strategy dominates in SMEs, whereas half of the large entities declared “pro-innovative” strategy (Table 1). The choice of innovation strategy differs statistically between SMEs and large companies (p-value – 0.82%).

Table 1 | Structure of sample - strategy – SME vs large

	Innovation - neutral	Occasional innovation	Pro-innovative	Total
SME	78 (22%)	181 (50%)	102 (28%)	361 (100%)
Large companies	6 (13%)	18 (38%)	24 (50%)	48 (100%)
Total	84	199	126	

Source: own elaboration.

The second analyzed question is the direct (subjective) proxy for financial constraints – problems with capital access. Respondents were asked “To what extent access to capital (funding) is an important factor hindering the development of the company?”. The answers were ranged with five ordinal response categories (Likert-scale): 1 - it is no problem, 2 - slight problem, 3 - moderate problem, 4 - significant problem, 5 - very serious problem. The structure of the answers for the whole sample and separately for SMEs and large companies is presented in Table 2.

Table 2 | Access to capital as a problem in the sample

Scale	Number	Answers structure - All	Answers structure SMEs	Answers structure Large
1 - it is no problem	81	19.8%	19%	25%
2 - slight problem	143	35.0%	34%	40%
3 - moderate problem	136	33.3%	34%	29%
4 - significant problem	48	11.7%	13%	6%
5 - very serious problem.	1	0.2%	0,28%	0%
Total	409	100%	100%	100%

Source: own elaboration.

The structure of answers was analyzed with chi-square and t-Welch's test which allowed us to check whether differences in answers between groups of companies that have different a innovation strategy are statistically significant. Similar methods were used to check whether there is a difference between large organizations and SMEs in this area. Also ordered logit model was employed to verify the hypotheses. The author used also financial data to check whether the financial situation may impact the results based on the self-assessment approach. The ANOVA test was employed in this part of the research.

4. Results

4.1 Innovation Strategy and Access to Capital

Welch's t-test (adaptation of Student's t-test) was employed in the first step – a two-sample location test to check the hypothesis that two populations have equal means. Average difficulty in accessing capital for each sub-group isolated based on strategy was calculated, assigning values of 1 to 5 for each answer in the Likert scale and then average values were compared using Welch's t-test (Table 3). The results show that there is no statistical difference between the mean of answers in groups of companies with different innovation strategy, whereas there is a statistically important difference between SMEs and large entities. However, lack of difference in average value of answers does not mean the lack of difference in distribution of answers. Then, the next step was to compare the structure of answers for the three options of innovation strategy.

The first look at the distribution of answers gives reason to suppose that there is a significant difference between companies declaring different attitudes towards innovation (Table 4). Only 16% of companies that declared a "pro-innovative" strategy and 15% with an "occasional" strategy have no problems with access to capital, whereas in the group of companies with a "neutral" strategy (non-innovative), it was 37%. However, surprisingly most "pro-innovative" firms (50%) indicate that finding capital it is slight

problem (2). It could be a link with a sample structure – the "pro-innovative" attitude was often chosen by large entities, which mainly indicated that access to capital is a slight problem for them. The group of companies that declared an "occasional" strategy seems to be more constrained than "pro-innovative" firms.

Table 3 | Welch's t-Test

Strategy	X1	X2	SD1	SD2	n1	n2	DoF	T emp	p-value
Neutral (X1) vs Pro-innovative (X2)	2.27	2.32	1.32	0.82	84	126	126	0.27	78.71%
Neutral (X1) vs occasional (X2)	2.27	2.46	1.32	0.72	84	199	105	1.20	23.19%
Pro-innovative vs occasional	2.32	2.46	0.82	0.72	126	199	241	1.57	11.80%
SMEs vs LARGE	2.40	2.17	0.89	0.76	361	48	65	1.99	5.14%

Note: X – mean, SD – standard deviation, n – number of observations, DoF – degrees of freedom; T emp – empirical t

Source: own elaboration.

Table 4 | Innovation strategy and access to capital – sample structure

Strategy	1	2	3	4	5	Total
NEUTRAL	37%	18%	26%	19%	0%	84
OCCASIONAL	15%	33%	44%	9%	0%	199
PRO-INNOVATIVE	16%	50%	21%	12%	1%	126

Note: Likert-scale: 1 – "No problem" to 5 – "Very serious problem".

Source: own elaboration.

The differences between answers for each strategy ("neutral" vs "occasional" vs "pro-innovative" and each pair of strategies) were statistically significant, which means that the company's innovation strategy may have an impact on the subjective assessments of problems with access to capital.[2]

However, according to the literature review, the size of a company may have an important impact on the problems with capital finding, thus the answers were also analyzed separately for each innovation strategy in the group of SMEs and large entities. The results of the chi-square test confirmed that answers inside the companies with "neutral" and "occasional" and "pro-innovative" strategies did not differ between SMEs and large companies.

