

Financial mechanism of the venture capital investment: an analysis of the effectiveness in the Russian economy

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Abstract. The paper analyzes effectiveness of the financial mechanism of venture capital investment in the Russian economy by identifying the correlation between parameters of venture financing and innovative economic development. The presence of a significant dependence of the volume of innovative products and services from the financial costs revealed, while the impact of venture capital financing to improve innovation performance in the economy is lower than that of direct investment in innovation. The ways of improvement of the financial mechanism of venture investment in Russia substantiated.

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Introduction

Priority development trajectory of modern society is becoming an innovative economy that defines a new context of the problem of financial support of innovative companies. Venture investment is an important component of a highly industrial economy and an instrument of technological innovation, characterized by special methods and forms of raising capital. In this context, implementation of the tasks of national innovation system in Russia largely depends on the formation of an effective financial mechanism of venture investment.

Process of formation of the financial mechanism of venture investment in the Russian economy runs contradictory: on the one hand, the subjects of innovative activity appeared the possibility of using new methods and ways of mobilizing financial resources, on the other - a number of institutional and economic factors limits the effectiveness of their application. These circumstances actualize the need to analyze the effectiveness of the financial mechanism of venture investment, taking into account the peculiarities of its functioning in the Russian economic conditions.

World experience of becoming a high-tech industry in developed countries shows that the use of the financial mechanism of venture investment as one of the most effective ways of resource mobilization for young innovative companies raises level of industry technological equipment, modernizes the means of production and, ultimately, leads to the implementation of technological advances in the production of goods-revolutionaries and increase the development of new unique types of innovative products. Therefore, identifying the relationship

between the implementation of the financial mechanism of venture investment and innovative development of the economy remains a priority for research in this subject area.

Quantitative estimation of influence of venture capital on innovation presented in the economic literature, based on econometric analysis frequently are contradictory. Differences relate primarily selecting specific factor and effective indicators, the character of their relationship, the horizon and scope of the study.

One of the first papers containing an econometric estimation of influence of venture capital on innovation identified the impact of venture capital on the number of patent applications in the United States [1]. It showed that the positive dynamics of fundraising venture funds and venture capital ratio increases inventive activity. The paper emphasized that the alleged connection between venture capital and innovation has not been studied systematically. Later S. Kortum and J. Lerner, exploring the impact of venture capital on the patenting process, found that venture capital investments have a greater impact on the number of patent applications than on R & D expenditures in the industrial sector, while venture capital accounted for 15% of all industrial innovation [2].

In some cases, researchers used productivity gains to identify the impact of venture capital on innovation as a productive attribute (Romain and van Pottelsberhe, 2004; Tang Chui, 2008; Ueda, Hirukawa, 2008). Despite the difference in specific evaluations, in general the results support the hypothesis of dependence of venture capital investments and productivity gains. However, if in studies using cross-country data, it was found that

venture capital accelerates the growth of labor productivity, the calculations according to the U.S. showed no significant effect [3]. Analyzing the relationship between venture capital and innovation, Ueda and Hirukava raised the question of the nature of its orientation. On the one hand, venture capital can help boost innovation by easing the financial constraints faced by innovative firms in connection with asymmetric information and high risk ("VC-first" - hypothesis). On the other hand, when innovative opportunities arise, innovative firms begin to make the demand for venture capital investments, and this causes an increase in venture capital ("Innovation-first" - hypothesis).

Using the method of autoregressive Hirukava and Ueda found that total factor productivity growth is often positive and significantly associated with future investments in venture capital. Positive impact on venture capital on labor productivity growth explained by technological replacement of human labor lots of energy and materials in industries using venture capital.

Some research results are consistent with the "Innovation-first" hypothesis [4; 5]. In particular, Katila and Shane (2005), using the level of commercialization of patents as an indicator of innovation, concluded that the positive relationship between venture capital and innovation could simply be a false correlation. They suggested that patents soon hit the market, if the licensing company will be in the industry with a high level of venture capital activity. As a result, they found that this effect exists only for existing rather than new companies that may be the recipients of venture capital.

