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The Impact of Institutional Features on R&D in Business Enterprise Sector and Sustainable Growth

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Abstract: The main goal of our study is to theoretically and empirically contribute to the analysis of relation between institutional features and R&D in business enterprise sector and consequently on sustainable economic growth. We exploited the available measures of institutional quality from World Government Indicators of World Bank and data on R&D in business enterprise sector. We employed First-Differencing GMM method to estimate the model on the balanced panel data including the following European countries: Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, Serbia and the Slovak Republic, for the time span of 2007-2017. The institutional features are statistically significant factor of R&D in business enterprise sector. We found that Government effectiveness and Control of corruption in particular are very important in supporting the R&D. These measures of institutional quality are key institutional determinants of R&D in business enterprise sector. R&D in business enterprise sector is one of the crucial parts of the overall R&D, and therefore policymakers have to develop favourable conditions for those activities in private firms. Institutional features should be an important variable in explanation of R&D intensity. The presented analysis empirically contributes to the body of knowledge on determinants of R&D for European countries that have to develop their institutions further in order to grow sustainably. This study is using contemporary methods for testing the underlying problem.

Keywords: R&D in business enterprise sector, institutions, sustainable growth, government effectiveness, control of corruption.

JEL Classification: O31, O38, O43

1. Introduction

The immanent strength of institutions is that they can play a role of the “rules of the game”. Development of institutions of any type is a time-consuming process and it leaves consequences on policies. Our goal is to analyse the importance of these institutions in R&D in business enterprise sector investment decisions.

Sustainable economic growth cannot be achieved in the presence of underdeveloped economic and political institutions. In addition, one should have in mind that the long run growth is only affected by real factors (Twinoburyo & Odhiambo, 2018). Also, extractive institutions are harmful for growth. Fabris & Galić (2015, p. 135) state that economic history has shown that a rapid growth or, more precisely, too rapid economic growth is always followed by an even faster economic collapse. However, it is very important to analyse the sources of growth, because the list of possible determinants of economic growth is continually expanding (Asanović, 2020). It is well documented that R&D and growth are strongly related, so we have aimed to analyse if there is a strong relation between institutions and R&D in business enterprise sector. Jakšić & Jakšić (2018, p. 6) argue that economic and social growth nowadays has two important features: first is sustainability, measured as durability, and the second is inclusiveness, measured as pro-poor growth. We used data for eight countries and applied GMM method to test our hypothesis.

The rest of the paper is structured as follows. First we discuss theoretical contributions in the literature and describe our motivation for this analysis. After that we present the methodology of the empirical investigation and stylized facts about the data. Finally, we state our results, discuss them and make policy implications.

2. The importance of institutions' development for the innovations and consequently economic growth

This chapter will make the basis for the empirical analysis. More importantly it will reveal the authors' motivation for research, i.e. the interconnections between institutions development and innovations, especially in the enterprise domain.

2.1. General aspects

The inherent strength of institutions is that they can play a role of the “rules of the game”. They can be useful in shaping the expected response function of the play-

ers involved in that game. In addition, they can empower that reaction function if they are developed enough to be credible mechanism of commitment. According to North (1993, pp. 6-7) institutions encompass formal rules (e.g. contracts, laws, regulations etc.), informal constraints (e.g. code of conduct) and characteristics of implementation of the both above mentioned.

Institutional development is a process that lasts long and it makes a trace on the policies, therefore, that process have to be in special focus of representative bodies. Based on the findings of Acemoglu and Robinson (2012, p. 377), policies although sometimes hardly can be changed they, in principle, can easier be changed than institutions. That implies that when formulating some policy in whatever sphere policymaker must have in mind the underlying institutions that shape policy outcomes. According to Jakšić (2012, p. 27), there is no natural gravity towards good institutions because they are perceived as threatening by the elite.

Sustainable economic growth cannot be achieved in the presence of underdeveloped economic and political institutions. The precondition for sustainable development of one country is that accumulation of capital and labour is employed in the optimal combination with the technology and human capital. This is dynamic process that involves interactions between many parties. Economic growth has to be accompanied with social preferences and economic policies that have to be implemented in a way to support the overall society goals. Finally, sustainable growth requires inclusive institutions that will produce not only obligations but incentives for growth supportive activities. That kind of institutions is not a guarantee for desired outcome, but they can make it easier to achieve it. Therefore, macroeconomic outcomes are closely connected to microeconomic decisions of entities. These decisions are besides all other determinants related to the underline institutions that minimize the social and individual costs, reduce risks and are constraints to the irresponsibility of stakeholders in that process. Yazgan & Yalçinkaya (2018), Freimane & Băliņa (2016) and Blanco, Gu & Prieger (2016) argue that R&D investments are substantially sufficient to change the long-term economic growth performances and income levels of the countries.

