БИЗНЕС И ВЛАСТЬ

ПОЛИТИЧЕСКИЕ ФАКТОРЫ ДЕЯТЕЛЬНОСТИ ИННОВАЦИОННЫХ СТАРТАПОВ

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Стимулирование появления новых предприятий является одной из основных задач государственной политики из-за их положительного влияния на экономическое и инновационное развитие. В данной статье будет использоваться регрессионная модель с фиксированными эффектами для определения влияния факторов государственной политики на развитие инновационных стартапов. Исследование доказывает, что наиболее существенное влияние на стартапы оказывает развитие системы высшего образования, тогда как исследовательские университеты и расходы на исследования и разработки не обязательно вызывают всплеск стартап-активности. Усиление защиты прав интеллектуальной собственности может нанести вред стартапам в развивающихся странах и при этом не внести существенных изменений в деятельность стартапов в развитых экономиках.

Ключевые слова:

Инновации, стартап, регрессионная модель с фиксированными эффектами, государственная политика.

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‘If you start me up I'll never stop’

The Rolling Stones

Introduction

A lot of literature is devoted to the study of how certain socio-economic and political factors affect the success or failure of a country in the development of entrepreneurial activity. Talking about these factors, one immediately comes up with such indexes as the Ease of Doing Business, Enterprise Survey, which assess the country's entrepreneurial potential by a wide range of indicators, from access to electricity to the percentage of firms that expect the need to pay bribes to officials for successful business registration. This subject occupies minds of many people because of the entrepreneurship’s vital role in economic growth and employment rate in the country [25]. That is why the emergence of new businesses is one of the major concerns of government policy and if it is not a concern yet, it must be.

Considering the challenges which are brought by the fourth Industrial Revolution, such as the declaration of innovation’s substantial role for economic development, preoccupation of the governments must lie not in the establishment of pleasant environment for just startups, but for the innovative ones [8, 863]. Innovative startups have higher chances for boosting the economy, labor market and human capital, because they have a higher survival rate and a higher rate of potential growth and development *(towards the unicorn)* [9, 287].

Many studies have tried to distinguish some state-level factors that can influence the national innovation rate. They found out that policy factors explain most of the variation in countries’ innovations rate [44, 203].

In particular, they have found success in naming and proving the influence of different policy factors that can shape the innovative landscape of the country. For example, there is a connection between governments' expenditures on research and development and countries' innovative potential.

However, those studies in the measurement of innovation do not separate innovations made in the state-owned research institutes and laboratories from the innovations made by the private sector. Such studies typically measure innovations by the number of patent applications in the country [11; 42; 47] .

Furthermore, there is a lack of studies that would capture not on a case level what specific policy measures can boost *(usually that is the goal)* the innovation activity of startups. This lack can be considered a research problem.

Given the exsting research gap, the research question of this paper would sound like this: What is the role of policy in the number of innovative startups? In particularly subjects of this paper concern are four specific policy measures that frequently appear in the literature about innovation. Those measures are “R&D subsidies”, “Enforcement of intellectual property rights”, “Educational policy”, “Support of the research universities”.

Therefore, the aim of this thesis is to investigate the influence of policy factors on innovative startups activity. A set of the following objectives will help to accomplish this aim:

1) To examine the theoretical influence of each policy measure on the innovation level of the country.
2) To build the empirical model to estimate possible effects of policies on the percentage of innovative startups.
3) To investigate the connection between the theory and the results of the empirical model.

The methodology of this research is *rational choice institutionalism (RCI)*, the main postulate of which is that institutions *(e.g. educational policy)* influence people’s rational behavior *(rationality of this behavior is associated with maximization of utility from institutes and gaining as much profit as possible)*. RCI relies highly on such analytical tools as statistic and mathematical modeling.

Therefore, this paper also relies on the statistical method, on fixed effect regression in particular, which allows making the calculations of some predictors' possible effects using a country-year observations dataset.

