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Mariusz Próchniak, Bartosz Witkowski

Economic Institute
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PhD Mariusz Próchniak – Department of Economics II, Collegium of World Economy, Warsaw School of Economics
PhD Bartosz Witkowski – Institute of Econometrics, Collegium of Economic Analyses, Warsaw School of Economics

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# Abstract

The study examines the relationship between the regulatory variables and economic growth on the basis of Bayesian model pooling applied to Blundell and Bond's GMM system estimator. The areas of regulations (institutions) are measured by the following indicators: index of economic freedom, worldwide governance indicators, democracy index, doing business indicators, transition indicators. The models are estimated based on overlapping panel data and they include nonlinearities. In general, regulatory environment is an important determinant of economic growth. To achieve rapid growth, it is necessary to increase economic freedom, quality of governance, and market reforms. The association between regulatory variables and GDP dynamics is mostly nonlinear. The countries with greater scope of economic freedom record more rapid GDP growth but a given increase in economic freedom has a higher impact on growth in those countries that are economically not (or partly) free. However, the results are not robust in a lot of areas – with regard to the sample of countries, the exact measure of the regulatory variable, and the type of nonlinear impact (concave vs. convex functions). There are many factors affecting both regulations and GDP dynamics as well as many transmission channels between these areas and the results sometimes are mixed.

**JEL classification codes:** C11, C23, O40, O43, O47

**Keywords:** economic growth, regulations, institutions, growth factors, Bayesian averaging

# 1. Introduction

The factors of economic growth can be divided into two groups: the demand-side and the supply-side determinants. The first group encompasses the components of aggregate demand, i.e. investment expenditures, government spending on goods and services, and net exports. The second group includes the supply-side determinants which affect potential output; among these variables one may include physical capital, human capital, labor, and technology. Of course, both demand-side and supply-side variables can be more disaggregated, including, inter alia, various types of investments or government spending, or much more types of capital. All these factors (both demand-side and supply-side) can be called direct ones because they immediately transform expenditures or inputs into output. The pace of economic growth depends, however, not only on these direct determinants but also on deep factors of production. Deep factors affect direct determinants and in this way they influence macroeconomic performance. Deep determinants are institutions and – among them – regulations that allow for interactions between output and measurable inputs.

The role of institutions in the process of economic growth is enormous. However, when assessing the impact of institutions the following questions (or problems) arise: (a) which institutions are the most important growth factors, (b) how to measure institutions quantitatively in order to include them in empirical studies. Since the term 'institution' is very broad, there is a huge (not to say almost infinite) number of variables that represent some kinds of institutions (see e.g. Wojtyna (2002, 2007), Rodrik (2007), Rapacki (2009), Sulejewicz (2009), or Persson (2010) for details). Hence, it is necessary to focus on the subset of them. This report focuses on the examination of the regulatory environment.

In this study, regulations are associated with economic freedom, quality of governance, the level of democracy, ease of doing business, and the progress of market (structural) reforms. These areas of regulatory framework are measured by the following variables: indices of economic freedom compiled by Heritage Foundation and Fraser Institute, worldwide governance indicators and doing

business indicators prepared by World Bank, democracy index reported by Freedom House, as well as the EBRD transition indicators. The details on the coverage of these variables are described later in the report (in section 'Data').

It is worth to refer our indices to a division of institutions introduced and popularized by Acemoglu *et al*. (see: Acemoglu, Johnson, and Robinson, 2001, 2004; Acemoglu and Johnson, 2005; Acemoglu and Robinson, 2012). These authors divide institutions into two broad categories: inclusive and extractive institutions. To maintain long-run economic growth, inclusive institutions are important, i.e. rules of law, property rights, free markets etc. For example, Acemoglu, Johnson, and Robinson (2001) refer to institutions of private property that means a cluster of economic institutions, including the rule of law and the enforcement of property rights. In contrast, extractive institutions help in transferring income between various groups of the society; these are institutions under which the rule of law and property rights are absent for large majorities of the population. Extractive institutions may lead to economic growth but only in the short run; in the medium run and the long run they are not conducive to further economic development. To achieve sustainable long-run GDP growth, it is necessary to have favorable inclusive institutions. In our opinion, institutional indicators examined in this study mostly refer to inclusive institutions because they are related with property rights, rule of law, political freedom, and free markets. However, it is likely that some aspects of extractive institutions are also accounted for because, e.g., component indicators related to the size of government may show a few aspects of expropriation of citizens by the government.

There have been numerous studies in macroeconomics whose target was to determine whether there is and if so – what is the impact of the regulatory framework (measured by various institutional indicators) on economic growth. The most recent empirical studies, in which modern econometric tools are used, are described in the next section. The literature review demonstrates that various authors apply different sets of control variables, different subsamples, different lags or nonlinearities to check the robustness of the results. However, although the theoretical structural model and most of the empirical studies both indicate that

regulations are important economic growth drivers, some questions are not solved yet. Namely, whether the relationship is linear or nonlinear; what is the impact of the individual component indicators on economic growth (some areas of regulations may have stronger impact than another ones); or what is the strength of the impact (by how much economic growth accelerates due to better institutional environment)?

This research tries to solve some of these problems by using modern econometric tools being the main value added of the analysis. Namely, in order to be robust to the selection of explanatory variables, the study uses Bayesian model averaging (BMA) method applied to Blundell and Bond's GMM system estimator. This approach allows us to improve the efficiency of estimation and to avoid the risk of making the omitted variables error. That is because the variables for the model are chosen on the basis of Bayesian probability of relevance of particular regressors' subsets instead of subjective opinion of the researcher. Hence, to address the problem of potential inconsistency of "typically used" estimators, Sala-i-Martin, Doppelhofer and Miller's approach named Bayesian averaging of classical estimates (BACE) is expanded for the situation in which instrumental variables estimators are used. Another contribution of the study is the use of 'overlapping' panel data in which subsequent observations cover observations from partly overlapping periods.

The report is composed of six sections. Section 2, that appears after introduction, presents some empirical evidence on the relationship between institutional variables and economic growth. Section 3 shows the methodology. Analyzed data are described in section 4. The results of the analysis are presented and discussed in section 5. Section 6 concludes.

## 2. Review of the literature

In the literature, there are a lot of studies that analyze the relationship between institutional variables and economic growth. Since it is impossible to review all (and even a large part) of them in this report, only the most interesting (from the point of view of the aim of the analysis) and up-to-date studies are cited and described here. Instead of extending the number of quoted studies, we decided to present a lower number of them but in a more detailed form to compare the results with our analysis and to show some unsolved problems and ambiguities.

De Haan, Lundström, and Sturm (2006) show probably the widest review of empirical studies on the relationship between economic freedom and economic growth, describing in details more than 30 empirical studies published between 1994 and 2005. A separate review is devoted to those studies in which the causality analysis is carried out. According to the authors, a large number of recent empirical studies suggest that economic freedom may be important in explaining cross-country differences in economic performance. The authors also argue that most studies reviewed have serious drawbacks, including lacking sensitivity analysis and poor specifications of the growth model used. This is one of the reason for employing the Bayesian model averaging as it is done in the current study. Another criticism refers to the problem of aggregation of the overall index – that is why in the current study the component indicators are also examined.

Similarly, Doucouliagos and Ulubasoglu (2006) examine the relationship between economic freedom and economic growth on the basis of the meta-analysis of 45 studies taken from the literature. Their meta-analysis shows clearly that there is a positive and statistically significant association between economic freedom and economic growth.

Justesen (2008) analyzes the causal relationship between economic freedom and economic growth using the Granger causality tests. The period analyzed is 1970-1999 and the number of countries differs between the respective models (approaching even 77 countries). The analysis is based on panel data grouped into 5-year intervals. Economic freedom comes from the Fraser Institute. The author

examines both the overall indicator as well as all the category indices. The control variables are: initial GDP per capita, investment rate, population growth, the average years of secondary schooling, and the democracy index. The models are estimated based on the bias-corrected fixed effects least-squares-dummy-variable (LSDV) estimator. The number of lags is up to 2. The main conclusion is that economic freedom does matter for economic growth, but that some freedoms matter more than others. In fact, a critical assessment of the results suggests that apart from the composite index, only two of the constituent components of economic freedom – government size and regulatory policies – have robust effects on economic growth and investment. On the one hand, these results support the hypothesis that at least some aspects of economic freedom are important determinants of economic growth. On the other hand, the analysis raises doubts as to whether all dimensions of economic freedom matter for economic growth. These findings justify that sensitivity analysis is very important and that BMA model applied to component indicators is necessary to verify the research hypotheses.

