



# DEVELOPMENT OF AN ECONOMETRIC MODEL FOR FINANCING INNOVATIVE PROJECTS IN THE TOP 30 COUNTRIES AND UZBEKISTAN WITH STARTUP DEVELOPMENT INDICATORS

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### ABSTRACT

The purpose of this work is to identify the most significant factors influencing the Global Startup Ecosystem Index in the Top 30 countries and Uzbekistan. Study the theoretical and practical experience of foreign countries. Building an econometric model that includes the most significant factors influencing the rate of development of startups in the country, with the aim of further use for forecasting the key driving forces of this development.

**KEY WORDS:** Global Startup Ecosystem, correlation matrix, funding from transactions, unicorns, panteons, market state.

### INTRODUCTION

Most existing models for financing innovation are built on country-specific factors, and there is no single effective tool that meets the requirements of sufficient flexibility for use in all countries of the world. The proposed classification of such factors is shown in Table 1. The proposed classification makes it possible to determine the prospects of a particular innovative company and identify its weaknesses in order to direct the company's top management to improve them .

**Table 1**

**Classification of factors for constructing financing models for innovative companies in business processes**

Market factors	<ul style="list-style-type: none"> <li>●Stock Market Condition</li> <li>●Industry Competitiveness Index Value</li> </ul>
Investment attractiveness of financing an innovative company	<ul style="list-style-type: none"> <li>●The Amount of Funds Already Attracted by The Company</li> <li>●Exclusivity of Participation in Investments</li> <li>●Experience of Previous Transactions to Attract Investments</li> </ul>
Financing factors	<ul style="list-style-type: none"> <li>●Angel Funding</li> <li>●Corporate Venture Funds</li> <li>●Convertible Loans</li> <li>●Bank Loans</li> <li>●Crowdfunding</li> </ul>
Internal company factors	<ul style="list-style-type: none"> <li>●Location</li> <li>●Publicity</li> <li>●Number of patents</li> <li>●CEO experience</li> <li>●Number of founders</li> </ul>

The fact that a high-tech company's investment receipt depends on the financial cycle was also noted in the early works of Gompers and Lerner <sup>1</sup>and Gompers . Gompers and Lerner found that investors' risk appetite increases during venture capital peaks, and this influences the nature of radical innovations that are subsequently <sup>2</sup>commercialized . Companies initially funded by angel investors have a higher likelihood of receiving subsequent venture funding than companies without it. <sup>3</sup>The likelihood of a project's success depends on the industry that the

<sup>1</sup> Gompers PA, Lerner J. *The venture capital cycle*. MIT press, 2004. P. 23.

<sup>2</sup> Gompers P. et al. *Venture capital investment cycles: The impact of public markets // Journal of financial economics*. 2008. T. 87. No. 1. WITH . 1 – 23; WITH . 15 – 18.

<sup>3</sup>Kerr WR, Nanda R., Rhodes- Kropf M. *Entrepreneurship as experimentation // Journal of Economic Perspectives*. 2014. T. 28. No. 3. pp. 25 – 48.



founders have chosen. When it comes to industrial equipment development, companies in related industries are competing for funding. Such companies need to build production, create a logistics chain for the supply and distribution of their products, and so on. On the contrary, companies developing IT products have significantly lower costs and a larger potential market. It is worth noting that some researchers have analyzed some of these factors separately and used them in their econometric models. However, the classification proposed by the author is more complete and takes into account not only the investment attractiveness of a single innovative company, but also external factors, as well as all possible methods of financing. Table 2 provides a description of the variables considered in the regression model.