2 Results of the chi-square test are not presented in the paper due to page limitations, but are available upon request.

The ordered logit model was used in the next step of the research for the whole sample (Table 5). The control variables were chosen based on the literature review, and the results of previous studies (Prędkiewicz & Prędkiewicz, 2015). The following variables were employed: age of company (AGE), debt to capital ratio (DEBT2), operational margin (EBITDAmargin), industry and company size.

Based on analysis of model 1 (Table 5), it could be concluded that companies which declared the "occasional" strategy are more financially constrained (coefficient is positive and statistically important) compared to the reference group, which includes companies with a declared "pro-innovative" strategy.

Table 5 | Ordered logit models – all companies

	Model 1	Model 1
	coefficient	p-value
AGE	0.012	0.01286**
DEBT2	0.736	0.23195
EBITDAMargin	0.012	0.14124
STRATEGY_NEUTRAL	0.017	0.95474
STRATEGY_OCCASIONAL	0.403	0.05589*
STRATEGY_PROINNOV	(reference group)	-
Industry, size	Included	
cut1	−0.499	0.38501
cut2	1.164	0.04345**
cut3	2.992	<0.00001***
cut4	7.022	<0.00001***
Number of cases 'correctly predicted'	156 (38.7%)	
Likelihood ratio test	Chi-square(12) = 119.9 [0.0000]	
Observation	403	

Dependent variable: ACCESStoCAPITALasPROBLEM (from 1 to 5). Control variable: AGE of company; DEBT2 – Debt/(Shareholder's Equity + Debt); EBITDAMargin - earnings before interest, tax, depreciation and amortization (EBITDA) divided by total revenue;

Standard errors based on Hessian

Source: own elaboration.

To compare whether there are differences between SMEs and large companies in the impact of innovation strategy on access to capital, separate logit models for SMEs and large firms were built (Table 6). It occurs that innovation strategy only impacts the

evaluation of problems with capital access in SMEs (model 2), but not in large companies (model 3). The coefficient for "occasional strategy" (model 2) is in line with the previous model 1, and is positive, which means that SMEs declaring an "occasional strategy" are financially constrained more than the reference group with a "pro-innovative" strategy.

Table 6 | Ordered logit models – SMEs and large companies

	Model 2 SME	Model 3 Large
	coefficient	coefficient
AGE	0.006	0.024**
DEBT2	0.751	1.352
EBITDAMargin	0.011*	0.064*
STRATEGY_NEUTRAL	0.087	–0.746
STRATEGY_OCCASIONAL	0.422**	0.498
STRATEGY_PROINNOV	-	-
Industry, size		
cut1	0.644	0.829
cut2	2.295***	2.818
cut3	4.091***	5.405**
cut4	8.059***	-
Number of cases 'correctly predicted'	148 (41.7%)	24 (50.0%)
Likelihood ratio test	103.814 [0.0000]	23.2327 [0.0057]
Observation	355	48

Note: dependent and control variables as in the Table 5.

Source: own elaboration.

4.2 Innovation Strategy and Financial Ratios

The above presented results raise a question whether companies in the sample (especially SMEs) which declared a "pro-innovative" attitude just have a better financial situation and enough internal generated funds to finance their projects, so they do not report problems with capital access. In this section, this issue is addressed.

The financial data are calculated for the year 2013 for all interviewed companies (Table 7) based on the financial statement collected from the Amadeus database. The first look at the ratios gives reason to believe that the financial situation of "pro-innovative" companies in the research sample could be better than other groups. The companies with a "pro-innovative" strategy achieved higher means of EBITDA margin than those with

"occasional" and "neutral" strategies, so they are more profitable and are able to generate higher internal cash flow than the rest of the sample, thus explaining the above results. What's more, EBITDA margin is the most diverse for companies with an "occasional" strategy (higher standard deviation compared to other strategies), which can also explain the previous conclusion – diverse profit margin means that in the sample there is a group of companies with worse profitability and also the possibility of profit accumulation.

Further, when we look at growth of assets (GRT ASSETS), the higher mean is observed for "pro-innovative" companies compared to the peer groups, which may confirm that their financial condition is better than in the two other groups. What's more, the sales revenue growth is higher for companies with an "occasional" strategy (6.6%), whereas for "pro-innovative" the sale increased only 2%. It could be also explained that due to higher revenue growth, capital requirements are higher for this group ("occasional" strategy), so those companies apply more frequently than the rest of the groups for external funds and they can, at the same time, be exposed to problems with capital finding. The two other synthetic profit ratios (ROA and ROE) are much lower in companies with an "occasional" strategy than in companies with a "neutral" and "pro-innovative" strategy, and the group is internally differentiated.

