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Do Innovative Enterprises Need More Funding? Studying Russian Enterprises

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Abstract

The availability of financial resources is of crucial importance for an enterprise. The enterprise can utilize these resources to introduce innovations that enhance its growth and competitiveness. The paper is dedicated to studying the relationship between the innovation activities of the enterprises and their demand for external financial resources. The considered innovation activities include introducing product innovation or process innovation and conducting research and development (R&D) activities. The analysis bases on data from the World Bank enterprise survey conducted for Russian enterprises. The authors define the enterprises that have a demand for external financial resources and utilize a quasi-binomial model to study the relationship. The results demonstrate that the relationship between the necessity for external funding and innovation outputs depends on the type of innovation output. This relationship differs by the enterprise size and industry type, as well. Nevertheless, enterprises that seek external funding tend to conduct fewer R&D activities. The importance of the current research stems from the fact that mainstream literature has concentrated on studying the relationship between innovation activities and financial constraints. In contrast, the relationship between these activities and the demand of the enterprise for additional financial resources is still unclear.

Keywords

Funding demand, innovation activities, Product innovation, Process innovation, Research and development, Russian enterprises

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Нужно ли инновационным предприятиям больше финансирования? Исследование российских предприятий

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Аннотация

Финансовые ресурсы играют решающую роль в развитии предприятий и достижении роста. Предприятия используют эти ресурсы для внедрения инноваций, которые ускорят их рост и конкурентоспособность. Статья посвящена изучению взаимосвязи инновационной деятельности предприятий и их потребности во внешних финансовых ресурсах. Рассматриваемые виды инновационной деятельности включают внедрение продуктовых и процессных инноваций, а также проведение исследований и разработок (НИОКР). Приведенный анализ основан на данных опроса российских предприятий, проведенным Всемирним банком. Авторы выделяют предприятия, которые имеют потребность во внешних финансовых ресурсах, и используют квазибиномиальную регрессионную модель для изучения данной взаимосвязи. Результаты показывают, что взаимосвязь между необходимостью получения внешнего финансирования и результатами инновационной деятельности зависит от типа реализуемых инноваций. Более того, наблюдаются различия в зависимости от размера и отрасли предприятия. Тем не менее предприятия, у которых есть потребность во внешнем финансировании, как правило, меньше проводят исследований и разработок. Важность текущего исследования обусловлена тем, что основная экономическая литература в этой сфере сосредоточена на изучении взаимосвязи между инновационной деятельностью и финансовыми ограничениями. Однако связь между инновационной деятельностью и потребностью предприятия в дополнительных финансовых ресурсах до сих пор не была установлена.

Ключевые слова

внешнее финансирование, инновационная деятельность, продуктовые инновации, процессные инновации, исследования и разработки, российские предприятия

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Introduction

Developing innovative products and new business processes have a positive effect on the company competitiveness and growth. Therefore, enterprises conduct many innovation activities that can result in innovations for the company or the market [1; 2]. However, conducting such activities requires financial resources that may not be available from the internal resources of the enterprise. Therefore, enterprises seek external financial resources that include credits from different financial institutions and the sale of new equity [3; 4].

Many factors can hinder the access of innovative enterprises to external financial resources. These factors relate to the high risk of innovation activities. Risks arise from the inherent high uncertainty of different types of innovation activities, in particular R&D, and from other market factors that can affect the demand for the new product [5]. Other factors relate to the nature of the output of innovation activities. Most of these

outputs are intangible and cannot be used as collateral for credits [6]. Besides, investors may hesitate to invest their resources in projects that are unclear to them. Innovative enterprises tend not to uncover details regarding their new developments in order to avoid appropriability issues. This behavior creates information asymmetry between innovators and the investors when the latter hesitate to invest their resources in such projects [7; 8]. Nevertheless, innovation projects and R&D activities need high sunk resources while companies start to obtain a return on these investments after a time lag [9].