**Table 2**  
**Description characteristics of the variables considered in the regression model**

No.	Variable name	Variable designation	Unit	Variable Description	Source
1	State of the stock market	Mkt	Logical variable	An indicator of the state of the stock market is the state of crisis in the economy: if the economy is at its peak, then the state of the market is bullish and bearish in the opposite situation. This variable is logical, and for crisis years it will take the value 1. The period of attracting investments can take from 6 to 12 months, so for this indicator a 1-year data lag was used.	<a href="https://www.imf.org/en/Publications/WEO/Issues/2022/10/11/world-economic-outlook-october-2022">https://www.imf.org/en/Publications/WEO/Issues/2022/10/11/world-economic-outlook-october-2022</a>
2	Ranking score in the Global Startup Ecosystem Index	RSc	Score	The Global Startup Ecosystem Index (GSEI) is built on the basis of hundreds of thousands of data processed by an algorithm that takes into account several dozen parameters. The index is used annually by hundreds of thousands of startup founders, startup ecosystem developers, corporations and other stakeholders to make critical policy, strategy, relocation and investment decisions.	<a href="https://www.startupblink.com/startupecosystemreport">https://www.startupblink.com/startupecosystemreport</a>
3	Amount of deals	Deal	Units	Number of transactions completed in 2022 in selected countries	<a href="https://www.startupblink.com/startupecosystemreport">https://www.startupblink.com/startupecosystemreport</a>
4	Investments through transactions	Fund	Million \$	Number of investments attracted from completed transactions in selected countries in 2022	<a href="https://www.startupblink.com/startupecosystemreport">https://www.startupblink.com/startupecosystemreport</a>
5	Number of pantheons	Pan	Units	The first group is the Pantheon of global startup ecosystems. This group now includes more than 240 organizations around the world and can be seen on the StartupBlink map. The Startup Ecosystem Pantheon is a category coined by StartupBlink, which includes companies such as SpaceX, Microsoft, and Netflix; These companies are no longer a startup or a unicorn, but still have a significant impact on their startup ecosystem and their brand. Organizations such as Y Combinator, StartupChile and the Estonian e-commerce program residencies are also considered part of the Pantheon Group, as their innovative initiatives influence the growth and legacy of their ecosystems. These organizations are divided into three levels (gold, silver, bronze) depending on their influence.	<a href="https://www.startupblink.com/startupecosystemreport">https://www.startupblink.com/startupecosystemreport</a>
6	Number of unicorns	unic	Units	Unicorns are startups that are valued at more than \$1 billion. Unicorns are critical success stories that not only increase the flow of capital into the ecosystem, but also contribute to the growth of the ecosystem through a powerful narrative that attracts more entrepreneurs and investors to the place.	<a href="https://tipalti.com/go-ipo/unicorn-hunting-2022/">https://tipalti.com/go-ipo/unicorn-hunting-2022/</a>
7	Investment in innovation	GERD	Billion \$	Gross domestic R&D expenditure is defined as the total expenditure (current and capital) on R&D undertaken by all resident companies, research institutes, university and government laboratories, etc. in a country. It includes R&D financed from abroad, but excludes domestic financing of R&D carried out outside the domestic economy. This indicator is measured in constant US dollars.	<a href="https://www.rdworlondonline.com/2022-global-funding-forecast-rd-variants-cover-more-than-the-pandemic/">https://www.rdworlondonline.com/2022-global-funding-forecast-rd-variants-cover-more-than-the-pandemic/</a>



Empirical data for the study was downloaded from the platform <https://www.startupblink.com>, the data includes all transactions that took place in the venture industry in the Top 30 countries of this index and Uzbekistan in 2022 (Table 3).