Finally, two debt ratios were calculated for the examined companies. The first ratio is relation of total debt (also accounts payable) to total assets (DEBT1). The second ratio (DEBT2) takes into account only interest-bearing debt to total assets. All debt ratios are much higher in the case of companies declaring a "neutral" strategy, e.g. DEBT2 is 23.8% for companies with a "neutral" strategy, whereas 18.3% for "occasional" and 17.5% for "pro-innovative" firms.

The conclusion from this part of the financial analysis is that companies declaring one of two innovative strategies are, to a lesser degree, indebted. The explanations of this situation may be at least two. The first is that the innovative firms are financially constrained, even though they declare that they are not. The second reason is that innovative companies have a higher profit rate (Schumpeterian rate), which helps them to accumulate higher external cash flow and the internal funds are sufficient to develop a different project. According to pecking order theory, they do not apply for external capital because they rely on internal funds, so they report smaller problems with capital access. This second explanation could be true in relation to companies in the third "pro-innovative" group, which have better a financial situation than the companies declaring a "neutral" and "occasional" strategy. The results from model 1 (Table 5) could be interpreted as that innovativeness impacts the access to external capital. However, the "pro-innovative" strategy was indicated by companies with better profitability, so they have more internal generated funds available and are better evaluated by external capital suppliers. Whereas the "occasional" strategy was pointed by enterprises with lower and more unstable profitability, so also was a lower ability to generate cash flow and higher demand for external capital.

However, generally the share of interest-bearing debt in the assets is lower for companies declaring an "occasional" or "pro-innovative" strategy compared to those with a "neutral" attitude towards innovation, which can be also the premise to believe that innovative firms may be financially constrained.

Table 7 | Chosen financial ratio depending on the innovation strategy

Ratio		Neutral	Occasional	Pro-innovative	All
EBITDA Margin %	Mean	6.102	7.221	9.439	7.67
	SD	8.259	12.525	8.593	10.68
GRT ASSETS	Mean	0.041	0.050	0.070	0.05
	SD	0.238	0.208	0.218	0.22
GRT SALE	Mean	0.062	0.066	0.020	0.05
	SD	0.519	0.754	0.199	0.59
ROA using Net income %	Mean	4.957	3.296	6.573	4.65
	SD	7.644	10.287	8.910	9.46
ROE using Net income	Mean	12.418	2.914	11.917	7.67
	SD	20.777	70.504	31.133	52.97
DEBT1	Mean	0.606	0.544	0.545	0.56
	SD	0.201	0.216	0.210	0.21
DEBT2	Mean	0.238	0.183	0.175	0.19
	SD	0.163	0.142	0.154	0.15
Total		84	199	126	409

Note: EBITDA Margin % - earnings before interest, tax, depreciation and amortization (EBITDA) divided by total revenue; GRT ASS – total assets in 2013 minus total assets in 2012 to total assets in 2012; GRT SALE – total revenues in 2013 minus total revenues in 2012 to total revenues in 2012; ROA – net profit to total assets; ROE – net income to equity; DEBT1 - total debt (also accounts payable) to total assets; DEBT2 - the interest-bearing debt to total assets.

Source: own elaboration.

The means of financial ratios differ statistically for EBITDA margin, ROA and the two analyzed debt ratio. The results of the ANOVA test are presented in Table 8. The p-value is less than 5% for DEBT2 and ROA. This means that innovation strategy is a factor that statistically significantly impacts debt level.

In table 9, the same financial ratios were calculated taking into account additionally both innovation strategy and access to capital. It was expected that there would be differences between SMEs and large firms. SMEs for each innovation strategy have a lower EBITDA margin, but higher debt ratios. The difference in means between subgroups is statistically important (p-value -0.034024) in relation to debt ratio based on interest-bearing debt. For companies which have indicated one of the innovative strategies, both SMEs and large organizations have lower debt ratios.

Table 8 | Results of ANOVA

Variables	Analysis of variance							
	SS	df	MS	SS	df	MS	F	P
DEBT2	**0.229**	**2**	**0.114**	**9**	**400**	**0.023**	**5.073**	**0.0067**
DEBT1	**0.251**	**2**	**0.125**	**18**	**400**	**0.045**	**2.801**	**0.0619**
EBITDA Margin %	**633.853**	**2**	**316.926**	**45178**	**400**	**112.945**	**2.806**	**0.0616**
GRT ASS	0.048	2	0.024	19	400	0.047	0.504	0.6043
GRT SALE	0.172	2	0.086	137	400	0.344	0.250	0.7785
ROA using Net income %	**824.100**	**2**	**412.050**	**35145**	**400**	**87.862**	**4.689**	**0.0097**
ROE using Net income %	8540.999	2	4270.500	1119392	400	2798.480	1.526	0.2187

Source: own elaboration.