Aixalá and Fabro (2009) carry out a wide empirical study on the causality between economic growth and the following dimensions of institutional quality: economic freedom, civil liberties and political rights. Moreover, the authors examine the relations between these freedoms and investment in physical and human capital to be able to isolate the direct and indirect effects on growth. The study is based on panel data for 187 countries and five-year observations for the 1976-2000 period. The index of world economic freedom is that published by the Fraser Institute. As there is evidence that the changes in the different institutional dimensions are even more relevant than their levels, the authors carry out the analysis for both the levels of and the changes in the institutional variables. The causality is tested using the Granger methodology. The estimation method is the generalized method of moments, dynamic panel data for the equation in first-differences proposed by Arellano and Bond. The results show that political rights precede growth, while there is a bilateral causality relation in the case of economic freedom and civil liberties with growth. When the analysis works with changes and not with levels, only the relation between changes in economic freedom and growth is significant

and it is also bilateral. Given these results, it is appropriate to analyze both the level of and the change in economic freedom and this approach is assumed in the current study. Moreover, the fact that the causal relationship between economic freedom and economic growth is mostly bilateral justifies the treatment of freedom variables as endogenous.

Heckelman and Knack (2009) analyze, among others, the relationship between economic freedom and economic growth in the typical growth regression estimated based on cross-sectional data. The study includes 47 aid recipient countries and the 1980-2000 period. To avoid the endogeneity problem, economic growth is regressed on lagged values of the change in the Fraser Institute index of economic freedom. The other control variables include initial GDP, democracy, investment, education, child mortality, and a number of colonial dummies. Two models are estimated: the first one includes the overall index of economic freedom and the second one includes its five components. The results show that the change in economic freedom has a positive and statistically significant coefficient in the growth regression. In the case of the component indicators of the index of economic freedom, four areas generate a positive coefficient (but legal structure and property rights variable is insignificant) while one area (regulation) generates a negative and statistically significant coefficient. In this light it is worth to check whether indeed regulation is the least important freedom from the point of view of economic growth or maybe this outcome is only a coincidence resulting from, inter alia, variable selection bias or improper method of model estimation.

Azman-Saini, Baharumshah, and Law (2010) conduct another study in which the component indicators of the index of economic freedom are analyzed. They analyze the relationship between the Fraser Institute index of economic freedom (both the overall indicator and its components), FDI, and economic growth for 85 countries during 1975-2004. The panel is divided into non-overlapping 5-year subperiods. They estimate growth regressions using the GMM system estimator where the variables used as regressors include also lagged income, life expectancy, FDI, investments, and population growth. Some models include nonlinearities (e.g. the product of FDI-GDP ratio and economic freedom). The authors find that

economic freedom is an important driver for long-run growth and – in terms of the index components – security of property rights, freedom to exchange, and market regulations are all important elements of a nation's absorptive capacity. These outcomes are partly opposed to those in the previously quoted study, being another argument for conducting an in-depth and robust analysis of the impact of various areas of freedom on economic growth as it is done in the current study.

Bergh and Karlsson (2010) examine the relationship between government size and economic growth, controlling for economic freedom and globalization. The study covers 29 OECD countries and the 1970-1995 or 1970-2005 periods. The models are based on panel data in the form of 5-year intervals. The index of economic freedom is calculated by the authors based on four (out of five) components of the Fraser Institute index of economic freedom (one component: size of government is excluded). The authors perform the BACE approach on the basis of panel regression with country and year fixed effects. The set of control factors includes 21 variables. Five variables are selected randomly for each regression. Unexpectedly, the results for 1970-1995 show that the idea that economic freedom matters is given little support: the indices have low inclusion probability and often the wrong sign conditioned on inclusion. However, for a longer period of 1970-2005, the results change a little bit: the freedom to trade (a component of the index of economic freedom) is robustly related to growth in one specification of the model. In our opinion, unexpected outcomes could result from inappropriate type of estimator and model specification – the use of Blundell and Bond's GMM system estimator with nonlinearities applied in this study should better reflect the true relationship between economic freedom and economic growth.

Pääkkönen (2010) tests the hypothesis that better institutions, measured in terms of economic freedom, contribute to growth using data for 25 transition economies during 1998-2005. Control variables include, apart the Heritage Foundation index of economic freedom which is – according to the author – the primary measure of institutions, also investment and general government expenditure. Regression equations are estimated using Arellano and Bond two-step GMM and the time series are taken as annual panel data. Some models include also

nonlinearities. The author finds that, first, as long as there are insufficient institutions or private capital, improvements in institutions and investment tend to boost productivity growth; second, government consumption has a negative impact on growth; and third, growth researchers should test for the presence of nonlinearities since nonlinearities are present in the growth model in terms of interactions. The latter finding is another justification for the nonlinear approach taken in this study.

Compton, Giedeman, and Hoover (2011) use the measure of economic freedom representing the following areas: size of government, takings and discriminatory taxes, and labor market freedom, and find the positive relationship between economic freedom and economic growth for the 50 US states during 1981-2004 (but not all components of economic freedom affect growth equally). Their results are partly robust because (i) the authors employ both OLS with fixed effects as well as system GMM dynamic panel analysis, (ii) the freedom variables are considered in two forms: the average level of freedom during the 5 year period and the change in the freedom index over the 5 year period. More specifically, the authors find that the level of economic freedom is significantly positively related to growth for a model using OLS but not related under system GMM; both estimation methods do, however, yield strongly positive relationships between changes in freedom and growth (though these results do not hold for every sub-component of economic freedom). These outcomes show that the results are mixed depending on the method; moreover, it is uncertain whether the level of regulatory variable matters or its change as well as which freedoms contribute mostly to economic growth. Hence, the approach applied in our study, namely the usage of both levels and changes of institutional variables (their aggregated indices and component indicators) along with the application of the BMA method, is justified to obtain possibly robust results.

Williamson and Mathers (2011) analyze the relationship between economic freedom, culture, and economic growth. Index of economic freedom is taken from the Fraser Institute while culture is the sum of three positive beliefs (control, respect, trust) minus the negative belief (obedience) and is calculated based on the World

Values Surveys. The other control variables are the following: investment share of GDP, logarithm of total area of a country, growth rate of population, percentage of population living in an urban area, total number of pupils enrolled in primary school, geography measured as the absolute value of the latitude of the country, and dummy variables representing English or French legal origins. The study covers the 1970-2004 period and is based on panel data using five-year averages. The number of countries differs between the respective models – in some models the number of countries exceeds 100. A lot of regression equations are estimated using OLS or fixed effects. The models differ in terms of the set of control variables; some of them include lags to test causation. The results indicate that economic freedom is relatively more important for growth than culture. The approach taken in the cited study, namely to estimate a lot of models with different methods and control variables, is also shared in our analysis.

Fabro and Aixalá (2012) examine the relative impact of economic freedom, civil liberties, and political rights on economic growth. They build a system of three simultaneous equations to unearth the channels through which these institutional dimensions affect economic growth (these include greater efficiency and enlarged investment in physical and human capital). The analysis covers 79 countries and the 1976-2005 period, divided into six 5-year time intervals. The system of three equations includes, inter alia, the growth equation where the average growth of the per capita GDP is regressed against the logarithm of the per capita GDP at the beginning of a given subperiod, the average rate of investment in physical capital (as a ratio of GDP), the average rate of enrollment in secondary education, and the institutional quality indicator being the index of economic freedom (from the Fraser Institute), or the indicator of civil liberties or political rights (from the Freedom House). The applied method is two-stage least square weighted (2SLSW) and panel data. Socio-cultural factors, ethno-linguistic fractionalization, legal origin, and percentage of the population belonging to the Muslim religion are used as instruments for the institutional variables. The results show that the three dimensions of institutional quality (economic freedom, civil liberties, and political rights) are important for economic growth either through a better allocation of resources or,

indirectly, through the stimulation of investment in physical and human capital. Given the large set of possible transmission channels between institutions and economic growth, it is also necessary to analyze a wide set of various institutional indicators, not only economic freedom and democracy indices as in the majority of the studies, but also such variables like doing business indicators or transition indicators. The use of these variables in this report augments the knowledge on the transmission channels between institutions and GDP dynamics.

Peev and Mueller (2012) examine the interrelationships between democracy, economic freedoms, and economic growth. They study 24 post-communist economies over the 1990-2007 period. Democracy index is taken from the Freedom House while economic freedom (and its components) comes from the Heritage Foundation. The analysis is based on annual data. In the growth equation, the explanatory variables include: total government expenditures or general government balance as percentage to GDP, logarithm of annual real GDP per capita lagged one year, investment as percentage to GDP, growth in population, and economic freedom indicators representing the following freedoms (and entering the regression equations separately): business, trade, monetary, investment, finance, property rights, and corruption. Some other models were also estimated by the authors. For example, the models with country fixed-effect dummies or – to address the problem of endogeneity of economic freedoms with respect to growth – a two equation model using three-stage least squares. The authors find that strong democratic institutions are associated with greater economic freedoms and larger public sectors and public deficits. Stronger economic freedoms lead to more rapid economic growth, but large public sectors and public deficits have adverse effects on growth. The study identifies trade freedom, monetary freedom and freedom from corruption as the most important economic growth determinants in transition countries. However, democracy can have also an adverse effect on economic growth, by producing larger public sectors and public deficits, which lead to higher taxes and a greater fiscal drag on the economy. Given these results, it is worth to carry out a more advanced analysis covering more countries and aiming to find which areas of freedom affect mostly economic growth and whether some negative effects between institutional variables (like democracy) and economic growth are indeed evidenced.