Representatives of the European Central Bank and the Rotterdam School of Management A. Popov and P. Ruzenbum on the example of 21 countries conducted a regression analysis of the number of newly established firms by industry for the period 1998-2008 depending on such factors as the number of concluded venture transactions, their volumes, the percentage of venture capital from GDP [6]. As a result, they have identified the impact of venture capital investment to create new business and proven positive effect, especially in high-tech industries of countries with low taxes on income and high levels of human capital.

Analysis of the relationship between venture capital investment and innovative development indicators (according to the statistics of 11 countries), conducted by the method of correlation analysis of pairs of indicators for 2000-2009 showed that the increase in venture financing gives an impetus to increase the number of research and development carried out by small business [7]. It was found that the correlation between the volume of venture capital

investment and expenditure on R & D business is higher in countries where the share of business R & D expenditure is more than the other (Sweden and the Netherlands). The results of calculations applied to the Russian economy in 2004-2009 showed that when the positive dynamics of fundraising venture funds using both national and foreign capital and the corresponding positive dynamics of venture capital ratio increases inventive activity.

Thus, the analysis of the relationship between separate elements of the financial mechanism of venture investment (financing structure, fundraising volumes, number of venture capital funds, etc.) and indicators of innovation in developed countries remains relevant in the current economic studies. Many international analytical agencies annually make innovative ratings based on the identified relationships taking into account among the indicators of innovative development of the share of innovative products in the export; business spending on research and development; human capital (human resources in science and technology sector, and the quality of their share of the total economically active population); coefficient of inventive activity (number of patent applications for inventions per 10 thousand inhabitants), etc.

Methodology

Analysis of key indicators of innovation activity in Russia indicates an extremely small-scale development of innovative sector. Russia is noticeably inferior to the level of innovation activity is not only the leading industrialized countries, where the share of innovative enterprises ranges from 55 to 70%, but the majority of European countries, where the rate is in the range 20-40% [8]. Insufficient level of innovation activity is aggravated by low-impact implementation of technological innovations. Although in absolute terms the volume of innovative products and services are constantly increasing (in the 1995-2012 year - 2.7 times), expenditure on technological innovation grow faster (for the same period - 3.4 times). Consequently, the cost of 1 ruble in 2012 accounts for 4.3 rubles innovative products compared to 5.5 rubles in 1995. Growth of the budget funding allocated to support research and development, for the development of sector knowledge generation, did not lead to the proper growth of innovative activity of enterprises. During the period from 2006 to 2012, the contribution of the domestic business sector in domestic expenditure on research and development fell from 15.6 to 11.7% while increasing the share of state funds by 3.2%.

In world practice, the economic efficiency of capital investment on technological developments and their implementation in the production of

innovative products and their indicators is estimated indicators of their commercialization. Thus, the global innovation index developed by the Boston Consulting Group and the National Association in the United States takes into account the measures undertaken by governments to promote and support the development of innovation and commercial innovation performance. In international comparisons on the level of innovation efficiency Russia in 2013 took place 62 (Table 1), dropping by 0.86 points compared with 2009 levels.

Innovation efficiency index is calculated as the ratio of innovation to the cost of their production. The data presented in Table 1 indicate an improvement of the international position of Russia in relation to the world leaders in the field of scientific and technological innovation. In 2009, the country was in the list of outsiders, but the stabilization of the overall economic situation in the financial markets in the post-crisis period has allowed Russia to adjust positions in the ranking. In addition, this is a result of the higher level of investment return on the capital advanced in innovation.