Table 9 | Chosen financial ratio depending on the innovation strategy and company size

Innovation strategy	Size	ACCESS to CAPITAL-PROBLEM	EBITDA Margin %	DEBT1	DEBT2 **	GRT ASS	GRT SALE	ROA using Net income % **	ROE using Net income %
Neutral	SME	2.31	5.70	0.61	0.24	0.04	0.06	5.24	13.20
	Large	1.83	11.36	0.57	0.21	0.04	0.06	1.27	2.28
Occasional	SME	2.48	7.04	0.55	0.19	0.04	0.07	2.86	1.62
	Large	2.17	9.04	0.52	0.14	0.12	0.06	7.58	15.68
Pro-innovative	SME	2.32	9.39	0.55	0.18	0.06	0.02	6.31	12.48
	Large	2.25	9.65	0.53	0.17	0.10	0.03	7.67	9.56
All		2.37	7.67	0.56	0.19	0,05	0.05	4.65	7.67

Note: *p-value < 0.1; ** p-value <0.05; *** p-value <0.01

Source: own elaboration.

5. Conclusion

To sum up the results, there are a few main conclusions. Firstly, the innovation strategy impacts distribution of answers and there is a significant difference in approach to strategy between SMEs and large companies. SMEs indicated mainly an "occasional" strategy, whereas large companies were "pro-innovative". Secondly, there is a statistically significant difference in the distribution of answers to the question on how access to capital hampers development of companies between different attitudes towards innovation

(however there is no difference in the mean between strategies). Thirdly, based on Welch t-test, SMEs are more financially constrained than large entities; however, the difference between SMEs and large firms in distribution of answers to a question on financial constraints for each innovation strategy has not been confirmed. Fourthly, based on the logit model, the group of companies with a declared "occasional" strategy is financially constrained more than companies with a "pro-innovative" strategy, which is the opposite of the formulated hypothesis, where it was expected that the group of "pro-innovative" firms declares that access to capital hampers their development. Also these results are not fully in-line with parallel conducted studies, where the objective proxy for innovation activity was used.[3] The companies with an R&D department were considered to be innovative, and using the same research methods it was found that R&D firms are financially constrained; however, similarly there were no difference between SMEs and large firms. In the presented studies, only moderate innovators are financially constrained. Many of the surveyed enterprises belonging to SMEs declared an "occasional" strategy, and in this group may actually be companies with a "neutral" and also "pro-innovative" strategy. The choice of answers was determined by understanding of innovativeness by the respondent. However, when an objective proxy for innovation (R&D department) was used, the results were fully in-line with expectations that innovative firms are more financially constrained.

There is a broad discussion in the literature regarding which indicator is the best proxy for innovativeness of companies. However, in the author's opinion, the best choice is to use wide data on innovation activity of companies (patent, declared strategy, R&D department, R&D expenditure, etc.) and create an "innovation indicator".

Also the way of measuring financial constraint was "direct", which has the same disadvantages – in particular, subjectivity. In the next stage of research, also other objective measures of financial constraints (e.g. calculated theoretical demand for funds based on financial data and success rate of finding capital) are planned. The results based on the self-assessment approach in further steps of research are going to be compared with other more objectives measures – which can also give additional information – if the self-evaluation approach to assessing of financial constraints is in-line with them.

The results raise a question of whether companies which pointed to a "pro-innovative" strategy have a better financial situation than the two other groups, and at the same time a better possibility of cash flow generation and profit accumulation and finally lower needs for external capital. The financial analysis of a basic ratio which takes into account the innovation strategy confirms that it could be true, and firms declaring a "pro-innovative" strategy may have a better possibility of cash-flow generation than firms with "occasional" strategy and at the same time, the last group is more diverse. However, what was noticed is that the debt ratio (interest-bearing debt to total assets) is lower for companies declaring one of the innovative strategies, which could also be the premise to conclude that finally innovativeness has an impact on access to capital.

The research also has practical implications. Firstly, SMEs are still in a worse position compared to large enterprises in the area of access to different sources of capital;

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however, this "funding gap" is not as severe as could be expected. This means that tools which may help improve access to capital for smaller companies as preferential loans or special grants are still justified. Secondly, innovative companies are exposed to additional difficulties in raising funds successfully, which also confirms the validity of the used dedicated tools as a subsidy by authorities.

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