## 3. Bayesian model averaging

In order to formulate and estimate models that would allow for proper treatment of regulatory environment and its influence on economic growth, a couple of issues must be mentioned and considered adequately. These are common for most GDP growth models, whether their main goal is identifying processes of convergence or finding relevant growth factors and shall be briefly discussed here in order to motivate the technique applied in the study.

First of all, the phenomenon of economic growth should be observed in longer time horizon and it does not seem economically sound to use observations from e.g. annual or biannual time periods. There is a huge number of papers that treat the empirics of economic growth. Hardly any of them make use of pure time series. The natural problem with time series in the discussed context is due to shortage of proper data set. Although it would be possible to collect a long time-series regarding typical macroeconomic measures for a selected economy, it is obvious that virtually all the macroeconomic processes are unstable in very long time horizon, thus it does not make much sense to consider e.g. an entire century as proper sample (even assuming that one would be able to gather trustworthy values of the essential variables). On the other hand, dividing medium-horizon data into very short periods in order to maximize the number of observations (for example using monthly data) would not enable identification of the process itself and its dynamics.

On the other hand, a number of papers are based on cross-sectional data covering differing groups of countries. Still nowadays it is no more as popular to make use of cross-sectional data as it used to be. There are a few reasons for that. One problem is that cross-sectional data make it much more difficult to handle endogeneous regressors. Classical least squares-based estimators are biased and inconsistent while those are involved, whereas it is virtually impossible to propose for macroeconomic variables valid exogeneous instruments which would be undoubtedly correct without making use of variables' lags. These, however, are usually unavailable if the data set is purely cross-sectional. Secondly, it is well known that cross-sectional regressions would be valid if and only if the steady states

of particular economies (units) involved were the same. Reaching this target is impossible unless there is perfect, unlimited flow of information, workforce, experience, knowledge etc. between all the considered countries, which is an unrealistic assumption. Theoretically cross-section-based models would be correct if all the variables that identify not just the growth dynamics but also the steady state were included in the regressions, however this again seems impossible to attain. Still, even assuming perfect flow of information and exogeneity of all the regressors, one would end up with a low number of observations (equal at best to the number of modeled economies) which might lead to quite incidental results.

Thus most contemporary economic growth studies are based on panel data. Just the use of panel data itself solves two of the above mentioned problems. Firstly, it provides the researcher with vastly extended number of observations without the necessity to divide the sample into very short time spans. Secondly, it allows for introduction of individual effects for particular units (countries) which can be interpreted as their steady states. The latter is possible thanks to repetitive observations overtime and thus there are no identification problems behind them, which would be a problem in the context of cross-sectional data.

In older growth empirics research works based on panel data the usual treatment of individual effects was based on either fixed or random effects specification. However, nowadays it is well known that both fixed effects and random effects estimators are inconsistent while applied to dynamic (autoregressive) models. Theoretically the fixed effects approach would be proper if the length of time series for particular countries was infinitely large. Since, as already discussed, it would not be a proper solution to divide the time series into a large number of observations covering very short subperiods each, this cannot be the case in growth research. Instead one can use a selected dynamic estimator based on instrumental variables or the generalized method of moments. Probably Anderson and Hsiao (1982) were the first to propose the use of instrumental variables in the context of panel data. Still their estimators were highly inefficient as compared to GMM-type estimator proposed by Arellano and Bond (1991) which actually expanded on one of Anderson and Hsiao's proposal. However Arellano and Bond also proved to be

inefficient and suffered from large small sample bias. In particular, while the true autoregressive parameter was close to unity, its estimate provided by Arellano and Bond's estimator would be typically biased downwards. That resulted in overestimating the true rate of economic convergence in early papers that made use of this technique. Out of a variety of GMM-based dynamic estimators for panel data, probably the system GMM estimator proposed by Blundell and Bond (1998) is the most popular and commonly used and it proves not to suffer from downward bias as it is the case with Arellano and Bond's estimator.

Applying GMM dynamic panel data estimators provides numerous advantages. GMM estimators, if properly formulated, are consistent in autoregressive specifications thus improve on random or fixed effects methods. Also, being based on the set of panel data allow for the inclusion of individual effects. Finally, regressors can be treated as endogeneous, predetermined or strictly exogeneous and instrumented adequately with the use of lags, which further reduces the risk of inconsistency. However, GMM is a typical large sample method: the positive properties of the above mentioned estimators would not essentially hold if the model was used on few observations only. This is an issue in growth models: on the one hand one would be interested in minimizing the length of a single observation and making it a month or a year in order to maximize the number of observations, which is required to maintain positive properties of GMM estimators. On the other hand, this way of proceeding is incorrect for typically long-horizon phenomena such as economic growth and would diminish economic sense of the obtained estimates. Finding a compromise is truly difficult to attain especially when one considers a limited sample of countries (e.g. EU27 countries) instead of all the countries of the world, which obviously further reduces the potential observations.

Finally there is a problem of model specification which basically covers two issues: what is its proper functional form of the growth model and which variables should be included in it. As far as the functional form is concerned, most authors in empirical research make use of the so called Barro regression at least as the starting point due to its relative simplicity and, first of all, economic motivation (see e.g., Barro and Sala-i-Martin, 2003). However, in case of at least some of the potential

regressors it is not clear whether their influence on the rate of growth should be linear (or even monotonous). One possible approach is to extend the list of regressors by inclusion of their nonlinear functions such as e.g. squares and interactions replacing the right hand side of the regression which typically is a first degree polynomial with a second degree polynomial of particular variables. This can naturally be further extended to any higher degree polynomial further on. Yet the complexity of the right hand side of the model yields the risk of finding a spurious relation: it is obvious that including additional variables results in the decrease in the number of degrees of freedom. That makes the model look as if it fits the data better than it does in reality whereas the true effect is worsening the properties of GMM estimators for whom the high number of degrees of freedom is crucial. Also the spurious "good fit" of the model attained by lowering the number of its degrees of freedom might result in obtaining incidental parameter estimates. Their values are only due to optimizing the fit of the model in the mathematical, not the economic sense whereas the economic interpretation based on the obtained estimates is far from reality. Thus unless the number of observations is truly huge, it is vital to limit the process of expanding the functional form by including extra variables considering only those of them which, on the basis of economic assumptions, are truly likely to be relevant and avoiding unnecessary higher order degree polynomials and interactions (unless their presence could be economically motivated).

The second issue related with model specification is the above mentioned set of independent variables. There hardly exist sets of papers with the same sets of independent variables in growth models. That is not only due to data shortages for particular country groups or periods: the main reason are different views of particular authors on what is and what is not a relevant growth factor on the theoretical basis and thus what is included in the model so as to provide empirical evaluation of the theoretical view. Just as it is in the case of excessive interactions of higher order polynomials, it would not be a proper solution to – experimentally – consider all the possible growth factors that the data allow for. The reason for this is again the same: such a situation would lower the number of degrees of freedom of the model excessively. In limited groups of countries (e.g. EU15) over shorter time

horizon that might even make the estimation infeasible since the number of growth factors considered in literature might exceed the number of available observations. Still even if treatable, that would decrease the efficiency of estimates and increase uselessly the risk of multicolinearity. On the other hand, skipping relevant growth factors is likely to cause the omitted variables bias should the removed growth factors be relevant and correlated with other regressors that are included in the model.

A possible solution is to apply one of the estimation tools that handle the problem of sets of regressors that might include both relevant and irrelevant variables, that cannot be objectively decided a priori by the researcher. Leamer's (1978) extreme bound analysis was probably the first systematically described tool that was designed to simplify making a proper choice in this respect, however it has been widely criticized for its weakness. Theoretically it was expected to divide the set of preselected wide set of potential regressors into relevant and irrelevant ones, however for numerous groups of countries and time periods no relevant growth factor could be found in Leamer's sense.

Bayesian model averaging (BMA) proves to be a much more powerful tool, though in the case of higher number of considered regressors the procedure is highly time consuming even despite availability of modern numerical methods (Bernardelli (2012) proposes an example of fast and efficient algorithm of estimation of linear models). It has been popularized in the context of growth regression by Sala-i-Martin, Doppelhofer and Miller (2004, SDM hereafter) who applied a simple version of BMA called Bayesian averaging of classical estimates (BACE). Their idea was to estimate growth regression with the use of a simple OLS estimator over a set of cross-sectional data for particular countries. Since the set of potential regressors included over 60 variables, one could theoretically select over $2^{60}$ non-empty subsets of the whole set of potential regressors thus constituting the same amount of different regression models, each explaining the rate of economic growth. Their algorithm was based on first assigning a prior probability of relevance to each of the models. The prior probability of relevance might be done in a number of ways, however the most natural assumption is to treat each of the variables as

relevant with the same prior probability being equal to the ratio of the expected number of variables in the true model and the number of variables in the predetermined set of potential regressors. Further on one can use Bernoulli's scheme to determine the prior probability of relevance of each possible model, which will thus be the same throughout all the models with the same number of regressors. The next step is to estimate each of the models (or a random sample of models if their number is too high, as in the case of SDM) and correct their prior probabilities with the use of Bayes formula thus yielding posterior probabilities for each of the considered models.