Finally, we have to mention innovation production function as a motivation for the analysis. Innovation production process is an innovation value-added process (Guan & Chen, 2010). Modelling and measuring of that process is difficult because many inputs in R&D production function are in relation with the R&D and there is a possibility of endogeneity. Econometric methods which account for that possibility are developed and we used one of them to avoid that risk.

2.2. Institutions and R&D

Many papers in literature deal with the determinants of R&D. Previous research studies have used the Schumpeterian hypothesis, resource based view and the behavioural view to explain the determinants of R&D investments. However, there are not many papers that analyse the institutional prism of R&D.

Falk (2006) discusses potential factors that determine business sector R&D intensity. These are: direct R&D subsidies, fiscal incentives for R&D, public sector R&D, patent protection, investment, human capital, industry structure, persistence of R&D, openness and GDP per capita. Griffith (2000) argues that social rates of return to R&D are much higher than private rates of return and therefore there is underinvestment in R&D. Government policy already does promote R&D, but it has to be stronger and more effective. Ortega-Argilés & Voigt (2009) state that there is a long debate tracing back to Schumpeter about the role of small and large firms in technological progress and innovation. During different periods of time, the importance of small and medium sized enterprises (SMEs) in R&D has been changing. It is very important to analyse that particular part of business R&D, because, for example, SMEs represent a higher share of total business R&D expenditure in the EU than in the USA. They emphasize that when discussing business R&D in SMEs it needs to be recognized that there are many aspects to be taken into account, such as the limited capabilities and resources available to SMEs, the diseconomies of scale they face in R&D activities, and also the stage of the firm's development. Zimmermann (2017) argues the similar. There are many constraints to innovation activity. Enterprises usually select high costs, uncertainty of success and financing difficulties as the most frequent obstacles. Dachs et al. (2013) analyse why firms increasingly perform R&D outside of their home countries. They called this development as the internationalisation of business R&D. In addition, they summarize the positive effects for the host country like direct effect when foreign-owned firms may help to increase aggregate R&D expenditure in a short time, positive relationship between R&D expenditure of foreign affiliates and labour productivity of domestic firms, and performance and size effects on domestic firms. Akcali & Sismanoglu (2015) argue that innovation is an important determinant of competitiveness for sustainable development.

In the observed literature, R&D is thought to be mainly influenced by human capital, development of capital market and openness to trade. However, Wang (2013) found a significant direct effect of institutions on R&D intensity. According to this author, institutions have a direct effect on R&D, and this relationship is robust after controlment for the effects of religion, legal origin, geography, hu-

man capital, openness to trade and financial development on R&D. Alam, Uddin & Yazdifar (2019) state that sound and strong institutions help to promote R&D investment by ensuring better access to finance, less information asymmetry, mitigating the managerial expropriation problem and providing better investor protection and reducing transaction cost.

That gives us the idea to analyse the similar issue on different framework and with different methods and units of observation. We want to investigate if there is a strong relation between institutions and R&D in business enterprise sector and the empirical part of the paper focuses on that relationship.

3. Methodology and data

3.1. Econometric methodology

There are many approaches that can be used to analyse the underlying problem which is at the core of this paper. However, based on the nature of the data, we decided to empirically test the influence of institutional factors on the R&D in business enterprise sector using the methodology of dynamic panel data framework.

Our estimation framework employs First-Differencing GMM method. OLS estimator employed on the underline model is biased because many assumptions are not satisfied. In addition, Fixed Effects estimation is also biased because when number of periods is low, the Within Groups estimator gives biased results. These are the reasons to use First-Differencing GMM method. It has to be mentioned that two-step GMM estimator is used in our analysis, which is robust to autocorrelation and heteroscedasticity. A transformation (first difference each variable in the regression) is applied to the specification of dynamic panel model with the purpose to eliminate the cross-section fixed effects. Based on the assumption that innovation has time series correlation structure that varies by cross-section, we used the White period instrument weighting matrix and the White period robust standard errors and covariance corrected for the degrees of freedom. Instruments used in the estimation are Arellano-Bond type dynamic panel instruments with lags that vary by observation and four-lagged variable from WGI. We examined the second order serial correlation of differenced residuals as proposed by Arellano & Bond (1991). We also performed Hansen test in order to test the validity of all orthogonality condition for the overidentified model.