Different theories attempt to explain the choice of the enterprise between equity or credit finance. The first attempt was the Modigliani–Miller theorem that proposes that in a perfect market, there is no difference between the external financial resources for the company value [10]. However, new theories suggest more realistic explanations. Pecking order theory suggests that enterprises follow a particular hierarchy in choosing financial resources. First, enterprises choose to use their internal resources. Then, they prefer to use debts on equity due to the asymmetric information [11]. Nevertheless, the trade-off theory postulates that the companies choose between debt and equity depending on the cost of each of them. Managers compare the costs and benefits and choose their external financial resources [12].

Numerous studies have been dedicated to the issue of enterprise access to external financial resources. Nevertheless, most of these works concentrate on evaluating the influence of financial restrictions on the innovation activity of the company. Several papers have studied the sensitivity of R&D expenditure to cash flow [13–15]. This methodology has been criticized for ignoring the existence of external financial resources and the tendency to smooth R&D spending in enterprises [16; 17]. Further studies have utilized experimental methods by asking the enterprises what they would do if they received the additional amount of funds. One inquires, would they use it to finance their innovation projects or do they give dividends. The diffusion of innovation surveys has enabled the scholars to link the issue of external financial resources directly to innovation activities and take into consideration different innovation activities and not R&D only [18].

The mainstream literature concentrates on financial constraints and capital structure [19]. A few papers are dedicated to studying the demand and supply of external financial resources in innovative enterprises. However, the results of these studies are uneven. Mina et al. [20] have found that the intensity of R&D and innovation outputs do not affect the probability of applying for credit. Furthermore, while R&D intensity has an adverse effect on the probability of obtaining credit, innovation outputs significantly positively affect it. However, the results of Mina et al. [20] do not comply with the results of Freel [21] and Lee et al. [22], who have found a higher probability for the rejection of the credit applications of innovative enterprises. Lee & Brown [23] have found that innovative firms are less likely to apply for bank credits, mainly if these firms are located in peripheral areas. The applications of these firms are less likely to be approved as well. Cowling et al. [24] have observed that high-tech firms are riskier for banks than conventional firms, with a slight difference in the probability of loan default. Furthermore, the crisis in bank financing creates a shortage in financing that has an adverse effect on innovation activities. One should note that innovative enterprises require more collateral to obtain credit than other enterprises [25; 26].

In the Russian Federation many strategies have been developed to achieve innovative development and stimulate the innovation activity of Russian enterprises [27;

28]. Thus, the studying of Russian market and enterprises is of particular importance. By exploiting the dataset of the World Bank Russian enterprises survey that was conducted in 2019, the paper attempted to respond to the following questions: what was the relationship between introducing product and process innovation and the need for external financial resources in the company and what was the relationship between the enterprise decision to spend on R&D internally or externally and the need of external financial resources in the enterprise. The primary advantages of the research in comparison to the few similar works are several. The paper studies the mentioned questions using a sample of SMEs and significant companies, while other papers have studied this question for SMEs in particular. Furthermore, the need for external financial resources in an enterprise has been defined by applying for credit. However, the paper provides a broader definition. Enterprises that have not applied for a credit for a reason rather than having sufficient funds are considered enterprises that need external financial resources. Regarding that the sample is a representative sample of enterprises of the Russian Federation, the research results are of substantial importance for comprehending the relationship between innovation activities and the necessity of external financial resources in the Russian Federation.

Materials and Methods

The paper is dedicated to studying the role of innovation outputs and the decision of enterprises to spend on R&D in creating a need for external financial resources in enterprises. The considered innovation outputs introduce product innovation or process innovation in the last three years, while the decision of the enterprise to spend funds on R&D has been explicitly considered for the last year due to the available data. The analysis is based on the World Bank data of the Russian enterprise survey conducted in 2019 [1] [26]. The survey covers 1,323 enterprises and uses a stratified sampling method by sector, region, and size of the enterprises. The survey structure includes many parts concerning different aspects of enterprises management, such as finance, competition, innovation activities, and others.