SDM's BACE differs from the general BMA algorithm in that it uses the simple OLS estimator only, which makes it easy to approximate posterior probabilities of each considered model with the use of a function of the sum of squared residuals (or with the use of the Bayesian (Schwarz) information criterion, yielding the same result). In the general case, the approximation of the posterior Bayesian probability of relevance of each model is computationally less attractive. However, for the GMM estimator Kim (2002) has shown a way to properly approximate the posterior probability.

Let $n$ be the number of observations available for every observation (a given country in particular period) and denote the number of "candidate-variables", that is the variables which are supposed to be the likely relevant growth factors, as $K$. Let $\mathrm{Q}(\theta_j)$ be the GMM loss function that is minimized while estimating model $M_j$ with $j=1,\ldots,2^K$. Further, let $D$ be the dataset used, while $\mathrm{P}(M_j \mid D)$ shall denote the probabilities of relevance of each $M_j$, that is the prior probabilities "corrected" by to which extent $D$ supports the hypothesis that $M_j$ is the true model. Kim shows that

$$\ln \mathrm{P}(D \mid M_j) = -0.5n\mathrm{Q}(\hat{\theta}_j) - 0.5K'_j \ln n \qquad (1)$$

with $K'_j$ standing for the (total) number of parameters of $M_j$ and $\mathrm{Q}(\hat{\theta}_j)$ standing for the minimized value of $\mathrm{Q}(\theta_j)$ is the limited information likelihood analog to Schwarz's BIC. That, after proper substitution, allows to write the posterior probability of $M_j$ as:

$$\mathrm{P}(M_j \mid D) = \frac{\mathrm{P}(M_j) n^{-K'_j/2} \exp[-0.5n\mathrm{Q}(\hat{\theta}_j)]}{\sum_{i=1}^{J} \mathrm{P}(M_i) n^{-K'_i/2} \exp[-0.5n\mathrm{Q}(\hat{\theta}_i)]}. \quad (2)$$

In the last step the estimates of parameters standing by each of the potential regressors are obtained as the weighted estimates of the parameters from each estimated model, while posterior probabilities (2) are treated as weights. Similar logic is applied to obtain the standard errors of estimates. Let $\hat{\beta}_{r,j}$ stand for the estimator of a parameter standing by the variable $r$ in model $M_j$. Let $\hat{\beta}_r$ be the "final" estimator of parameter $r$, being the result of the total BMA process. Let us denote their variances as $\mathrm{Var}(\hat{\beta}_{r,j})$ and $\mathrm{Var}(\hat{\beta}_r)$ respectively. Then:

$$\hat{\beta}_r = \sum_{j=1}^{2^K} \mathrm{P}(M_j \mid D) \hat{\beta}_{r,j}, \quad (3)$$

$$\mathrm{Var}(\hat{\beta}_r) = \sum_{j=1}^{2^K} \mathrm{P}(M_j \mid D) \cdot \mathrm{Var}(\hat{\beta}_{r,j}) + \sum_{j=1}^{2^K} \mathrm{P}(M_j \mid D) \cdot (\hat{\beta}_{r,j} - \hat{\beta}_r)^2. \quad (4)$$

The statistics that could be used to draw conclusions regarding significance of particular potential regressors could be based either or averaged *t* statistics (yielding a pseudo *t*) or on a Bayesian posterior probability for each variable. We shall not further discuss the formulas and their derivation for the BMA algorithm applied in general or applied to GMM estimators. The interested reader might refer to one of the papers incorporating this technique, such as Próchniak and Witkowski (2013), or Moral-Benito (2011) limiting the attention just to the papers devoted to economic growth.

The approach incorporated in this study makes use of the techniques mentioned above so as to solve the discussed problems and expands on them in the following way. The classical Barro regression is firstly written in the context of panel data:

$$\Delta lnGDP_{it} = \beta_0 + \beta_1 lnGDP_{i,t-1} + x'_{it}\beta + \alpha_i + \varepsilon_{it}, \quad (5)$$

where $\Delta lnGDP_{it}$ is the change of log GDP for *i*-th country over *t*-th period, $\beta_0$ is the constant, $lnGDP_{i,t-1}$ is the one period lagged log GDP, $x_{it}$ is a vector of the considered growth factors for *i*-th country over *t*-th period, $\alpha_i$ is the individual effect

of the *i*-th country and $\varepsilon_{it}$ is the error term.

However, the dynamics of (5) requires it to be transformed to:

$$lnGDP_{it} = \beta_0 + (\beta_1 + 1)lnGDP_{i,t-1} + x'_{it}\beta + \alpha_i + \varepsilon_{it}, \quad (6)$$

which enables estimation with the use of instrumental variables or GMM approach. For the sake of the efficiency reasons, Blundell and Bond's system GMM is used. The vector $x_{it}$ for each model contains a set of considered variables, including the institutional environment measures. Most potential regressors are allowed to be endogeneous, however few of them are assumed to be strictly exogenous. The division is made on the basis of economic theory while the way it is done is described in the section devoted to the description of the dataset.

Following most authors and also our own views, the variables in $x_{it}$ are included either linearly or are logarithmized, except for the institutional environment measures, which are additionally included in their second power. There is a clear reason for inclusion of their squares in the set of independent variables. While it would be difficult to explain why their impact on economic growth could be monotonous, there is no reason to believe it is linear. A logical alternative is to expect them to have a positive, yet decreasing influence on the economic growth and such a situation might be – in most cases – reasonably well approximated with a parabola. Naturally should the true relationship be linear (or none at all), that may be easily detected on the basis of the significance test of the given squared regulatory environment indicator. Such a way of proceeding does not lead to huge increase in the number of variables (thus does not reduce the number of degrees of freedom in a way that might be viewed as dangerous for the properties of GMM) but does allow for simple nonlinearities in the modeled relationship.

The problem of the unknown set of the relevant explanatory variables is solved with the use of BMA algorithm. However, we do make an assumption that the process of GDP beta convergence *does* take place and do not wish to check for it and so the lagged GDP is included in every regression. The reason for this treatment is the fact that there exists hardly any research pointing to nonexistence of the relative convergence process in longer time horizon and so the lagged GDP can be almost surely treated as a relevant variable in the regression. Dropping it from the

estimated models would thus almost surely mean making an omitted variable bias error. Naturally that is a nature of BMA algorithm itself, however it is unnecessary if for a given variable there exist sufficient reasons to undoubtedly treat it as relevant and just keep it inside every estimated equation. We follow a similar procedure with regulatory environment measures, however in their case the reason does not come from the certainty regarding their relevance but is due to limiting the attention to the equations in which regulatory environment measures are present since the study is profiled at estimating their influence on economic growth. While a given indicator is included in an equation, its square is included as well for the above mentioned reason. However since the set of considered environment indicators differs between particular models, we provide the more detailed explanation on which indicators where included and what the algorithm of their selection was separately for every estimated model. In general the number of considered candidate variables was low enough to enable estimation of every possible $M_j$ without restricting the attention to randomly selected subset of possible $M_j$'s – few exceptions from this rule are also mentioned later in the report.

As it has been mentioned, it is vital to divide time series into relatively long subperiods since observing and explaining growth dynamics on the basis of e.g. annual observations is not economically sound. Depending on the authors, length of a single period in the applied research is usually designed to be a few years long (although papers where both shorter and longer periods are used are not uncommon either), ideally it might be expected to be between 5 and 10 years. The obvious consequence of such a design of the data set is that due to the length of a single observation there are going to be very few observations per country if "traditional" methods are applied: assuming 30-year-long time series for each country involved, one would end up with a series of merely 3 to 6 observations per unit. Applying Blundell and Bond's system GMM further reduces the length of the effectively used series by at least two initial periods due to lack of instruments. Naturally the number of observations that are left in the sample is difficult to accept and it cannot be expected to provide valid estimates, especially when typically large sample estimators are used. A typical solution of this problem is to shorten the length of

particular periods. That naturally allows for extra observations, however disables measuring the growth dynamics in a proper way.

Instead we propose the following algorithm. Suppose that the length of a single period in the data is set to be 10 years (in the study it equals 5 or 10 years, depending on the indicator). Let $t$ stand for the number of the year. Thus the first period in most research would cover observation from years $t$=1 up to $t$=10, then it would be followed by observation from years $t$=11 up to $t$=20 and so on. Depending on the character of the variables and the completeness of the data set, an observation on a selected variable $z$ for a single period would either be evaluated as a mean $z$ from the years covered by the period of interest, the value of $z$ for the last (or possibly first) observation or eventually the difference between the value of $z$ in the first and the last year covered by the period of interest.