Expected effects of the policies are presented in the following hypothesis:

1. The effect of intellectual property rights protection on the number of innovative startups may vary in developed and developing countries. *(It is negative in developing countries and positive in developed ones)*
2. The effect of Research and Development Expenditures positively influences the percentage of innovative startups.
3. The established system of higher education increases the percentage of innovative startups.
4. The established system of Research universities increases the percentage of innovative startups.

1. National innovation system

Literature review

In 1980-1990s there was an active elaboration of the National innovation system theory, such authors as Richard R Nelson, Stan Metcalfe, Christopher Freeman, developed a theory of how the institutions *(that were set up primarily by the government politics and policy actions)* can contribute to the number of innovations and technologies within this country [31; 28, 409-512; 14, 5-24].

Later influence of some particular institutions from the theory that were framed by countries' policy was investigated in the case studies. Lily H. Fang and her coauthors show by a fixed effect model how greater protection of such institute as Intellectual property rights *(IPR)* in some of the Chinese provinces strengthens firms' incentives to innovate [11, 2446–2477]. Some cases do not demonstrate such a straightforward connection between the IPR rate and innovations and argue that overregulation can actually be harmful to innovations or that the IPR have a different effect on the developing and developed countries as it was investigated on a cross-country regression of innovations in the pharmaceutical industry [5; 34].

Another big institution that was framed primarily by the country's policy is expenditures on research and development *(R&D)*. Orviska and Hunady built up a regression model based on the twelve years of observation of European countries, which shows a positive effect of research and development expenditures on the number of patents *(the most popular variable for measuring an innovation level)* in the country [19]. Another group of scientists used a more narrow case of Grease similarly to demonstrate a positive and significant effect of expenditures on innovation, also estimated by patent applications [49].

Varsakelis, N. C. also proved that the higher the investment of society in the quality of education, the higher the output of innovation activity *(measured with the number of patent application)*. The author used information on 29 countries and panel-data methodology to come to this conclusion [47].

In addition, when it comes to the measurement of innovation by patents, a huge explanatory role is given to research universities, because they usually produce a massive bulk of patents [42]. A case study of microregions in the state of São Paulo, Brazil shows with the help of three different variables *(that reflect innovations rate from different standpoints)* significant effect of High-Quality universities on all the dependent variables [37].

An empirical test of the same institutions effect on the innovative startup level shows an ambiguous result. USA case that measure startup rate for high-tech sector reveals *(with the help of regression models)* on the data of the metropolitan areas that the great government's protection of the intellectual property is not associated with higher rates of startups, such variables as government's research expenditures, the presence of research universities is also insignificant. Only a high ratio of college graduates in a metropolitan area means the rise in the number of startups, which makes education institute significant [30].

Italian case, however, that was also analyzed with regression and measured factors that influence 'innovative startups' *(new companies with a high technological value)* demonstrate that intellectual property is associated with higher rates of innovative startups. The study also confirmed the findings of the USA case that a higher system of education has a positive effect on level innovative startups and that R&D expenditures have not a significant impact [27].

It was hard to find some unification study that would measure cross-country effects of different institutions on innovative startups, as studies usually investigate the state of things in specific countries, like Russia, Argentina, India [48; 6; 20]. Moreover, some results may differ like the effect of IPR protection on innovative startups.

Theoretical framework

In the current paper the Innovations are viewed as the implementation of a new or significantly improved product *(good or service)*. It worth mentioning that innovation does not necessary mean hi-tech, some innovations could be rather simple. *(E.g. recipe of the syrup from hulless oat is also an innovation, it provides the minimum time of the process with obtaining the optimal chemical parameters, so syrup can be recommended for therapeutic purposes)*.The Startup is defined as an emerging new company or established one just recently. Innovative startups development lies within the theory of national innovation system.

National innovation system *(NIS)* theory emerged in the 80^{s} with an agenda to provide policymakers with the new analytical foundation that would recognize the importance of innovations for the growth and welfare of the economy. Before these foundations, common approaches to the establishment of countries firms' competitiveness was mainly through regulation of price by devaluing national currency or reducing national nominal wages [26].