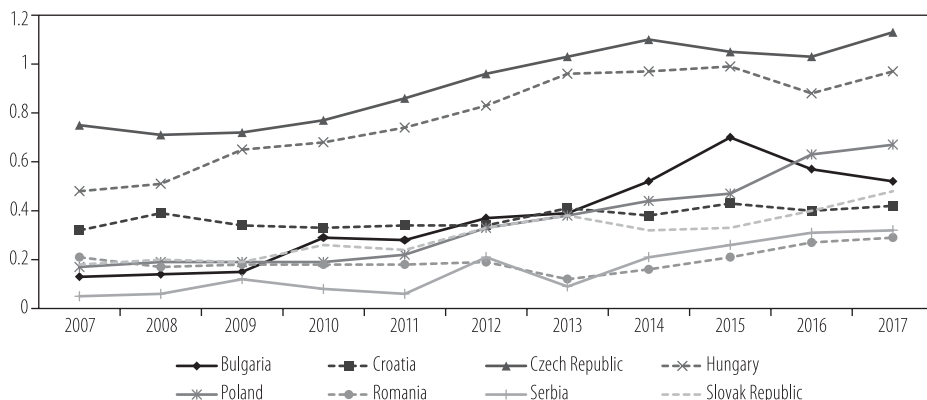
3.2. Data used in the analysis

The data that is used in analysis cover eight European countries (Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, Serbia and the Slovak Republic) which have many characteristics in common. They were all socialistic countries that have to pass through the transition process to market economies. Nowadays some of them are more developed than others and all of them, except Serbia, are the EU member states, but all of them have to develop their institutions further in order to grow in a sustainable way.

Business enterprises decisions are strongly related to the economic, institutional and political framework of economy in which they operate. That calls for analysis of institutional influence on R&D in business enterprise sector and, consequently, on innovations and sustainable growth. Time span covers the 2007-2017 period. Panel has a characteristic of a balanced panel. Before empirical analysis we briefly present stylized data on the used variables.

The dependent variable in our analysis will be R&D expenditures in the business enterprise sector which is measured in % of GDP. We have an interest to analyse what are the determinants of that variable because that part of R&D is very important for innovations, technology development and overall long run economy and social sustainable development. Figure 1 shows that observed countries are different in that sense since e.g. Romania and Serbia have very low expenditures on R&D in that sector in comparison to the Czech Republic.

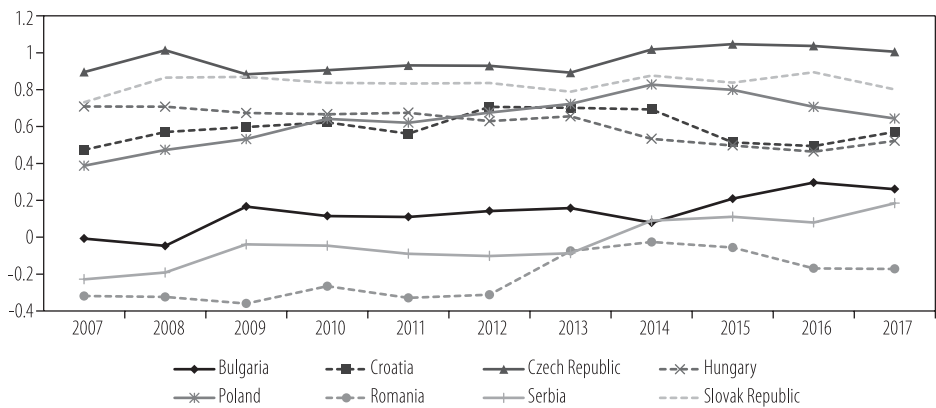
Figure 1: The trends in R&D expenditures in business enterprise sector in % of GDP



Source: EUROSTAT

As a measure of institutions' quality we used selected components of the World Government Indicators (WGI) of the World Bank that consist of six composite indicators of broad dimensions of governance: Voice and accountability, Political stability and absence of violence/terrorism, Government effectiveness, Regulatory quality, Rule of law, and Control of corruption. As one of the independent variables we used Government effectiveness, which captures the perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. That variable can take a value in the range from -2.5 to 2.5, with meaning that higher value gives better government performance. According to this parameter again there are huge disparities among the countries, but the Czech Republic and the Slovak Republic managed to achieve the best result in the observed group. Romania had the worse result.