However in order to increase the number of observations without shortening the length of a single one, we propose the use of overlapping observations. Still assuming that the length of a single period in the data is 10 years, that would mean using observations from years $t$=1 up to $t$=10 for the first period, however from years $t$=2 up to $t$=11 for the second period, from years $t$=3 up to $t$=12 for the third period, etc. More generally, assuming that the length of a single period is $s$ years (in this study, $s$ = 5 or 10), an observation from period $\tau$ is based on the data from years $\tau$ upto $\tau + s - 1$. At first this might seem like artificially created redundant observations which only seem to constitute long time series, but in reality contain each piece of information $s$ times. That, however, is not true. It can be easily noticed in formula (5) that the dependent variable in the initial form of the model as well as in (6) that the dependent variable in the finally estimated version of the model for each observation is different. The value of GDP for the $i$-th country in year $t$ is used to create exactly two observations: once as a starting one ("old", "former") and once as "current" GDP, just as it is in the case of panel based on non-overlapping observations. Thus the proposed procedure does not lower the relative variance of the dependent variable by construction and does not lead to inefficiency. We believe that this way we make the most efficient use of the available data.

The description of the method used would be incomplete if the details of

particular regressions were not provided as regards the assumptions referring to the type of regressors (endogenous, predetermined, strictly exogenous), the way particular variables were constructed for subsequent periods on the basis of annual data (whether based on means, differences or the value for the initial/final year), the length of particular periods and finally the way BMA is organized: which variables are maintained in the model throughout the estimation process and how are the candidate variables selected for particular models in those marginal cases where not all the possible models are estimated. Since for each of the proposed final forms of (6) differing in, mostly, the set of regulatory environment indicators and the $x_{it}$ list slightly different algorithm had to be assumed, these details are provided in the next section.

# 4. Data

The study analyzes the following areas of the regulatory environment: economic freedom, the quality of governance, the level of democracy, the ease of doing business, and the progress of market (structural) reforms. These areas of regulations (institutions) are measured by the following indicators:

- the Heritage Foundation index of economic freedom,
- the Fraser Institute index of economic freedom,
- the World Bank worldwide governance indicators,
- the Freedom House democracy index,
- the World Bank doing business indicators,
- the EBRD transition indicators.

The institutional variables (described later in this section) are included in the analysis in the following ways: (a) as the overall indicator or the component indicators, the latter ones being category indices of the aggregated variables; (b) as the level being the arithmetic average of the values recorded over a given subperiod, or the change between the initial and the final year of a given subperiod. The respective institutional variables are included in separate BMA models to obtain the most reliable results and to avoid multicollinearity. The full list of BMA models estimated in this study is presented in Table 1.

Table 1 also shows the way of data transformation applied in a given model: cross-sectional or overlapping panel data, and – in the latter case – the length of a given subperiod. If an institutional variable is available for a relatively long time horizon (as in the case of Fraser Institute index of economic freedom and Freedom House democracy index), the model is based on 10-year time intervals to avoid the influence of business cycles and short-term shocks affecting the pace of economic growth. The models for the Heritage Foundation index of economic freedom, the World Bank worldwide governance indicators, and the EBRD transition indicators are based on 5-year overlapping panel data because the available time series are much shorter. Only doing business indicators, which are available for a very short time span, are estimated based on cross-sectional data.

Economic growth is measured by GDP per capita at purchasing power parity (PPP) in constant prices, taken from PWT database (Heston, Summers, Aten, 2012). In the case of panel data, economic growth is calculated as follows: e.g. for the 2001-2010 subperiod it is the difference between the log GDP per capita levels in 2000 and 2010. In the case of cross-sectional data, it is simply the difference between the log GDP per capita levels in the last and the initial year of a given time horizon.

The selection of control variables is in line with empirical studies: 20 control variables (not including regulatory variables) are tested as growth factors in the study (but in the respective BMA models the set is further reduced). Those are listed in Table 2. Control variables are taken as averages for the years covered by a given observation (some interpolations were carried out if necessary). Since it is believed that there does exist the beta-convergence, initial GDP per capita appears in each estimated equation. The remaining control variables are randomly chosen from the initially selected set of factors.

Life expectancy, fertility rate and all the population variables are treated as exogenous. All the remaining variables are assumed to be endogenous which reflects our own opinion but it is also in line with the other empirical studies. It should be noticed that while treated a truly endogenous variable as exogenous might result in inconsistency of the applied estimator, the opposite operation (allowing a truly exogenous variable to be treated as endogenous) will not cause that problem, though might result in decreasing the efficiency. Still, efficiency gains are tempting. While in case of most macroeconomic variables it would be very difficult to give rationale for treating them as exogenous, there might be some doubts concerning the institutional variables. The following studies suggest or empirically confirm that institutions are endogenous: Hall and Jones (1999), Acemoglu, Johnson, and Robinson (2001), Dawson (2003), Eicher, García-Peñalosa, and Teksoz (2006), Tridico (2011), still is would be interesting to run a formal check of their endogeneity since a natural question comes up: are the institutions the engine of growth or maybe is the positive growth an engine of institutions' development? In the research we treat them as endogenous, however, in the chapter describing the

results we present some more formal verification of this assumption.

Since it would be impossible to collect the complete data for all the control variables for a relatively long time horizon and a wide range of countries, in the respective BMA models the list of explanatory variables is reduced to obtain a reasonable compromise between a large number of observations and a large set of explanatory variables. The detailed list of variables included in the respective BMA models is presented in Table 3.

The main argument of reducing the set of explanatory variables in the respective BMA models is related with the necessity to obtain a partly balanced panel in each BMA model. The partly balanced panel means that if a given observation is included, there are no missing values of any of the explanatory variables. But the panel is not fully balanced and the number of observations differs for the individual countries.

The study covers 171 countries (listed in Table 4) and the 1970-2012 period. However, due to data unavailability, various BMA models are estimated for different groups of countries and different years. The exact sample of countries and time period for which a given BMA model is estimated are shown in Table 5. Nevertheless, except for models for the EBRD transition indicators which cover only post-socialist countries, all the BMA models are estimated based on more than 100 countries which should make the obtained results reliable.

One aspect of achieving robust results in this study refers to the BMA method incorporating the random selection of variables treated as control factors. Another area of robustness is performing calculations for the whole sample of countries as well as for different subsamples. In this study, two subsamples of countries are analyzed: the group of 27 European Union countries (EU27) as well as the group of post-socialist (transition) economies. All the BMA models are calculated for the whole sample of world countries as well as for the two distinguished subgroups.

Let us characterize now in greater detail the institutional variables analyzed in the study.

The Heritage Foundation index of economic freedom is an arithmetic average of the 10 category indices: business freedom, trade freedom, fiscal freedom,

government spending, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption, and labor freedom. All the indicators range between 0 and 100. Higher value is the desirable outcome because it represents a greater scope of economic freedom. In the study, only nine component indicators are analyzed (except labor freedom which covers a shorter period).

Another index of economic freedom is compiled by the Fraser Institute. The Fraser Institute index of economic freedom is a qualitative variable composed of 5 indicators: (a) size of government, (b) legal structure and security of property rights, (c) access to sound money, (d) freedom to trade internationally, (e) regulation of credit, labour and business. The indicators are further made up of several sub-components. In total, the index covers more than 40 distinct variables. It ranges between 0 and 10 with higher outcome representing greater scope of economic freedom. In the study, all the five main component indicators listed above are examined.

The World Bank worldwide governance indicators cover six areas: (a) voice and accountability (it captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media); (b) political stability and absence of violence (it measures the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including domestic violence and terrorism); (c) government effectiveness (it captures 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); (d) regulatory quality (it captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development); (e) rule of law (it captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence); (f) control of corruption (it captures 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). The indicators range between –2.5 and +2.5 where higher value represents a better outcome. The overall score has been calculated by us as the simple average of the six category indices.

Three indices from the Freedom House database are analysed in this study: political rights, civil liberties, and freedom of the press. The political rights index measures the degree of freedom in the electoral process, political pluralism and participation, as well as functioning of government. The civil liberties index measures freedom of expression, assembly, association, and religion. Freedom House rates political rights and civil liberties on a scale of 1 to 7, with 1 representing the most free and 7 representing the least free. To achieve a scale where higher value corresponds to better outcome, these two indicators have been inverted to 1-7 scale where 1 representing the least free and 7 – the most free. Democracy index has been calculated by us as the simple average of political rights and civil liberties. The freedom of the press index assesses the degree of print, broadcast, and internet freedom. Its original values ranging between 0 (the most free) and 100 (the least free) have been inverted to 0-100 scale where 100 means the best outcome. The freedom of the press index is not included in the democracy index but it is analysed along with political rights and civil liberties.

Doing business indicators are taken from the World Bank database. In general, they are objective measures of business regulations and their enforcement. The study examines 28 doing business indicators which are listed and described in Table 19 (along with the results). The selection of these indicators is based on data availability and economic significance. Of course, we are aware of the fact that they are not equally important measures of the regulatory environment of a given country.