Through the years, the theory gained some success, so the policymakers on a country level and on the level of international organizations *(e.g. OECD, World Bank)* have adopted this concept at least as a part of an official narrative. Nowadays NIS covers different aspects of the innovation process, which includes political, organizational, economic and social dimensions [17].

However, our work is devoted only to the government's policy and its ability to shape a specific type of a nation's innovation activity — innovative startups. Nevertheless, it does not sufficiently diminish the number of potential variables for our research, because for forty years of the theory's existence hundreds of influential policy factors from space programs to food policy were suggested by the researchers *(mostly on the case studies)*.

Despite that, some policy factors you can meet in the literature almost on a regular basis, while the others have the spontaneous frequency of occurrence. This study is more interested in the "popular" factors, which work for nearly every case since it is supposed to generalize the results on a group of countries.

Consequently, the study relies on the following four policies as factors that determine innovative startup activity: "R&D subsidies", "Enforcement of intellectual property rights", "Educational policy", "Support of the research universities". Some researchers consider those factors as major policy pillars of innovations [44, 144].

R&D subsidies

Organization for Economic Co-operation and Development *(OECD)* defines Research and development expenditures as "the money spent on the creative work undertaken on a systematic basis to increase the stock of knowledge and the use of this knowledge to devise new applications" [34]. Subsidies are the same exact thing but with the emphasis on the source of money, which is the government.

R&D subsidies are carried out by the national government in the forms of ministries and departments, which produce decisions about the amount and direction of subsidies, such decisions are supported by the country's main budget account.

Sometimes R&D grants are also formed by the country's agencies, which have different legal structures and dispose of extra-budgetary units. For example "Branch-wise non-budgetary fund for R&D of the Ministry of Agriculture of the Russian Federation " [33].

R&D money can be provided to all of the resident companies, research universities and government laboratories, etc. *(usually to the last two)* [30]. The usefulness of such money for the last two institutions was scientifically proved, mainly on the case studies where the dependent variable was "number of the patents" *(or logarithm of this variable)* [19; 48].

On a firm and startup level, there is no such a straightforward connection that more government investments can produce more innovations in the private sector. There are two reasons for that. The first reason is the potential of the private sector's crowding out [6]. It means that the government provokes an increase of demand on R&D, the demand boosts the price of scientific activity, high price incites private investors to make fewer expenditures on R&D. The second reason is the potential effect of displacement when firms do not produce more work that is scientific, they just cut their own expenses on this activity, without a surplus of work [18].

Enforcement of intellectual property rights

Production of innovations is considered as a high-risk and capital-intensive activity, you could imagine the frustration of innovators in the case of intellectual property theft. This frustration also has an economic effect, as the stolen product or startup will face competition with the robber-firms the budget of which was not squeezed out with R&D expenditures, that scenario can lead your company to a fewer revenue or even none, so you will not be able to afford the next R&D expenditures.

Considering that risk in the case of weak intellectual rights protection, startups and firms would struggle with attracting investments [22]. Empirical evidence shows that IPR protection and enforcement can positively affect the ability of firms and startups to acquire debts, attracting investments for R&D and consequently produce more sales from the new products [23].

According to the World Intellectual Property Organization *(WIPO)*, intellectual property policy provides "structure, predictability and beneficial environment" for accessing and sharing knowledge [50].

Since the state is the main subject of legal relations, which forms the regulatory framework, IPR policy usually is formed by the legislative branch, which creates a legal environment for such rights protection. Beneficial steps towards the good legal environment are 1) unification of regulatory and legal documentation, 2) creation of united information array (for free information exchange of structural divisions) 3) instilling a legal culture to the population (maybe with the help of education policy) 4) integration with the world community in the field of intellectual property rights protection [3].

Nevertheless, as was already mentioned in the literature review, overregulation of IPR may have a negative effect on innovation activity. A good example of this is the phenomenon of "patent thickets". Patent thicket could be described as a huge overlapping set of patent rights and the variety of patent-holders that seeking license fee which startups and innovative firms face *(especially in such fields as biotechnology, semiconductors, computer software)* in an attempt to commercialize new technology [40].