Table 1. Ranking of countries included in the calculation base of the innovation index, the level of innovation efficiency in 2013 compared with 2009 [9]

Position in the ranking	Country	The index value in 2013	The index value in 2009
14	China	1.0	1.32
55	Sweden	0.8	1.88
69	Brazil	0.8	-0.51
11	India	1.1	-0.02
5	Switzerland	1.1	1.88
40	Germany	0.9	1.09
95	Republic of Korea	0.7	1.55
86	USA	0.7	2.16
63	France	0.8	0.96
102	Russia	0.7	-0.16
60	United Kingdom	0.8	1.37
68	Canada	0.8	1.32
62	Italy	0.8	1.24
112	Japan	0.7	2.25

However, use of these innovative ranking possible information for acquaintance purposes and increasing Russia's innovative leaders chart does not allow a correct conclusion about what exactly was the reason for the growth of innovative efficiency. Due to the fact that many of the studies of modern economists do not include in the calculation base the Russian economy, limited local level other national economies, and the universal methodology for assessing the impact of the financial mechanism of venture capital investment on innovation performance Russia is missing, we need to explore the interdependence of these indicators.

Proceeding from classification of of financial resources venture capital used in European methodology and adapted to the Russian practice, consisting in the fact that the creation of innovative products and services used sources of venture capital and private equity, as a factor of parameters we chose the amount of venture capital investments, mobilized in the early stages of the venture cycle - Venture Capital funds, and direct investment - Private Equity funds, i.e. investments in companies at later stages of development. The application of this classification will provide a fairly complete and fair view of the state of the venture capital industry, as in almost all the activities of Russian venture funds primarily relate to Private Equity Investments.

We define the impact of each of these sources, as well as their cumulative impact on the volume of innovative products produced by constructing two-factor regression model. The first parameter of the model (variable x1) two-factor regression equation is the volume of fundraising of venture capital investments in the early stages of the venture cycle - Venture Capital, and the second parameter (variable x2) - the volume of private equity fundraising in companies at later stages of development - Private Equity. Information about their dynamics during the period is presented in Table 2.

Table 2. Dynamics of volumes of fundraising fund and investment goods [10; 11; 12].

Period	Volume innovative goods (works, services) million rubles (y)	Volume fundraising funds Venture Capital, RR (x1)	Volume fundraising funds Private Equity, million rubles (x2)
1995	9 796.8	170.4	990.4
1996	35 334.2	272.8	1 113.8
1997	54 948.9	434.9	1 502.0
1998	41 173.1	716.7	1 946.3
1999	53 735.4	1 476.2	3 259.6
2000	102 412.8	3 198.3	3 573.9
2001	190 970.2	8 563.4	5 203.9
2002	210 575.1	4 460.3	4 826.3
2003	332 824.3	3 981.4	5 425.5
2004	461 023.5	1 028.5	5 315.4
2005	589 005.4	812.5	6 174.4
2006	773 110.9	2 081.8	16 019.4
2007	955 201.2	24 659.4	25 225.0
2008	1 095 799.0	4 028.9	32 579.7
2009	914 540.0	3 993.1	12 204.4
2010	1 228 384.0	4 596.5	71 198.6
2011	1 921 807.8	8 200.0	80 603.5
2012	2 565 696.6	12 267.4	108 651.7

High correlation of factor variables with the simulated sign confirms the significance of the impact of selected parameters for the regression model. Explanatory variables x_1 and x_2 have a close relationship with the observed value y . Check of factors x_1 and x_2 for multicollinearity by calculating the pair correlation coefficient showed that the observed value of the t -statistic does not exceed the critical level, which allows to conclude that the absence of a close linear interdependence factors x_1 and x_2 .

The main part

Using the capabilities of the econometric analysis to describe the change in the volume of innovative products and services from the financial costs, we were able to detect the presence of a significant association between the described parameters.

The calculations showed that the variables selected for the model parameters are independent of each other fluctuations, providing an isolated effect on the resulting change in the sign - the volume of innovative products and services. Thus, the resulting linear regression equation constructed from historical data 1995-2012, has the following form:

$$y=12,7x_1+20,1x_2+152536,2$$

Analysis of the equation shows that for the same cost Private Equity additional growth in venture capital mobilized for 1 ruble entails an increase in the volume of innovative products (works, services) at 12.7 rubles, and increased Private Equity costs at constant volume of venture capital investments promotes growth productive attribute an average of 20.1 rubles.