Transition indicators are compiled by the EBRD to assess progress in transition (progress in structural – or market – reforms). Progress is measured against the standards of industrialised market economies, while recognising that there is neither a "pure" market economy nor a unique end-point for transition. Assessments are made in six areas: (a) large scale privatisation; (b) small scale

privatisation; (c) governance and enterprise restructuring; (d) price liberalisation; (e) trade and foreign exchange system; (f) competition policy. The indicators range from 1 to 4.3 (4+ in original scale), where 1 represents little or no change from a rigid centrally planned economy and 4.3 represents the standards of an industrialised market economy. The overall score has been calculated by us as the simple average of the six category indices.

Regulatory variables sometimes may have quite a similar coverage and this does not only concern the two indices of economic freedom which refer to the same aspect of institutional environment. For example, the business freedom component of the Heritage Foundation index of economic freedom is based on the World Bank doing business indicators.

All the estimated regression equations include institutional variables. If the overall index is examined in a given model specification (in a BMA sense), this variable appears in each estimated regression equation. If the BMA model refers to component indicators, the component indices are randomly chosen for the individual regressions but each regression equation includes at least one category variable (but in some cases, to avoid multicollinearity, the models with large number of components are not analyzed – for example, in the case of the Heritage Foundation index of economic freedom the estimated regression equations are constrained to avoid models with e.g. 9 category indicators).

Since nonlinearities are tested in this study, all the institutional variables are included in the regression in a nonlinear form represented by a quadratic function. This concerns both levels and changes.

It is worth noticing that although all the institutional variables (and their components) are treated as endogenous in the regression equations, in some cases endogeneity is more evident than in some other cases. This concerns especially the EBRD transition indicators. These indicators have been created by the EBRD to „promote" and „positively assess" high economic growth of post-socialist countries; hence, it may be expected that such definitional relationship will yield a positive link between GDP dynamics and transition indicators. Of course, the pace of GDP growth is not directly included in transition indicators and that is why the regression

analysis may be carried out. In the case of some other indices, e.g., the Heritage Foundation indicator, the situation is slightly different because the Heritage Foundation when assessing economic freedom of a given country is not influenced by the speed at which an individual economy grows over time. Hence, in this case, the results may be more mixed than in the case of the EBRD transition indicators.

# 5. Results

The results of the main analysis are presented in Tables 6-20 and Figures 1-22. Since the study involves a lot of data processing and there are a lot of numerical outcomes, tables and figures present only the most important and interesting results from the point of view of verifying the research hypotheses. It is necessary to have in mind that some estimated models are not presented in the report (e.g. those that refer to component indicators estimated for country subgroups); similarly, not all the parameter estimates are reported in the case of some BMA models.

All the tables show estimated coefficients obtained with the use of BMA approach along with standard deviations and pseudo *t*-statistics. Estimated coefficients are the numbers averaged over a large number of regression equations that were estimated for a given BMA model.

Tables 6-14 refer to those BMA models which include the aggregated indices of institutional indicators (index of economic freedom, worldwide governance indicator, democracy index, and transition indicator). For these models, the estimated coefficients for all the explanatory variables are reported in the tables; moreover, the results are shown for the whole analyzed sample of countries as well as for the two country groups (EU27 and post-socialist countries).

Tables 15-20 refer to those BMA models which include component indices of institutional variables as well as the individual doing business indicators. These models are presented only for the whole analyzed sample and, for the sake of conciseness, parameter estimates for the other explanatory variables are not reported.

All the figures present the nonlinear relationship between the level of or the change in a given regulatory variable and economic growth using the estimated coefficients from the respective tables.

Figures 1-10 refer to those BMA models which include the aggregated indices of institutional indicators. These figures show the results for two groups of countries: the whole sample (world economies) and the EU27 group. The range of arguments on the horizontal axis refers to the observable range of values of a given

variable in a specified sample of countries; however, to eliminate the interpretation which would refer to non-existing (or hardly ever existing) values of a given institutional variable the axes are further constrained to range between the 5$^{th}$ and 95$^{th}$ centiles in the empirical distribution of a given institutional variable. The values on the vertical axis are not standardized – that is, they represent the direct impact on economic growth based on parameter estimates reported in a corresponding table (and taking the *ceteris paribus* assumption as regards the other control variables).

Figures 11-22 concern the component indices of the aggregated variables, as well as selected worldwide doing business indicators. To put on one chart a large number of functions (which sometimes take completely incomparable values, notably in the case of doing business indicators), the horizontal axes in these figures have been normalized: regardless of the true values of a given variable, point 0 on the horizontal axis corresponds to the 5$^{th}$ centile observed for a given variable in a given country group while point 100 represents the 95$^{th}$ centile in a given group. Moreover, the values of functions in these figures have been standardized according to the formula: (value – mean) / standard deviation + 100, which makes presented outcomes clearer and does not change the aim of the analysis; in the case of component indicators, it is sufficient to know the character of the nonlinear relationship.

The analysis of tables and figures yields a number of interesting findings. For the sake of conciseness, this report tries to find, present and interpret the general characteristics of the results, while the detailed outcomes are given in the tables. (Unless stated otherwise, the results for a given model described below refer to the whole sample of world economies).

According to model 1, the level of economic freedom (Heritage Foundation) nonlinearly contributes to economic growth as reflected by statistically significantly different from zero estimates for all the considered samples of countries. The results for pseudo *t* statistics demonstrate that economic freedom, *ceteris paribus*, affects the pace of economic growth. However, the direction of this relationship (positive or negative) cannot be directly seen from Table 6. To assess the direction of the relationship, it is recommended to draw a respective function on the chart.

The relationship between the level of economic freedom (Heritage Foundation index) and economic growth is shown in Figure 1. This relationship is represented by a concave and upward sloping function (although in the case of EU27 group the function is also partly downward sloping). Thus, the study shows that economic freedom contributes to economic growth which means that countries with greater scope of economic freedom record on average the more rapid output growth. This relationship is clearly nonlinear. The most beneficial effect on economic growth appears in the countries with low scope of economic freedom: making the country more economically free has greater benefit in terms of output acceleration if the level of economic freedom is low. Yet, for the EU27 countries it may be seen that once a certain high level of economic freedom is reached, further raises in economic freedom do not contribute to more rapid GDP growth.

The results for model 3 where the change in the Heritage Foundation index of economic freedom is examined also point to a nonlinear and statistically significant association between changes in economic freedom and the pace of economic growth. Figure 2 demonstrates that the relationship between the change in economic freedom and economic growth is represented, as in the case of the level of economic freedom, by a concave and upward sloping function (with minor exceptions). The graph shows that even a small rise in economic freedom is sufficient to get an acceleration of economic growth since any $(x,y)$ point in the graph represents that the expected *ceteris paribus* extra rate of growth in result of the increase in economic freedom by $x$ points equals $y$ as compared to the situation when no change in economic freedom is observed. Moreover, the higher the increase in economic freedom is, the more dynamic the acceleration of GDP growth is. However, economic growth accelerates less than proportionally: the *ceteris paribus* increase of the index of economic freedom by e.g. 2 points leads to less than twice as high acceleration of economic growth as compared with the situation when the index of economic freedom raises by 1 point.

Comparing these results with the Fraser Institute index of economic freedom, it turns out that the level of economic freedom (Fraser Institute) also nonlinearly contributes to economic growth as reflected by statistically significantly different

from zero estimates of the coefficients standing for EF and $EF^2$ for the sample of world countries. The results for pseudo *t* statistics (42.08 for EF and –40.25 for $EF^2$) demonstrate that economic freedom, *ceteris paribus*, affects the pace of economic growth.

The relationship between the level of economic freedom (Fraser Institute index) and economic growth is shown in Figure 3. This relationship is represented by a concave function which has the shape of a downward sloping parabola. Unlike the previously considered Heritage Foundation index which was entirely increasing, the function for the Fraser Institute index is upward sloping first, and – once a certain level of economic freedom is reached – it becomes downward sloping. Nevertheless, these results also show that economic freedom contributes positively to economic growth in a nonlinear way: the most beneficial effect on economic growth appears in the countries with low scope of economic freedom.

These results are reasonable and they are in line with the theoretical structural model. In economics, the law of diminishing returns often holds which means that marginal productivity of the input is decreasing. In other words, the highest rate of return of a given input is seen when the level of that input is low. Economic freedom can be interpreted as the additional input to the production function. Indeed, there are augmentations of theoretical models of economic growth where institutions are accounted for. In such specifications, institutions are treated as additional inputs in the production function – see e.g. Hall and Jones (1999). In such a case, it is reasonable to assume that regulations, e.g. economic freedom, are another factor of production and they reveal the highest productivity in those countries where they are relatively scarce. This is confirmed in the calculations carried out in this study. Increasing the scope of economic freedom is the most beneficial from the point of view of economic growth acceleration in the countries which are least economically free.