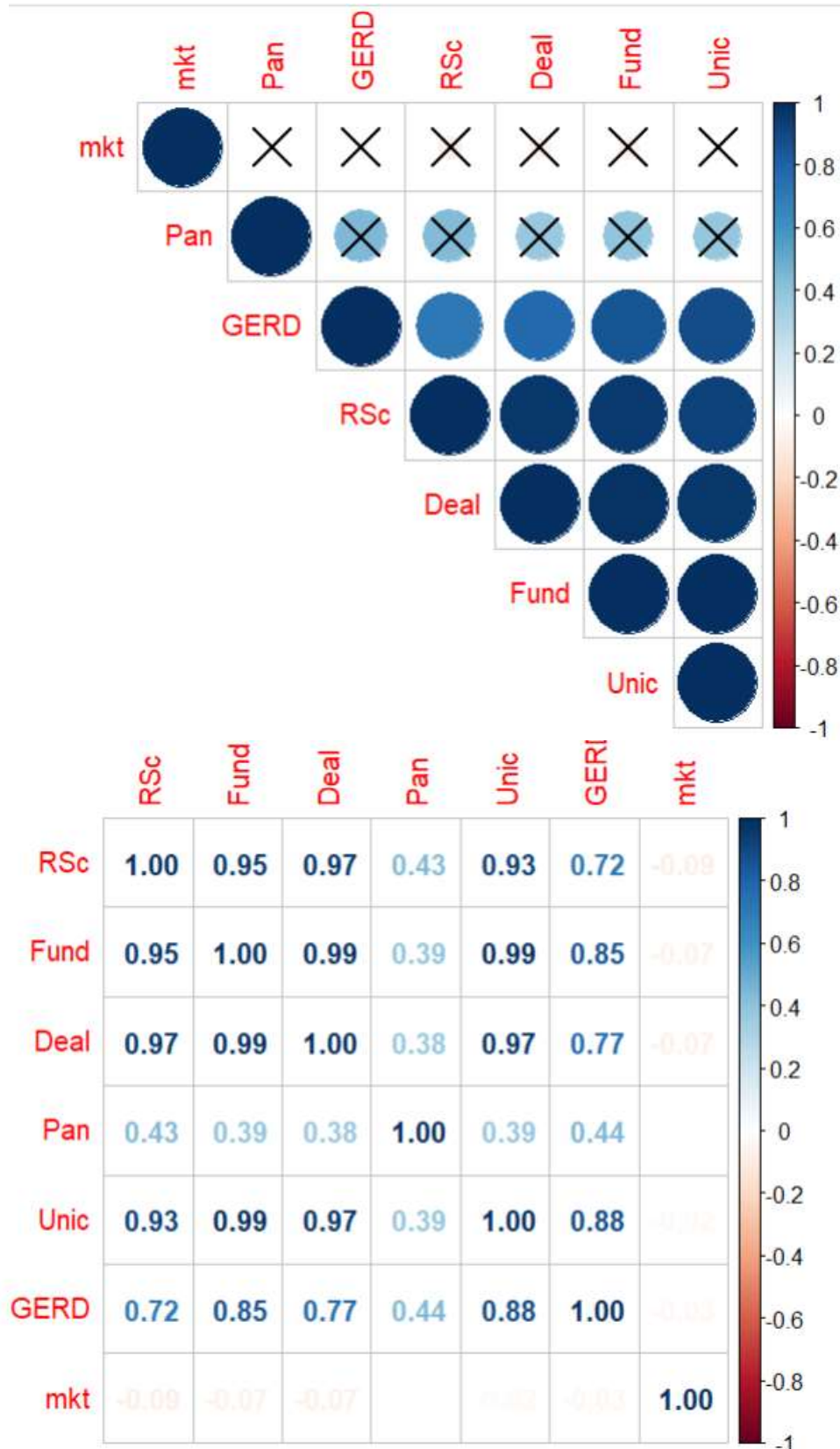
**Table 3**  
**Input data for the regression model**

2022	RSc	Fund	Deal	Pan	Unic	GERD	Mkt
United States	198.08	217429	14978	4	615	679.4	0
United kingdom	51,218	27211	2445	3	43	54.9	0
Israel	46,573	8892	493	3	21	18.9	0
Canada	34.49	10295	1211	1	19	30.9	0
Sweden	27,074	5275	367	3	8	18.7	0
Singapore	26,571	11250	625	3	13	11.2	0
Germany	25,939	11989	873	3	29	143.1	0
France	22,916	14281	1017	3	24	68.5	0
Australia	21,503	5319	513	2	8	30.9	0
The Netherlands	21,423	2483	395	3	6	21.9	0
Switzerland	21.125	3722	562	2	6	21.3	0
China	20,491	46646	1206	3	174	551.1	0
Finland	18,372	1418	166	3	4	7.8	0
Spain	16,958	2757	506	3	3	24.1	0
Ireland	15,141	2542	193	0	6	6.1	0
Japan	13,871	3732	150	3	6	182.2	0
Denmark	13,831	5124	171	0	2	10.6	0
South Korea	12.15	10063	860	3	13	106.1	0
India	11,982	23519	1818	3	65	65.2	0
Belgium	11,429	1325	138	1	3	17	0
Norway	11,315	1302	122	0	5	7.6	0
Taiwan	10,591	559	44	3	28	31.9	0
Austria	9.84	1164	121	0	2	16.1	0
Portugal	9,692	811	65	1	7	6.1	0
Brazil	9,606	4315	482	1	17	37	0
UAE	9,518	2946	230	0	3	9	0
Russia	8,095	288	33	2	27	52.2	1
Italy	7,897	1666	285	0	1	35.6	0
Uzbekistan	0.374	139	64	0	1	1.2	0