Thus, we can conclude more effective impact of private equity on the production of innovative goods and not enough high return of venture capital resources in the Russian economy. This conclusion is confirmed by the fact that the proportion of the innovation sector in the GDP growth, according to the Ministry of Economic Development, is 0.3-0.7% per year, including the effect of the implementation of projects of investment funds and venture capital funds - 0.17% [13].

Validation of the resulting model, which describes the dependence of innovative products and services, carried out by analyzing the statistical significance of the coefficient of determination, conducted by comparing the actual and critical values of the coefficient Fischer (F-test). The coefficient of determination in this simple regression equation was 0.9. Thus, there is a functional relationship between the parameters calculated by the model, and the variation is due to the characteristic efficiency factor variable by 90%.

Calculation of indicators to assess the quality of the regression model revealed that at a confidence level of 95%, the actual value of F - statistic is 70.38, which exceeds the critical value of 3.68.

Confidence intervals covariates include their true values:

$$-10.12 < x_1 < 35.53; 15.79 < x_2 < 24.32.$$

The magnitude of the standard errors of the regression coefficients a_1 and a_2 are not greater than their absolute values, hence there is no need to exclude covariates x_1 and x_2 from the analysis. The calculated coefficients of the equation also confirm its authenticity, since the values of the Student's t-tests (t-statistics) above the critical value.

From this, we can conclude the nonrandom nature of the estimated model parameters and their statistical significance and reliability. Analysis of elastic parameters of the model shows that an increase in the volume of funds fundraising venture capital or private equity funds by 1% volume of innovative products (works, services) will increase by 0.06% and 0.78% respectively.

The calculations show that the impact of venture capital financing to improve innovation performance in the Russian economy is much lower than from direct investment in innovation. It should be noted that the number of transactions committed funds Venture Capital, despite the small amounts of fundraising has been growing steadily (Table 3).

Table 3. Number of venture capital and private equity transactions

Period	Venture Capital transactions, units	Private Equity transactions, units	Patents granted, units	Advanced manufacturing technology, units
2006	12	38	23299	735
2007	34	51	23028	780
2008	67	53	28808	854
2009	48	31	34824	789
2010	81	47	30322	864
2011	105	30	29999	1138
2012	136	58	32880	1323

Growing interest of investors in early-stage signals the activation of the role of venture capital funds, as the possibility of high yield investing in companies already working end, and investors are willing to take on additional risks associated with the early stages of projects and incubating start-up companies. This fact is confirmed that the analysis of the number of transactions made by venture capitalists in the early stages of the development of innovative companies, shows a high correlation with the number of patents issued (0.45) and registered advanced manufacturing technologies (0.95) on the territory of Russia, while transaction Private Equity funds have low correlation (0.33 and 0.17 respectively). This situation is due to the underdevelopment of the system of organization of mass financing of non-financial economic agents through the financial market [14; 15; 16; 17]. Poor quality of the national financial system, weak financial institutions, and insufficient variety of used financial technology - all this creates a weighty institutional constraint of economic growth, which are the material basis of technological innovation as a crucial role in financing innovation owned financial institutions and market-based instruments.

Thus, it is necessary to improve the existing organizational forms of raising capital in the tech industry; the activation levers to stimulate venture activity, formation of the legal and infrastructural innovation process favorable treatment to the innovative sector became the engine of economic

progress of the country. A coherent state policy to eliminate disparities in the sectorial structure of industry, regional asymmetry, personnel and technical backwardness, market dysfunction is of particular importance.

The main directions of improving the financial mechanism of venture capital investment should be:

- the launch of new and more effective use of the existing institutional levers to stimulate high-tech industries;
- adaptation of financial instruments to the needs of the stock market venture capital market;
- adjustment of organizational and legal mechanisms of venture capital funds and investment opportunities;
- formation of informational field functioning of the subjects and objects of venture capital investment;
- improve the system of modern managerial staff for the venture business;
- implementation of risk-oriented strategies of banks in the financial support of the innovation process.