For example, if the scope of economic freedom raises by one point in a country for which the Fraser Institute index of economic freedom amounts to 3.5, the pace of economic growth accelerates more than twice as high, *ceteris paribus*, as in the case of a 1-point increase in the country in which the value of that index has

already reached the level of 4.5. Taking into account the analyzed sample of countries, it turns out that the most beneficial effects on economic growth appear in poor countries – mainly from Africa, Latin America as well as South Asia. Making these countries more economically free leads to a rapid acceleration of economic growth as opposite to the countries which have well developed institutions. In rich countries, such as North American and Western European economies, the effects of raising economic freedom are limited as reflected by a downward sloping part of the parabola.

The results suggest that in rich countries more economic freedom may be even detrimental to economic growth. If this relationship is not spurious, the possible ways of causality are the following. For example, if the rich country increases its scope of economic freedom (e.g. labor market becomes less regulated) it may lead to higher income inequalities (measured by the Gini coefficient) and finally to lower economic growth. Another channel refers to the financial sector, and the recent global crisis is a good example. If financial markets become less regulated, it may raise speculative actions made by financial institutions and the appearance of bubbles which has fatal implications for the economy as it may put the economy into recession.

Although for the full sample the relationship between the Fraser Institute index of economic freedom and economic growth is represented by a downward sloping parabola, this property does not hold for the EU27 countries. In the case of EU27 countries, the pseudo *t* statistics equal 11.99 for EF and 3.67 for $EF^2$. It means that both estimated coefficients are statistically significantly different from zero. However, unlike the full sample encompassing 111 countries from the world, for the EU27 economies the relationship is represented by a convex function, notably an upward-sloping parabola. Figure 3 shows that the observable range of values of the index of economic freedom for the EU27 countries is such that the range between $5^{th}$ and $95^{th}$ centiles corresponds to the upward sloping part of the parabola. Hence, the study demonstrates that for the EU27 countries there is a positive and statistically significant association between the level of economic freedom and economic growth. Countries in which economic freedom is high revealed on average a more

rapid economic growth than the countries with low scope of economic freedom. It means that regulations are very important factor of economic growth of the EU countries and reforms of the regulatory environment should be the priority for policy makers in the European Union. Unlike the outcomes for the Heritage Foundation index, statistical results for the Fraser Institute index do not show that the benefits from institutional reforms are rapidly exhausted in the EU27 group because the function is convex. Hence, Poland as well as the other Central and Eastern European (CEE) countries should focus on institutional reforms aiming to make these countries more economically free.

For transition economies (to be precise – 14 post-socialist countries) the association between the level of economic freedom (Fraser Institute index) and economic growth is nonlinear and estimated coefficients are statistically significantly different from zero. The pseudo *t* statistics for the estimated coefficient standing for EF equals 11.17 while that for $EF^2$ amounts to –7.97. Hence, like in the full sample, the relationship between economic freedom and economic growth is represented by a downward sloping parabola. It is thus extremely important for policy makers in Poland as well as in the other CEE countries to carry out necessary reforms aiming at increasing the scope of economic freedom.

Based on these results it may be concluded that the level of economic freedom is a very important economic growth determinant. To increase the standard of living of the countries and the economic wellbeing of the societies, it is necessary to improve the regulatory environment and to undertake reforms aiming to make the countries more economically free. Association between economic freedom and economic growth is nonlinear which shows that the effects of raising economic freedom may vary depending on the level of economic freedom which has been already achieved.

The results for model 6 where the change in the Fraser Institute index of economic freedom is examined on the basis of full sample also point to a nonlinear and statistically significant association between changes in economic freedom and the pace of economic growth. Pseudo *t* statistics equal 8.05 for $\Delta EF$ and 8.58 for $(\Delta EF)^2$ implying that both estimated coefficients are statistically significantly

different from zero. Figure 4 demonstrates that the relationship between the change in economic freedom (Fraser Institute index) and economic growth is represented by a convex and upward sloping function. The graph shows that even a small rise in economic freedom is sufficient to get an acceleration of economic growth. The higher the increase in economic freedom is, the more dynamic the acceleration of GDP growth is. Moreover, economic growth accelerates more than proportionally which is another difference with the previously considered Heritage Foundation index: the *ceteris paribus* increase of the Fraser Institute index of economic freedom by e.g. 2 points leads to slightly greater than twice as high acceleration of economic growth as compared with the situation when the index of economic freedom raises by 1 point.

When analyzing the results for the two distinguished subgroups it turns out that the nonlinear impact between the change in economic freedom (Fraser Institute) and the pace of economic growth has also been evidenced. However, unlike the full sample, the association is represented by a concave function. The pseudo *t* statistics amount to 18.91 and –11.73 for EU27 countries and 16.16 and –9.05 for 14 post-socialist countries, respectively for the coefficients standing for $\Delta EF$ and $(\Delta EF)^2$. Figure 4 shows that for the EU27 group the observable range of values lies on the upward sloping part of the function implying that the association between the change in economic freedom and economic growth is positive.

The results obtained for the change in economic freedom reinforce the previous findings obtained on the basis of the level of economic freedom. Namely, the calculations demonstrate that there is a positive impact of economic freedom on economic growth regardless of whether the level or the change in the index of economic freedom is examined. Moreover, each estimated model (in the BMA sense) implies that the relationship is statistically significant and nonlinear. However, empirical evidence is more mixed as to the fact whether the relationship is convex or concave. From the theoretical structural model one might expect the figures to show a concave relationship corresponding to the upward sloping part of a downward sloping parabola. But not all the models yield such outcomes which means that the relationship between economic freedom and economic growth

requires further testing both from theoretical and empirical perspectives.

As we can see, despite many similarities, there are also some differences between the results for the Heritage Foundation and Fraser Institute indices of economic freedom. These differences may be partly explained by different time periods and the length of subperiods. However, some differences between the two indices with – theoretically – a similar coverage also suggest that the relationship between regulations and economic growth is multidimensional, deep and cannot be easily explained by econometrical models. There are a lot of factors affecting both regulations and GDP dynamics as well as many transmission channels between these areas and it is possible to obtain sometimes mixed results. Surely, the results are not robust with regard to the sample of countries and that is why the results for country subgroups are often different as compared with those for the whole sample of countries.

While better institutions, regulations, and economic freedom positively affect economic growth, according to this study most beneficial effects concern rather those countries which have poorly developed institutions. Indeed, even a small improvement of regulatory environment in a least developed country (in terms of institutions) may have much larger positive impact on economic growth as compared with a country in which institutions are well developed. This is in line with the assumption of diminishing marginal products of inputs. That is good news for the authorities of many underdeveloped countries: rapid acceleration of economic growth may be achieved there simply by institutional reforms aiming at increasing the scope of economic freedom. This important finding could not be achieved in the model which would not account for nonlinearities.

The results for the World Bank worldwide governance indicator are different as compared to those for the index of economic freedom. The relationship between the level of quality of governance and economic growth is nonlinear and the estimated coefficients for both WGI and $(WGI)^2$ are statistically significantly different than zero (pseudo $t$ statistics amount to 4.34 and 7.53 – see Table 10). However, unlike the majority of the previous results, this function is convex which is clearly seen in Figure 5. The figure shows that the relationship between the

quality of governance and economic growth is generally positive – the higher the value of the worldwide governance indicator, the more rapid economic growth. This outcome is in line with the theoretical structural model saying that institutions and regulations are important sources of growth. Figure 5 demonstrates that the function is an upward sloping parabola and the relationship is decreasing if the governance indicator takes small values, that is in the countries with low quality of governance. This is in contrast with the results for economic freedom where the relationship turned out to be concave, and a negative relationship, if observed, appeared in the countries with well-developed institutions.

There are also some other discrepancies between the governance indicator and the index of economic freedom. Namely, the results for the governance indicator relatively often suggest the existence of linear instead of nonlinear relationship. It is so if the estimated parameter for a squared variable is not statistically significantly different from zero. A linear association appears for the level of indicator in the EU27 countries as well as for the change in the indicator in all three distinguished country groups. Nevertheless, even if the evidenced relationship is linear, it is still positive suggesting that regulatory reforms aiming at improving the quality of governance lead to faster economic growth.

The differences between these models and the earlier ones suggest that the results are not entirely robust to the sample of countries and to the exact measure of the regulatory variable. Regulatory variables taken from different sources cover various areas of institutions and they do not exhibit an identical impact on economic growth. This finding will be reinforced later when considering composite indicators of the aggregated indices. The institutional environment is a very wide economic, political and social concept and even considering relatively similar (but surely not the same) indices measuring regulations we do not obtain the same results.