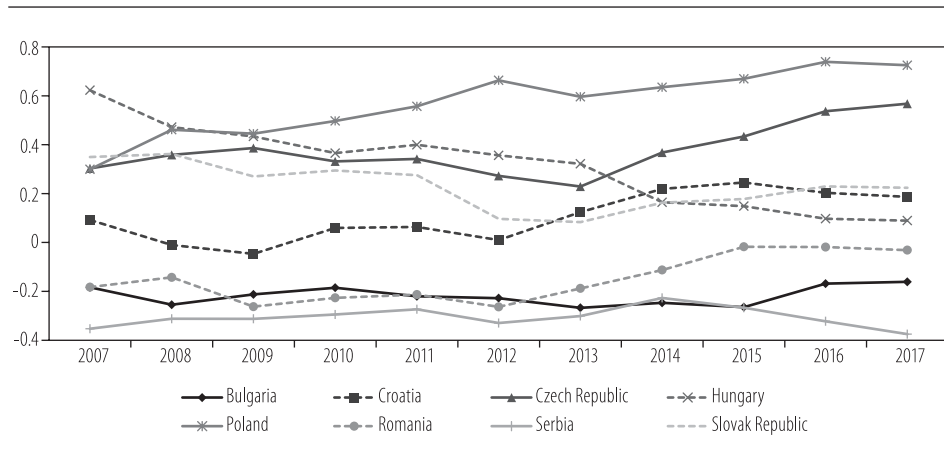
Figure 2: Line diagram of variable Government effectiveness



Source: Authors' presentation based on the WGI data

One more variable that will be used in the analysis is Control of corruption, also from WGI. We wanted to include that variable into analysis because of the results of Weiyu & Xixiong (2019) who confirmed that anti-corruption actions affect firm's innovation strategies and their spending in R&D activities. The variable we used captures the perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. It has the same range of values as the previous variable. Serbia, Romania and Bulgaria were the worse among the observed group, while Poland achieved the best score.

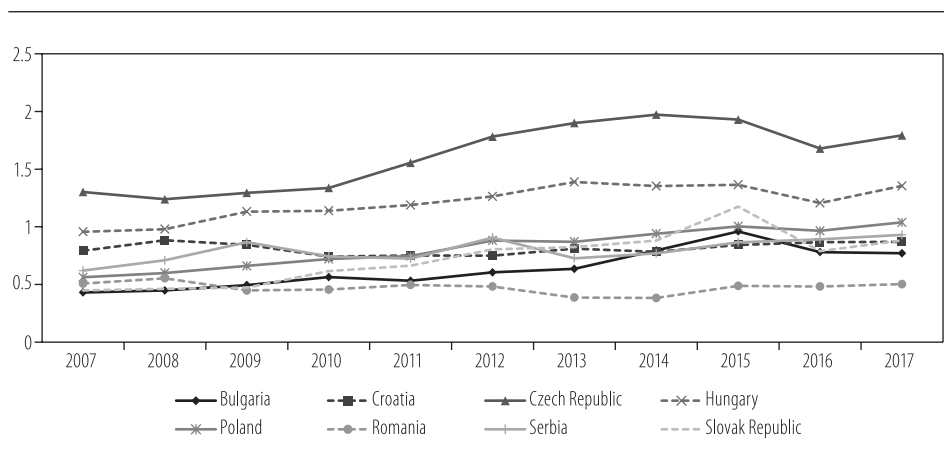
Figure 3: Line diagram of variable Control of corruption



Source: Authors' presentation based on the WGI data

Finally, we used the total value of R&D expenditures in % of GDP. Figure 4 shows that similar to R&D in business enterprise sector Romania has very low expenditures on R&D in comparison to the Czech Republic. Overall R&D significantly determines R&D in business enterprise sector, because it includes governments expenditures on R&D, non-profit businesses expenditures and universities expenditures on R&D.

Figure 4: The line diagram of variable R&D expenditures



Source: EUROSTAT

Table 1 gives a brief summary description of the used variables.

Table 1: Summary description of used variables

Variable name	Definition	Source
R&D expenditures in business enterprise sector	R&D performed by business enterprise sector.	EUROSTAT
Government effectiveness	Variable that captures the perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	WGI
Control of corruption	That variable that captures the perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	WGI
R&D expenditures	total value of R&D in % of GDP	EUROSTAT

Source: EUROSTAT, WGI

Table 2 gives a wider picture of used variables. It can be concluded that countries which are members of the Visegrad group achieved better scores.