It is not only harmful to small enterprises and startups which deal with legal and financial pressure but sometimes also *(as the example of U.S. pharmaceutical and chemical industries shows)* the cost of legal disputes can surpass the potential benefits of being a legal owner of some invention [4].

Some studies argue that the effect of IPR on innovation can change in accordance with the level of the country's income. A country- and time-fixed effects model serves as empirical proof of it. It was based on the set of 94 countries over the period from 1965 to 2005 that observed significant positive effect of intellectual property rights protection in the countries with income above mean, and non-significant effect

or significant negative effect *(depending on model)* for less fortunate countries [42].

Motivation for this argument is intuitive: weak IPR in low-income countries is more likely to boost innovation because it leaves some space for cheating, which is a huge factor for innovation activity in the underdeveloped environment.

Therefore, it is hard to generalize the effect of IPR on startup innovation activity of the country, because it can vary from nation to nation and even from industry to industry in a single country [19].

Educational policy

The level of education in a country has at least four positive scenarios to influence the country's innovation success. The first and the most obvious one is the ability of a good educational system to produce better-qualified scientists since more scientists *(especially natural scientists)* means more innovation [2].

In the second scenario, the educational system contributes to innovation by producing a highly skilled workforce, such a workforce can work in innovative enterprises [40]. Third, startups and innovative enterprises require professional entrepreneurs with passion for innovation and the abilities for organization and optimization of the production process to gain competitiveness. The major way to produce such a force is to establish a proper system of education [46]. The final and not so obvious scenario of innovation improvement with the help of the educational system is the creation of a cluster of new customers with higher awareness demands and expectations [14].

The educational system of countries consists of several layers; the most valuable for innovation development is higher education. It not only seems logical but also has empirical justification [92, 43].

Government policy in a sphere of higher education usually consists of:

- Strategic reallocation of country's budget account *(no wonder that government expenditure on education % of GDP is a popular variable in innovative studies)* and establishing a system of tuition [28].
- Align educational opportunities to demand. The task here is to create a proper combination of educational programs that will match students' and market' requirements. *(For example, the Russian Ministry of Digital Development estimates the lack of 1 million IT specialists, so the government needs to answer this request)* [1].
- Simplification of students' transitions between educational sectors *(it is about the elaboration of pathways system between degrees)* [11].

Support of the research universities.

This particular policy measure sounds synonymic to the measures that were already discussed. Of course, the support of the research universities is a huge part of research and development subsidies and a significant part of Educational policy, nevertheless, innovation theory authors prefer to outline this specific policy separately.

The reason why is the theory so specific on this behalf may lie in the fact that the typical variable of interest in the studies of innovation is the number of patent applications. Since research universities produce, many patents in the countries up to 80% *(For an example of China, Singapore, Hong Kong, Korea and Taiwan research universities from 1977 to 2010 produced over 80% of total patents amount)* authors prefer to outline this policy separately [41].

Policy measures that typically used for establishing the system of research universities as were already discussed in the previous paragraphs *(educational policy, R&D subsidies)*. However, there are some serious considerations for establishing an excellent system of research universities, that policymaker must keep in mind:

- Diasporas play a huge role especially when you when

establishing a new university because they attract overseas scholars to come back to the origin country.

- Usage of English as the main language in universities can attract professional foreign academic.
- The specialization of the universities in narrower fields greatly boosts the productivity of these fields.
- Benchmarking is a useful tool to guide the universities in their modernization efforts [33].

Even though research universities have a great contribution to the number of patents, there are some doubts that they supply the market with innovations. The thing is that the overwhelming majority of the patents are worthless and produces little or negative revenue compared with expenditures [37].

Therefore, an established system of research universities may have an ambiguous effect on the number of innovative startups, from one side it is a part of an educational system that manufactures human capital, on the other side comparatively small amount of their work have successful commercialization on a market.