Conclusion

World experience shows that overcoming technological backwardness and ensure competitiveness in the international market is provided primarily by the presence of a developed environment "generation of knowledge" based on a

powerful sector of fundamental research combined with effective education system and the national innovation system and integral state policy innovation activities. In this context, the analysis of the effectiveness of the financial mechanism of venture capital investment at the present stage of development of the Russian economy involves an appeal to analyzing the degree of its impact on the level of innovation. Econometric estimates suggest that the impact of venture capital financing to improve innovation performance in the country's economy while much lower than from direct investment in innovation. Improving the effectiveness of the financial mechanism of venture investment in achieving the objectives of building an innovation-oriented Russian economy requires an integrated element of improving its structure, functional characteristics and organizational forms.

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References

1. Kortum, S. and J. Lerner, 1998. Does venture capital spur innovation? NBER working paper series, 4. Date Views 01.06.2014 www.nber.org/papers/w6846.pdf?new_window=1.
2. Kortum, S. and J. Lerner, 2000. Assessing the contribution of venture capital to innovation. *Journal of Economics*, 4(31). Date Views 01.06.2014 www.home.uchicago.edu/kortum/papers/rje_2000.pdf.
3. Ueda, M. and M. Hirukawa, 2008. Venture capital and innovation: which is first? CEPR Discussion Papers, 7090. Date Views 01.06.2014 www.setsunan.ac.jp/~hirukawa/upload/hirukawa_ueda_per11.pdf.
4. Zucker, L.G., M.R. Darby and M.B. Brewer, 1998. Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises. *American Economic Review*, American Economic Association, 88(1): 290-306.
5. Katila, R. and S. Shane, 2005. When does lack of resources make new firms innovative? *Academy of Management Journal*, 48(5): 814-829.
6. Popov, A. and P. Roosenboom, 2010. Venture Capital and New Business Creation: International Evidence. European central bank working paper, 1078. Date Views 01.06.2014 www.alexanderpopov.org/Papers/VC_and_new_business_creation.pdf.
7. Kalinina, L.L. and S.S. Kishenevskaya, 2011. Relationship of venture investment and innovation. *Economic Journal*, 3. Date Views 24.05.2014 www.economicarggu.ru/2011_3/kalinina.pdf.
8. Government Decree of the Russian Federation "On the Strategy of Innovation Development of the Russian Federation for the period up to 2020" of 08.12.2011 Volume 2227-r.
9. INSEAD. The global innovation index 2013. Date Views 01.05.2014 www.globalinnovationindex.org/content.aspx?page=data-analysis.
10. Market Review. Equity and Venture Capital in Russia 2012, 2013. St. Petersburg: RVCA. Date Views 01.06.2014 www.rvca.ru/upload/files/lib/RVCA_yearbook_2012_Russian_PE_and_VC_market_review_2011_rus.pdf.
11. Indicators of innovation activities: 2014. Statistical Compendium. 2014. Moscow: National Research University "Higher School of Economics", pp: 68-82.
12. Official site of the Federal Service of State Statistics. Date Views 01.05.2014 www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/enterprise/science.
13. Scenario conditions and basic macroeconomic parameters of socio-economic development of the Russian Federation in 2010 and the planning period of 2011 and 2012. Date Views 01.06.2014 www.economy.gov.ru/minec/activity/sections/macro/prognoz/?WCM_PI=1&WCM_Page.556a41804309ce5898fbbb1aee474279=3.
14. Igonina, L.L., 2013. Economy and finance: the nature of interplay and its reflection in the modern economic policy of Russia. *Int. J. Management Concepts and Philosophy*, 2(7): 150-164.
15. Igonina, L.L., 2012. Modernization of Russia's financial system: challenges, imperatives, trends. *Finance and credit*, 3: 2-7.
16. Igonina, L.L., 2009. The financial crisis and financial market development strategy in Russia. *Economics of contemporary Russia*, 1: 52-61.
17. Lisin, V.S. and K.E. Yanovsky, 2011. Institutional constraints of modern economic growth. Moscow: Publishing house "Delo" RANHiGS, pp: 396.

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