Table 2: Descriptive statistics of used variables

		Variable			
		R&D expenditures in business enterprise sector in % of GDP	Government effectiveness	Control of corruption	R&D expenditures in % of GDP
Bulgaria	Mean	0.37	0.13	-0.22	0.64
	Median	0.37	0.14	-0.22	0.60
	Maximum	0.70	0.30	-0.16	0.96
	Minimum	0.13	-0.05	-0.27	0.43
	Standard deviation	0.19	0.10	0.04	0.17
Croatia	Mean	0.37	0.59	0.10	0.81
	Median	0.38	0.57	0.09	0.81
	Maximum	0.43	0.71	0.25	0.88
	Minimum	0.32	0.47	-0.05	0.74
	Standard deviation	0.04	0.08	0.10	0.05

Czech Republic	Mean	0.92	0.13	0.38	1.62
	Median	0.96	0.14	0.36	1.68
	Maximum	1.13	0.30	0.57	1.97
	Minimum	0.71	-0.05	0.23	1.24
	Standard deviation	0.16	0.10	0.10	0.28
Hungary	Mean	0.79	4.72	0.32	1.21
	Median	0.83	4.77	0.36	1.21
	Maximum	0.99	5.15	0.62	1.39
	Minimum	0.48	4.20	0.09	0.96
	Standard deviation	0.19	0.35	0.17	0.15
Poland	Mean	0.35	0.64	0.57	0.82
	Median	0.33	0.64	0.60	0.87
	Maximum	0.67	0.83	0.74	1.04
	Minimum	0.17	0.39	0.30	0.56
	Standard deviation	0.18	0.13	0.14	0.17
Romania	Mean	0.20	-0.22	-0.15	0.47
	Median	0.18	-0.27	-0.18	0.48
	Maximum	0.29	-0.03	-0.02	0.55
	Minimum	0.12	-0.36	-0.26	0.38
	Standard deviation	0.05	0.12	0.09	0.05
Serbia	Mean	0.18	-0.03	-0.31	0.80
	Median	0.21	-0.05	-0.31	0.77
	Maximum	0.32	0.18	-0.23	0.93
	Minimum	0.06	-0.23	-0.38	0.62
	Standard deviation	0.10	0.13	0.04	0.10
Slovak Republic	Mean	0.30	0.83	0.23	0.73
	Median	0.32	0.84	0.23	0.79
	Maximum	0.48	0.89	0.36	1.18
	Minimum	0.18	0.73	0.08	0.45
	Standard deviation	0.10	0.05	0.09	0.22

Source: Authors' calculations

4. Results, discussion and policy implications

The above mentioned methodology is employed in order to estimate the concrete model based on the panel data for the eight observed countries. Instruments used in the estimation are Arellano-Bond type dynamic panel instruments with lags that varies by observation, i.e. lagged levels of dependent variable as an instrument for the equations in first differences and four-lagged of variable Control of corruption from WGI, which is strongly correlated to variable Government effectiveness. Table 3 depicts the main results.

Table 3: Estimated model

Variable	Coefficient	Std. error	Prob.
R&D expenditures in business enterprise sector (-1)	0.39	0.20	0.0511
Government effectiveness (-4)	0.11	0.06	0.0862
R&D expenditures	0.49	0.10	0.0000

Source: Authors' calculations

It can be seen that this dynamic panel model gives reasonable results. All variables significantly contribute to the R&D in business enterprise sector. The model is of dynamic nature because the dependent variable is explained by itself with one lag, which in this case confirms some degree of persistency in dependent variable tendency.

Government effectiveness as a variable is significant and shows that this factor is an important determinant of R&D in the business enterprise sector. Based on the variable description already made, it is expected to have a positive impact on incentives of business enterprises to invest in R&D. Due to the methodology of measuring this variable it has influence on R&D in business enterprises with four lags. Finally, overall R&D significantly determines R&D in business enterprise sector, because it includes governments expenditures on R&D, non-profit businesses expenditures and universities expenditures on R&D. Business enterprise sector can make decision on the level of investment in R&D based on the other sectors investment and their expenditures can influence the expectations from the angle of businesses. Sometimes projects of the business enterprise sector are complementary and sometimes conflict with projects of other sectors, but some degree of collaboration is necessary and these interrelations are the reason for the inclusion of this variable in the model.