To sum up, NIS theory gives a huge explanatory power of the countries' innovation success to the aforementioned policies, however, while boosting the overall level of innovation, some of these policies do not necessarily lead to the growth of innovative startups. There are doubts that R&D expenditures and support of research universities greatly contributes to startups. Enforcement of IPR may have an ambiguous effect depending on countries income, higher-income countries are tend to benefit from IPR protection, while for low-income countries this policy may be harmful. Only educational policy leaves no doubts about its usefulness.

2. Fixed Effects regression model

Data

The dependent variable is supposed to reflect the number of innovative startups in the countries, usually, in the scientific papers, the authors use local sources that provide data for their cases, for instance, the business dynamics database provide data for the USA [29].

The only source that provides cross-country data for innovative startups *(for at least 5 years)* is the Global Entrepreneurship Monitor survey *(data forms by the survey of 2000 respondents in each country)*, but it does not do it in a straightforward manner. First of all, the survey has an indicator *TEA* that is the percentage of people who are about to start an entrepreneurial activity or have already started one in the recent 3.5 years. Secondly, the survey has an indicator *Innovation rate,* which represents the percentage of those who are involved in TEA and indicate their product as new *(and few/no businesses offer the same product)*.

Multiplication of *TEA* by *Innovation rate* in each country and division of this number by *100* gives a proxy variable of the percentage of innovative startups. It is worth mentioning that innovation does not necessarily imply high-tech or IT sector, it can be all kinds of projects from biodegradable films to the new nutritious supplements for feeding bees.

The data is available for 32 countries for a time span of 8 years from 2011 to 2018.

The first independent variable is Intellectual Property Rights *(denoted as IPR),* the variable that is based on the World Economic Forum experts *(policymakers, business executives)* survey. The experts assess IPR protection in the country on a scale from 1 to 7, where 7 reflects the absolute success of a country in IPR protection [38]. It is the only independent variable that puts further limitations on observation periods because the data from the survey is available only for the period from 2011 to 2017.

The second independent variable is Research and Development expenditures % GDP *(denoted as R_D)*. It is a typical variable in innovation researches for measuring the intensity of R&D policy [18]. The data was

collected by UNESCO Institute for Statistics [44].

The third independent variable is supposed to reflect educational policy, and the usual choice here is % of expenditures on education from GDP [43, 148]. However, this data contains dozens of missed observations and seems to have a time lag between the policy and the outcome. Such policy outcome as "% of the total working-age population with advanced education" *(from bachelor and above) (denoted as AdLab)* seems a much better option, moreover, it reflects only the successful examples of higher education policy. The variable is the product of International Labour Organization surveys with a great number of respondents, in some countries more than138,000 [45].

The last dependent variable is the number of research universities per 10 million people which are listed in The Academic Ranking of World Universities *(a.k.a. Shanghai rankings)* concerning the indicator "Papers published in Nature and Science" *(denoted as Uni10)*. This is again a common choice for innovations-related literature; however, the choice of indicators may vary [41]. It represents the success of a country's policy in establishing the innovation system.

The research also has five control variables that may potentially have significant effects on the percentage of innovative startups

1) Foreign direct investments net inflow % GDP *(denoted as FDI)* is discussed as a good booster for innovative activity in the papers *(from International Monetary Fund Sustainable Development Goals Dataset)* [23].
2) Trade openness (*denoted as Trade*) is also considered as a beneficial factor for innovation and is typically measured as % ratio to GDP *(from World Bank national accounts data)* [9].
3) Political Stability and Absence of Violence *(denoted as Stability)* – while the researchers lock horns in an attempt to prove whether political regime influence general innovation rate or not, there is no controversy that politically stable countries attract more investments and produce more innovative goods *(WGI index is constructed from 18 sub-variables like 'Ethnic tensions', 'Violent demonstrations' etc.)* [15].
4) Corruption *(denoted as corrupt)* according to the literature has an ambiguous effect on innovations that vary depending on sector and recipient *(from Corruption perception index)* [35].
5) Urban population *(denoted as Urban):* the cities are usually considered as innovation hubs. A greater percentage of the urban population may be beneficial for innovations rate *(the data was collected from the United Nations reports The Population Division of the Department of Economic and Social Affairs)* [12].