The covered enterprises are asked to answer a question of whether the enterprise has applied for a new loan or credit line or not. Later the enterprises are asked concerning the primary reason for not applying for a loan or lines of credits. An enterprise is considered to be seeking external funding in two cases. First, it is the case when the enterprise has applied for a loan. Second, if the enterprise has not applied for a loan for other reasons rather than that it has sufficient capital.

In order to understand the role of innovation outputs and R&D spending in creating a demand for external funding, a bivariate probit model has been used regarding that the independent variable takes only two values; 1 – if the enterprise has a demand for external funding and 0 – otherwise. However, applying a probit regression will create the overdispersion issue. To cope with this issue, a quasi-binomial probit model has been applied.

[1] World Bank (2019) Russian Federation – Enterprise Survey (ES) 2019. URL: https://www.enterprisesurveys.org/portal/login.aspx

The dependent variables are a binary variable for Research and Development (R&D) that takes 1 if the company spends on R&D internally or externally. Other binary variables related to innovation outputs are a variable for product innovation that takes 1 if the enterprise has introduced a product innovation in the last three years and takes 0 otherwise and a variable for process innovation that takes 1 if the enterprise has introduced a process innovation in the last three years and takes 0 otherwise. Control variables include the enterprise size and age. Other controls variables include the existence of a credit line obtained before, using overdrafts and a binary variable if the enterprise is a part of a financial group. The regression has been applied for all enterprises and separately for each of the large enterprises, SMEs, manufacturing enterprises, and service enterprises. Table 1 presents the descriptive statistics of the used variables.

Table 1

Descriptive statistics of the independent variables

Таблица 1

Описательная статистика независимых переменных

Variable	Type	Average	Standard deviation
Size Large	Order	0.29	0.45
SMEs		0.71	0.45
Age 1–5 years	Order	**0.21**	0.40
6–10 years		0.22	0.41
>10 years		0.57	0.49
Industry type Services	Order	0.33	0.47
Manufacturing		0.67	0.47
Product innovation	Dummy	**0.14**	0.35
Process innovation	Dummy	0.10	0.30
R&D	Dummy	**0.18**	0.38
Overdraft	Dummy	**0.28**	0.45
Credit line	Dummy	**0.30**	0.46
Part of financial group	Dummy	0.19	0.39

Source: Compiled by the authors.

Results

Five regression equations have been conducted in order to study the relationship between the need for external funding and innovation outputs (products and process)

Table 2

Results of the implemented quasi-binomial probit models

Таблица 2

Результаты реализованных квазибиномиальных пробит-моделей

	All enterprises (1)		**Manufacturing (2)**		**Services (3)**		**Large enterprises (4)**		**SMEs (5)**	
	Coeff.	Se	Coeff.	Se	Coeff.	Se	Coeff.	Se	Coeff.	Se
Intercept	**-0.16****	0.07	-0.10	0.08	0.01	0.11	**-0.24****	0.11	**-0.15****	0.08
Size (large)	0.03	0.24	0.20	0.26	-0.09	0.43				
Age: 1–5 years	**0.51*****	0.10	**0.66*****	0.13	**0.50*****	0.16	0.53	0.38	**0.50*****	0.11
6–10 years	0.04	0.10	0.07	0.13	0.12	0.17	**0.49****	0.23	0.04	0.12
Manufacturing	0.03	0.11					-0.20	0.19	0.03	0.13
Product innovation	**-0.42*****	0.16	**-0.36****	0.15	-0.17	0.30	-0.31	0.38	**-0.42****	0.19
Process innovation	**0.25***	0.15	0.02	0.18	0.39	0.26	**1.37*****	0.45	0.22	0.18
R&D	**-0.61*****	0.13	**-0.72*****	0.15	**-0.52****	0.22	**-1.03*****	0.18	**-0.59*****	0.16
Overdraft	**-0.57*****	0.11	**-0.58*****	0.13	-0.26	0.17	**0.67*****	0.23	**-0.59*****	0.13
Credit line	**1.14*****	0.10	**1.23*****	0.14			**1.11*****	0.22	**1.14*****	0.12
Part of financial group	**0.55*****	0.13	-0.05	0.16	**0.95*****	0.25	-0.26	0.23	**0.56*****	0.16
Number of observations	1,227		828		399		353		874	
Pseudo R-squared	0.15		0.14		0.04		0.22		0.15	
Robust standard errors in parenthesis *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$										

Source: Compiled by the authors.

and conducting R&D. The first quasi-binomial regression is conducted on a dataset of all covered enterprises. The other regressions are conducted on enterprises by size (large enterprises and SMEs) and industry type (manufacturing and services). Table 2 demonstrates the results of all regression equations.