The model has good statistical features since all variables are significant. In addition, tests that are usually employed in the dynamic panel data modelling also show good characteristics of the estimated model. All these features of the model give the basis for discussing policy implications. The Hansen test for overidentification restrictions shows that instruments are valid. As stated in the literature, for a dynamic panel model estimated by First-Difference GMM estimator it is important that Arellano-Bond serial correlation test of order 2 shows the absence of correlation. This can be seen in Table 4.

Table 4: Estimated model's statistical features

Hansen test	
J-statistic	4.42
Prob.(J-statistic)	0.49
Arellano-Bond serial correlation test	
Test order	AR(2)
Prob.	0.9798

Source: Authors' calculations

In addition to the baseline model, we estimated an alternative one which also gives reasonable results. Instruments used in the estimation are four-lagged variable Government effectiveness form WGI which is highly correlated with variable Control of corruption and Arellano-Bond type dynamic panel instruments of dependent variable with lags that varies by observation. All variables significantly contribute to the R&D in business enterprise sector.

Table 5: Alternative estimated model

Variable	Coefficient	Std. error	Prob.
R&D expenditures in business enterprise sector (-1)	0.42	0.13	0.0020
Control of corruption (-1)	0.15	0.07	0.0496
R&D expenditures	0.39	0.09	0.0000

Source: Authors' calculations

The model also has dynamic nature and the dependent variable is explained by itself with one lag, which confirms some degree of persistency in dependent variable tendency. Control of corruption as a variable is highly significant. It significantly determines R&D in business enterprise sector, because it measures one aspect of institutions' quality. Similar to the previous variable, due to the meth-

odology of its measuring it has influence on R&D in business enterprises with one lag. Overall R&D again significantly influences R&D in business enterprise sector, because of the previously mentioned reasons.

Model has good statistical features, since all variables are significant. In addition, tests that are usually employed in dynamic panel data modelling also show good characteristics of the estimated model. It can be seen in Table 6.

Table 6: Alternative estimated model' statistical features

Hansen Test	
J-statistic	5.41
Prob.(J-statistic)	0.37
Arellano-Bond serial correlation test	
Test order	AR(2)
Prob.	0.6476

Source: Authors' calculations

The Hansen test shows the validity of instruments. Arellano-Bond test does not reject null hypothesis that there is no correlation in residuals. It gives the same result for both orders.

Our results are consistent with Wang (2013) and Alam, Uddin & Yazdifar (2019). Countries with better institutions qualities tend to spend more on R&D. Effective government may stimulate R&D investment by facilitating access to finance, ensuring market entry, increasing investors' confidence and protection. Corruption increases information asymmetry and the cost of R&D.

With regard to policy implications, it can be stated that government should strengthen its effectiveness and develop inclusive institutions because firms' decisions involving R&D are highly dependent on these factors. Also, it should stimulate other complementary types of R&D. It should help all parties involved in R&D process to overcome financing difficulties. That kind of policy will be supportive toward economic growth. Sustainable economic growth is one of the main goals of every society and it can be achieved more easily if R&D expenditures in business enterprise sector are high.

We are aware of potential limitations of this research. First of all, there are many other factors which are significant determinant of R&D in business enterprise sector. In the future research we will investigate the influence of patent protec-

tion, macroeconomic factors, tax policies, etc. In addition, panel dimensions could have been wider, but we were constrained by data availability. We also did not analyse sources of funding of the investment in R&D in business enterprise sector because of lack of the adequate data.

However, we have made contribution to the field by analysing the institutional factors of R&D in business enterprise sector, because they are rarely used in the analysis. In addition, the scope of countries included in the analysis is unique and significant for other emerging market economies. This study is using contemporary methods for testing the underlying problem.

5. Conclusion

Economic growth has to be accompanied by social preferences and economic policies that have to be implemented in a particular way to contribute to the overall society aims. Sustainable growth assumes good institutions which are not always a guarantee for desired outcome, but they can make it easier to achieve.

Institutions are a highly significant determinant of R&D in business enterprise sector. We found that Government effectiveness and Control of corruption in particular are extremely important in boosting the R&D and consequently sustainable growth of one economy.

Our estimation framework employs First-Differencing GMM method, because of the possibility of endogeneity. Statistical features of the model fulfil all required preconditions for using the model results in order to give policy implications. R&D in business enterprise sector is one of the crucial parts of the overall R&D and, therefore, policymakers have to develop favourable conditions for those activities in private firms.

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