Model

Since the data represents a country-year observation, the typical choice here would be a fixed or random effects regression model. Usually, the researchers conduct a Hausman test to estimate which model is preferable, however, the case of low observations and secondary data sources is a great clue that indicates no need of using random-effects model.

However, before the model specification, it is worth mentioning that data have a drawback that is a high correlation between predictors *(e.g. correlation of IPR and R_D is equal to 0.69, IPR and Uni10 to 0.62).* This situation is called multicollinearity and is usually considered a problem because it can make effects of predictors insignificant and skewed.

One way to avoid this problem is splitting the set of predictors into several groups with the acceptable level of collinearity. A common way to assess collinearity is the usage of variance inflation factor *(VIF)*. If the VIF value exceeds 10, it indicates strong collinearity in the data that needs to be modified.

$$(1) Startups_{it} = \beta_1 \times R_{D_{it}} + \beta_2 \times AdLab_{it} + + \beta_3 \times Uni10_{it} + controls_{it} + \ddot{u}_{it}$$

$$(2) Startups_{it} = \beta_1 \times IPR_{D_{it}} + controls_{it} + u_{it}$$

$Where\ Startups_{it} = Startups_{it} - \overline{Startups_i}$

$the\ country$

$- demeaned\ data\ on\ Startups, and\ similarly$

$for\ all\ Predictors_{it}, Controls_{it} and\ for\ ü_{it} (error\ terms).$

On Table 1 "Before Split" column represents that two variables in a joint model significantly exceeded the comfortable VIF value, but after splitting the set of variables on two parts *(next two columns)* with common control variables, there is no values that far above 10.

Table 1: Variance inflation factor

	Before split	After split (1)	After split (2)
IPR	67.67		10.03
R_D	10.08	9.03	
AdLab	46.21	10.72	
Uni10	7.36	7.21	
Trade	9.39	8.27	
Urban	5.27	5.31	4.47
FDI	2.03	1.71	1.89
Stability	3.89	3.69	3.54
Corrupt	9.71	8.24	5.48

Taking into account this division following regression equations can be written down as:

Taking into consideration the discussion about the differences between some predictors effects in developed and developing countries, it would also be useful to check the regression outcome on separate datasets for developed and developing countries.

The first three models are based on the first equation data for these models available for 8 years from 2011 to 2018:

Model 1 — Assesses the whole available sample of 32 countries.

Model 2 — Assesses the sample of 18 developed countries

Model 3 — Assesses the sample of 14 developing countries

The next three models are based on the second equation and data for them available only for 7 years from 2011 to 2017:

Model 4 — Assesses the whole available sample of 31 countries. *(Same countries, but without Egypt)*

Model 5 — Assesses the sample of 18 developed countries

Model 6 — Assesses the sample of 13 developing countries

Results

The results are presented in the table below.

Table 2: FE Models – Policy and innovative startups

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
IPR				-0.44	0.31	-1.32*
				(0.29)	(0.26)	(0.51)

R_D	-0.41	-0.18	5.34			
	(0.70)	(0.45)	(2.77)			
AdLab	0.18*	0.07	0.5**			
	(0.08)	(0.08)	(0.16)			
Uni10	0.08	-0.01	0.39			
	(0.08)	(0.05)	(0.40)			
Controls are included						
Observations	214	122	92	193	111	82
R^2	0.11	0.06	0.31	0.09	0.10	0.26

Standard errors in parentheses

*p < 0.05, ***p < 0.01, ***p < 0.001

Model 1 and *Model 4* reveal that in the full sample of countriesmost of predictors have an insignificant effect on the percentage of innovative startups. Only educational policy *(AdLab)* measured by the percentage of people in the country with tertiary education have a threshold significance, its p-value is equal to *0.044.* Nevertheless, it still can be interpreted as a significant and positive effect, when the percentage of people with tertiary education increases on one *(other things being equal),* the proxy of amount of innovative startups increases on 0.18. It is also worth mentioning that models have small explanatory power of *Startups* variation, their R^2 are around 0.1 value.