Introducing innovative products and processes is significantly correlated with the need for external funding. However, the correlation with introducing product innovation is more significant than with introducing process innovation. Nevertheless, the correlation with product innovation is negative, while the correlation with process innovation is positive. A significant negative relationship can be observed between the need for funding and the company's decision to conduct R&D. The coefficient of this relationship (-0.61) is more significant than that for introducing product innovation (-0.42). Regarding other control variables, young enterprises require external funding more than other enterprises. The correlation between seeking funding and overdrafts is negative, while the relationship is positive with using credit lines and the membership in a finance group.

Equations 2 and 3 depict the regression result by the industry type. There is no significant effect of introducing process innovation on the need for external funding. Furthermore, the relationship between seeking funding and introducing product innovation is valid for manufacturing enterprises in particular. Conducting R&D has a significant negative correlation with the need for funding for both manufacturing and service enterprises. Nonetheless, the magnitude of this correlation is larger for manufacturing companies than for service companies. Using overdrafts and credit lines is more relevant for manufacturing enterprises with the same sign of correlation as for all enterprises, while membership in a finance group is relevant for service enterprises in particular.

Table 3

Signification and significance of the correlations between the dependent variable and the primary independent variables

Таблица 3

Значение и значимость корреляций между зависимой переменной и основными независимыми переменными

	All enterprises	Manufacturing	Services	Large enterprises	SMEs
Product innovation	---	--	/	/	--
Process innovation	+	/	/	+++	/
R&D	---	---	--	---	---

*Note**: (-): negative significant relationship, (/): no significant relationship; (+): positive significant relationship. *Source*: Compiled by the authors.

Regarding the results for enterprises by size, the correlation with product innovation is significant only for SMEs, while the correlation with process innovation is significant only for large enterprises. The coefficient for the relationship between the need for funding and process innovation is more significant (0.25) than that for all enterprises (1.37). Conducting R&D is negatively correlated with seeking funding for all other categories. While overdraft is negatively correlated with the dependent variable

for SMEs, the correlation is positive for large enterprises. The existence of a credit line is positively correlated with the need for funding as in all other categories. While the relationship between the membership in a financial group and the need for external funding is significant and positive for SMEs, this relationship is not significant for large enterprises. Table 3 concludes the significance and the sign of the relationships between the dependent variable and the variables for innovation outputs and R&D spending.

Discussion

The results of implemented regression equations demonstrate a relationship between the need for external resources and R&D and innovation outputs. Nevertheless, breaking down the sample into two categories by size (SMEs and large) and two other categories by industry type (manufacturing and services) provides uneven results.

The relationship between seeking external financial resources and the enterprise decision to conduct R&D is negative and significant for all categories. It can be explained by the need for significant financial resources for the research. Therefore, enterprises needing loans or credits tend not to conduct R&D activities. This correlation has the most significant magnitude for large enterprises. Furthermore, this correlation is more significant for manufacturing enterprises than for service enterprises.

A significant negative relationship has been observed regarding the innovation outputs between introducing product innovation in the last three years and the need for external funding. This relationship is relevant for SMEs and manufacturing enterprises in particular. It can be explained by the fact that the successful introduction of product innovation can have a positive effect on the financial situation of the enterprise by increasing its profitability. This effect is more significant for SMEs than for large enterprises. Despite the significant positive correlation between needing funding and introducing process innovation, this relationship is relevant for large enterprises. These enterprises can appeal to do process innovation that costs fewer resources than product innovations and can have positive results on the enterprise financial situation.