As part of the research, it is important to understand the factors that influenced the success of a particular company in a particular country. For this purpose, a regression model will be used, which will consider the score of countries in the Global Startup Ecosystem Index as the dependent variable, and the factors that influenced this variable. The model specification for the regression analysis in the first stage is given below. The main goal of this model is to understand what most influences the assessment of countries in a given index.

$$RSc = \alpha_0 + \alpha_1 mkt + \alpha_2 deal + \alpha_3 fund + \alpha_4 pan + \alpha_5 unic + \alpha_6 GERD + \epsilon_t$$

Estimates obtained from regression analysis should have the smallest possible variance; be linear and unbiased: the mathematical expectation is zero. Accordingly, the premises of Gauss's theorem Markov must be respected.



**Fig.4 Correlation matrix of indicators (compiled by the author using R studio )**

The correlation matrix showed that there is multicollinearity in the data: independent variables correlate with each other at the 80% level. The highest level of correlation is observed in the number of transactions and investments from them, as well as the number of unicorns. The correlation rate is 99%. Based on the correlation matrix, it is

obvious that it is necessary to determine those indicators that are less correlated with each other. For this purpose the following operation was performed. ( Best subset )

**Table 5**  
**The best combination of variables for the model**

Vars	R-Sq	R-Sq (adj)	Mallows		f	d	u	G
			C-p	S	n	a	a	i
1	93,7	93,5	4,3	9,0104	X			
1	90,8	90,5	17,7	10,876	X			
2	94,2	93,8	3,9	8,7955	X	X		
2	93,9	93,5	5,2	9,0109	X		X	
3	94,9	94,3	2,6	8,4109	X	X	X	
3	94,6	94,0	4,0	8,6464	X	X	X	
4	95,3	94,5	3,1	8,2912	X	X	X	X
4	95,0	94,1	4,4	8,5370	X	X	X	X
5	95,3	94,2	5,0	8,4602	X	X	X	X
5	95,3	94,2	5,0	8,4658	X	X	X	X
6	95,3	94,0	7,0	8,6486	X	X	X	X

Based on this table, it can be determined that the most effective model with the indicated indicators is: investments received in completed transactions, the number of pantheons, investments in innovation, and the number of unicorns. But since, according to the tests carried out, the number of unicorns does not meet the requirements according to t critical and p - value , it was decided to select 3 variables as the final model. Of the presented factors, the most significant were: investments received in completed transactions, the number of pantheons, investments in innovation.

$$RSc = 9.14 + 0.00107 fund + 3.14 pan - 0.0846 GERD$$

Once the variables were selected, they were all tested for significance. The result is presented in Table 7. Since the values of the t coefficients exceed the model ones indicated in Table 6, all selected variables are significant at the 1% level.

**Table 6**  
**Model t coefficient values for testing variables for significance**

	Standard Error	Model Values
t critical	$\alpha=0.05$	1.94
	$\alpha=0.01$	1.65
	$\alpha=0.1$	0.75

**Table 7**  
**Actual t coefficient values for testing variables for significance**

Predictor	Coef	SE Coef	T	P	VIF
Constant	9,139	2,802	3,26	0,003	
fund	0,00107134	0,00007505	14,27	0,000	3,6
pan	3,137	1,327	2,36	0,026	1,2
GERD	-0,08457	0,01992	-4,25	0,000	3,8

S = 8,41091    R-Sq = 94,9%    R-Sq (adj) = 94,3%

These variables explain the country's rating by 95%. Also, the indicators meet all the requirements of the tests performed. Thus, when attracting funding by innovative companies in selected countries, it is necessary to take into account 3 variables that were selected as part of the study.



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