Model 2 and *Model 5* are responsible for the reflection of predictors' effects on developed countries shows no significant effects whatsoever and low R^2.

Model 3 and *Model 6* that indicate the effects of independent variables in developing countries show a more interesting picture. For the developing countries the effect of policy in a sphere of higher education becomes more distinctive, it grows in a number more than twice and gains more significance *(p-value = 0.002)*. IPR in this set of countries becomes significant and indicates a negative effect of IPR strengthening on the percentage of innovative startups. R_D expenditures were almost significant with p-value= 0.057 *(for 95% significance level)*. R^2 for these models is higher than in the previous one and accounted for around 0.3, however, the joint model could give a higher value of R^2

Robustness of the results

A robustness check of tree models with significant coefficients *(Model 1, Model 3, Model 6)* was made by excluding from the models those observations that have a low correlation module *(<0.3)* with predicted by the regression model values *(Table 3)*.

In *Model 1* the significance of the coefficient AdLab have not changed, but R^2 and the effect of predictor have noticeably grown-up. It means that the model is robust for some set of countries and that the excluded countries diminished the intensity of the effect and explanatory power of the model. The list of these countries *(Belgium, Egypt, Estonia, Finland, Germany, Portugal, Romania, Spain, and the United Kingdom)* reveals that almost all of them (*except* for *Romania, Egypt*) are developed countries. This fact once again demonstrates that there is a difference in the effect of predictors for developing and developed countries.

Model 3 and *Model 6* seem less robust, in the first case after throw away uncorrelated observations with the help of the aforementioned procedure, the significance of *AdLab* increases noticeably, in the second case *IPR* loses its significance. However, robustness checks for *Model 3* and *6* do not necessarily indicate that the models are bad; shifting of the

coefficients may be simply be caused by the little number of observations.

Table 3: Robustness check

	Model 1	Model 3	Model 6
IPR			-0.34
			(0.68)
			(0.51)
R_D	0.43	3.82	
	(1.11)	(3.21)	
AdLab	0.29*	0.76**	
	(0.12)	(0.23)	
Uni10	-0.04	0.30	
	(0.13)	(0.45)	
Observations	157	74	57
R^2	0.16	0.38	0.40

Standard errors in parentheses

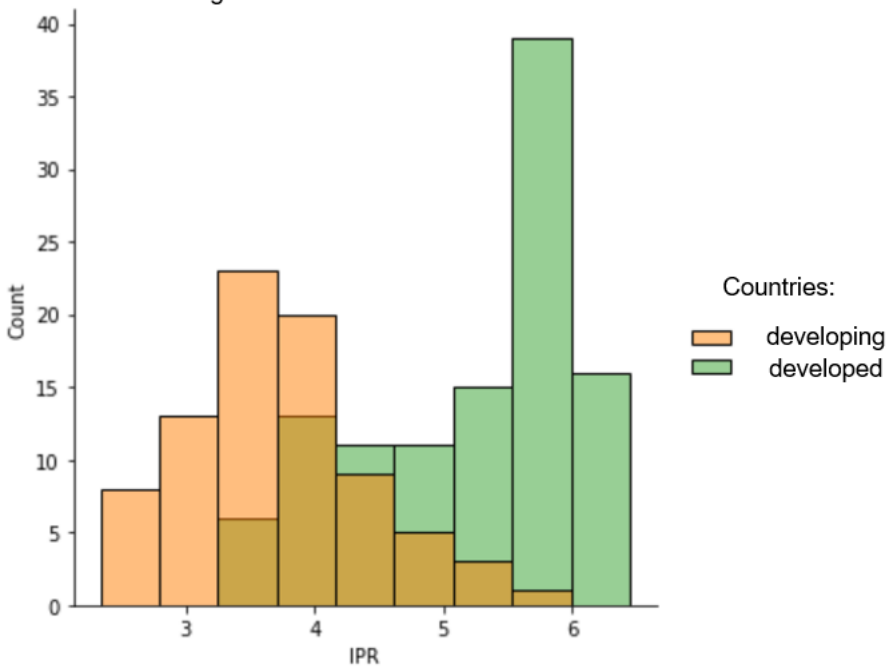
*p < 0.05, ***p < 0.01, ***p < 0.001

Once again, the most interesting things are the lists of the excluded countries in *Model 3 (Chile, Egypt, Hungary)* and in *Model 6 (Argentina, Chile, Croatia, Hungary)*. Chile and Hungary were dropped twice, and in the first scenario it boosted the significance of and the value of the *AdLab* effect and in the second one, it reduced the significance of the negative effect of IPR protection. This fact allows guessing that these countries may heavily rely on the drawbacks of the IPR protection system in their innovational activity of startups.