Considering control variables, young enterprises are in more need of external funding. Using overdrafts is a choice for enterprises than seeking other external financial resources. However, this choice seems to be insufficient for large enterprises that use overdrafts and are still in need of external funding. Enterprises that are part of a financial group need external funding, and its membership does not let them avoid seeking external funding.

The research results do not coincide with the results of a few papers that consider the relationship between seeking funding and both innovation outputs and R&D spending. Other papers have suggested that there is no significant relationship between the intensity of R&D spending, introducing innovations, and the enterprise demand for external funding [19]. Other works found that innovative enterprises are less encouraged to apply for credits, particularly enterprises in peripheral regions [16]. However, the data utilized in the paper provides a broader definition of the need for financial resources. Enterprises may need external funding and do not apply for credits. The significant negative correlation between introducing product innovation and the need for funding can mean that innovative enterprises that have introduced new products do not apply

for credits because they do not seek external funding – not due to their hesitation or discouragement. This conclusion is relevant for manufacturing enterprises and SMEs in particular.

Conclusion

The primary research goal is to study the relationship between needing external financial resources and innovation outputs and the enterprise decision to conduct R&D. This issue is of great importance regarding mainstream literature concentrating on the relationship between financial constraints and innovation activities. While some other contributions have studied the relationship between the enterprise demand on financial resources and their innovation outputs, the demand has been defined by applying on credits. However, many enterprises can require external funding and do not apply for credits due to different reasons. Therefore, the paper provides a broader definition of the need for external funding.

Table 4

Description of the utilized variables

Таблица 4

Описание используемых переменных

Variable	Description
Dependent variable External funding need	Dummy variable that takes 1 if the enterprise needs external funding and 0 otherwise.
Independent variables Size	Dummy variable that takes 1 for large enterprises and 0 for SMEs.
Age	Dummy variable that takes 1 for one of the following categories (1–5 years, 6–10 years, more than 10 years)
Manufacturing	Dummy variable that takes 1 for manufacturing enterprises and 0 for service enterprises.
Product innovation	Dummy variable takes the value 1 if the enterprise introduced a product innovation in the last three years and the value 0 otherwise
Process innovation	Dummy variable takes the value 1 if the enterprise introduced a process innovation in the last three years and the value 0 otherwise
R&D	Dummy variable takes the value 1 if the enterprise spent on R&D in the last fiscal year internally or externally and the value 0 otherwise
Overdraft	Dummy variable takes the value 1 if the enterprise has an overdraft facility and takes the value 0 otherwise
Credit line	Dummy variable takes the value 1 if the enterprise has a credit line or more and takes 0 otherwise
Part of financial group	Dummy variable takes the value 1 if the enterprise is a part of the multi-establishment firm and takes 0 otherwise

Source: Compiled by the authors.

Using a quasi-binomial model shows a significant correlation between needing external funding and both kinds of innovation outputs (product innovation and process innovation). While the correlation with product innovation is negative, the relationship with process innovation is positive. Breaking down the sample by size and by industry type provides a clearer view. Manufacturing enterprises and SMEs that have introduced product innovation in the last three years do not need external financial resources. This result confirms the importance of introducing product innovation in SMEs for their financial situation. Nevertheless, the results show that large companies tend to introduce process innovation when they require external funding. It can be due to the absence of significant resources that they need to introduce product innovation. Introducing process innovation can be a choice to positively influence the significant enterprise financial situation when they require external funding. The well-known negative relationship between external and the enterprise decision to conduct R&D activities has been observed.

The results mentioned above can be of great importance for policymakers. While some other papers confirm that innovative enterprises are less encouraged to apply for credits, the research results confirm that they may not need external funding. Therefore, it is crucial to support developing product innovations in SMEs due to their influence on their financial situation. External financial resources are vital for large enterprises, while these enterprises are still in need of funding even when they use overdrafts. The primary limitation of the research is that it does not define a causal relationship but just correlations between the considered variables. The availability of panel data can help overcome such limitations.

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