Discussion

The results of FE regression corroborated the first hypothesis that the effect of intellectual property rights protection varies in developed and developing countries, it appeared that severe legal mechanisms of protection decrease the possibility of developing countries startups to innovate, while in developed countries it seems that IPR system does not affect startups activity. It can be explained by the initially high level of IPR protection in these countries *(Fig.1)* that does not allow them to cheat in the first place.

Fig.1 IPR index value Distribution



The second hypothesis about the significance of research and development expenditures effect on startup innovation activity does not have a statistical confirmation. It seems that R&D subsidies are boosting innovation activity only in the research universities and government laboratories rather than in startups. The same logic may be applied to the hypothesis that claims significance of the research universities system, in theory, it may boost patent activity, but empirical results revels that the effect of this policy on the innovation level of local firms is not significant.

FE models confirm the last hypothesis that the established system of higher education can contribute greatly to the innovation level of startups. In this case, the effect also follows the logic of different effects for the developed and developing countries, however, the division, in this case, is not clear. *Model 1* and robustness check for this model displayed that for some developed countries the logic of increasing *AdLab* works and only some European developed countries refuse to follow it. This observation needs further elaboration.

Nevertheless, while the developed countries need further classification, it becomes clear that for the developing countries it would be useful to intensify a higher-education policy to produce more innovative startups. However, immediate reaction and rise of government expenditures on this sphere may have a positive effect only in the remote future, when the established system will rise up the percentage of educated people.

Conclusion

In this research, the effects of policy factors on innovative startups were investigated. As it turned out, the most promising policy for establishing a state system of innovative startups is the policy of higher-education system development, which can be achieved in various ways, but usually, it is accomplished by rising government expenditures and creating educational programs that will match students' and market' demand. It was also proved that this policy has greater effect on the developing countries, however, this division is not precise because it seems that some of the developed countries can

also benefit greatly from this policy. Thus, further investigation is needed.

A more precise division of the effects on the developed and developing countries was demonstrated by the IPR variable. It appears that the level of IPR protection has no significant effect on startups in the developed countries. It seems that though the developed countries got used to living in the established system of IPR protection, further development of such protection does not contribute to the already existing big trust of investors. On the other side of the developing countries, toughening of IPR legislation can undermine the innovative activity of startups, leaving them less space for borrowing ideas. However, it does not necessarily mean that the developing countries must unleash entrepreneurs; this study covers too short of a time period to conclude that it is an everlasting effect. The theory argues that it is a helpful policy tool to build the trust of the investors and business community, such things usually do not happen in a short period, so the governments need to consider some possible positive long-term effects.

Concerning the research universities and research and development expenditures, they do not necessarily lead to the blossoming of innovative startups. Rater they have a significant effect on innovations produced in the universities and government laboratories.

Considering low R^2 in the study models, further determination of factors that shape the landscape of innovative startups is needed.

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POLICY DETERMINANTS OF INNOVATIVE STARTUP ACTIVITY

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Stimulation of the emergence of new businesses is one of the major concerns of government policy due to its positive influence on economic and innovative development. Current article will use fixed effects regression model to determine the influence of policy factors on innovative startups activity. The study proves that higher-education system development has the most significant impact on startups, while research universities and research and development expenditures do not necessarily cause a surge in the startup activity. The improvement of IPR standards can be harmful to the startups in the developing countries and make no significant change for the developed ones.

Keywords:
Innovations, startup, R&D, fixed effects regression model, national policy.