The conclusion that the results may be different and depend on the sample of countries and the area of regulations (institutions) is also confirmed by comparing the former models with those involving the democracy index. The results for the democracy index are presented in Tables 12 and 13 and Figures 7 and 8 (models 13 and 15). The level of democracy reveals a statistically significant and nonlinear

impact on GDP dynamics. The direction of this relationship is different in the whole analyzed sample of countries and in the EU27 group. Figure 7 shows that the association between the level of democracy and GDP dynamics is rather negative because the chart is dominated by a downward sloping part of an upward sloping parabola. At the first view, this relationship may be interpreted as spurious. However, when looking at the chart in greater detail it may be the case that the results confirm a certain view appearing in the literature, namely that democracy reveals a nonlinear impact on economic growth and the fastest-growing countries are those which are the most and the least democratic. Such a view may be reasonably explained because some non-democratic countries (e.g. United Arab Emirates or China) revealed during the last decades very rapid economic growth, like several democratic countries (e.g. Luxembourg or the United States). It may be the case that a medium level of democracy is the most detrimental to growth. This approach is confirmed by our results because Figure 7 shows that once a certain level of democracy is achieved, more democracy leads to higher growth. To fully justify this view, the function (for the world countries) should be quite symmetric around the minimum value or it should be rather non-symmetric with larger right-part than left-part, but given imperfect data our results may be in line with this view. In the homogenous group of EU27 countries, which are democratic, a different association holds, namely that there is a positive relationship between democracy and GDP dynamics as reflected by an upward sloping function in Figure 7.

The progress in structural (market) reforms shows – as expected – a positive impact on output growth. This is demonstrated by the results for model 19 presented in Table 14 and Figure 9. The level of the EBRD transition indicator affects GDP dynamics in a nonlinear way – the estimated coefficients for both TRAN and $(TRAN)^2$ variables are statistically significantly different than zero. This finding has important policy implications. Namely, transition countries, to accelerate economic growth and to come closer to Western Europe in terms of the level of development, should undertake market reforms in the areas of privatization, enterprise restructuring, international trade and foreign exchange system, price liberalization etc. There is much room to carry out such reforms especially in the non-EU

transition countries, namely post-Yugoslav republics (Serbia and Montenegro, Bosnia and Herzegovina, Macedonia) and the CIS countries (Ukraine, Belarus as well as Caucasian and Central Asian republics).

In terms of the individual components of the index of economic freedom (both Heritage Foundation and Fraser Institute), the majority of results also points to a statistically significant and nonlinear association between economic freedom and economic growth. However, some exceptions are present. For example, in terms of levels of the Fraser Institute index, the most significant impact on economic growth reveal the following areas of freedom: legal structure and security of property rights, access to sound money, and regulation of credit, labor and business. Figure 13 shows that – in the observed range of values – the relationship is positive and convex but sometimes it enters into a decreasing part of the parabola. For legal structure and security of property rights the association is positive in the whole range of observable values (between the $5^{th}$ and $95^{th}$ percentiles). It means that protection of persons and their rightfully acquired property, being a central element of economic freedom and a civil society and the most important function of government, indeed leads to acceleration of economic growth according to the calculations carried out in this study. The construction of a given index indicates exactly which areas should be reformed and improved to boost the economy. For example, in the latter case, to foster economic growth, policy makers should focus on the improvement in the following areas of economic freedom: judicial independence, impartial courts, protection of property rights, military interference in rule of law and politics, integrity of the legal system, legal enforcement of contracts, regulatory restrictions on the sale of real property, reliability of police, and business costs of crime, all of these being the components of the indicator measuring legal structure and security of property rights. In the case of sound money and regulation, the relationship is positive but once a certain level of freedom is achieved it becomes negative. It may be explained referring to the component indicators of these areas of freedom; in the case of sound money they are: money growth, standard deviation of inflation, inflation in most recent year, and freedom to own foreign currency bank accounts, while in the case of regulation those are: credit market regulations (e.g.

interest rate controls), labor market regulations (e.g. hiring regulations and minimum wage), and business regulations (e.g. costs of starting a business). Hence, excessive freedom in terms of regulations of, e.g., labor market or financial markets may be harmful to the economy because it may lead to higher income inequalities and excessive credit expansion which may be detrimental to economic growth. On the other hand, in the case of sound money, too low inflation may also be a disease of the economy. While high inflation (at the two-digit levels) is by no way an obstacle to economic growth, zero inflation (or even deflation) is not good for further economic expansion either. These hypotheses may partly explain why the functions are decreasing once a certain level of freedom is achieved but, of course, this may also result from the methodology of econometric modeling.

In the case of size of government (the component of the Fraser Institute index of economic freedom), the association between this area of freedom and economic growth is clearly positive. However, the coefficient on a squared variable is statistically insignificant which means – given a statistically significantly different than zero coefficient standing for a non-squared variable – that the relationship is linear rather than nonlinear. According to Figure 13, the function is increasing in the whole observable range of values. Hence, the results demonstrate that excessive fiscalism hampers economic growth. More fiscal freedom leads to acceleration of GDP dynamics. The study thus shows that policy makers should undertake actions aiming at decreasing government engagement in the economy (in quantitative terms). It means the necessity to carry out reforms in the following areas which are included in this component indicator of economic freedom: government consumption, transfers and subsidies, government enterprises and investment, and top marginal tax rate. Freedom to trade internationally is also positively related with economic growth but the results are partly insignificant.

In a similar way, it is possible to interpret the individual component indicators of the other aggregated indices analyzed in this study.

Looking at Figures 11-18 and 21-22 the following general implications may be found. First, the individual component indicators of the aggregated regulatory indices sometimes reveal similar behavior as regards the impact on economic

growth. This concerns mainly the component indices of the Heritage Foundation index of economic freedom for which the positive relationship with economic growth was evidenced in the case of most of them. Component indices of the EBRD transition indicator (in levels) also reveal a positive impact on economic growth. Some similar tendencies may also be found for component indicators of the Fraser Institute index of economic freedom and the worldwide governance indicator. Second, the similarity of the results is not a rule, however. Hence, it may be argued that various areas of regulations affect the pace of economic growth differently, taking into account also the statistical significance of the impact as well as the character of a nonlinear relationship (concave vs. convex functions). It may be thus concluded that the results are not robust to a selected institutional variable. This is caused, among others, by the fact that the indices analyzed in this study cover different regulatory environment; and various institutional areas may exhibit different impact on economic growth. The results suggest the need for further testing of the relationship between regulations (institutions) and economic growth – also with the use of non-econometrical approaches.

Table 19 shows that almost all the doing business indicators do not reveal a statistically significant association with economic growth. This finding may suggest that the analysis based on panel data with the use of overlapping periods is better than that based on cross-sectional data in the sense that the former one leads more often to statistically significant results. If the whole analysis presented in this report was carried out based on cross-sectional data, it would be possible to get the majority of insignificant results and the conclusions would be very weak.

The results provide also some interesting information on the other economic growth determinants. All the models confirm the existence of conditional $\beta$-convergence. $\beta$-convergence means that less developed countries grow on average faster than more developed ones; this catching-up process is conditional upon the growth factors included in the set of explanatory variables. In the standard growth regression where economic growth is the explained variable and initial income level is the explanatory variable, the necessary condition for convergence is that the estimated coefficient on initial income level be negative and statistically

significantly different from zero. In the growth model applied in this study, however, the level of GDP per capita instead of its growth rate is the explained variable – in such a case the necessary condition for convergence to exist is that the estimated coefficient on initial income level be statistically significantly less than 1. Data in Tables 6-14 suggest that this is true. For each model the estimates are less than 1, ranging from 0.7070 to 0.9162. Subtracting 1 from these values and applying some mathematics (see, e.g., Próchniak and Witkowski (2013, p. 323)) yields the following $\beta$-convergence coefficients: $\beta$ = 1.0-3.9% for the world, $\beta$ = 1.1-6.9% for the EU27 countries, and $\beta$ = 0.9-4.4% for transition economies. These results are partly in line with the other studies on convergence, including those on the basis of Bayesian methods – for example, Próchniak and Witkowski (2012) report $\beta$-convergence coefficients at the level of about 1.3% for the whole world. For all the individual models estimated in this study, $\beta$-coefficients for the EU27 countries are greater than those for the full sample of countries which is in line with the common view in the literature that EU countries catch up at a faster rate than the world as a whole. This also indicates positive trends observed in the enlarged European Union that the development gap between new and old EU members is falling.

Among the other variables, the study reveals that government expenditures on consumption do not contribute to faster economic growth – the estimated coefficients are negative and statistically significantly different than zero in most model specifications. This shows that excessively strong expansionary fiscal policy focused on increasing consumption is counterproductive in terms of output acceleration (at least in the medium and long run). On the other hand, the analysis demonstrates highly beneficial effects of investment on economic growth. Investment rate is statistically significant variable in each model specification.

For human capital variables, represented by the two enrolment ratios and life expectancy, the results indicate in general the positive impact on economic growth. However, some exceptions are present which may be partly caused by the fact that there are a lot of measures of human capital and none of these measures is perfect. The lack of one concrete definition of human capital implies that the researchers use a number of variables that approximate human capital accumulation. Moreover, the

variety of results may be due to the fact that human capital meant as healthy and well-educated society reveals rather an impact on long-term rate of economic growth. But unlike some other studies based on shorter subperiods where the results for human capital were completely mixed, in this study more clear-cut positive relationship is evidenced which may be caused by the fact that 5- and notably 10-year averaged data better reflect long-term relationships between the variables involved. Indeed, the return on investment in human capital usually takes a lot of years, as opposite to the majority of investment in physical capital. The outcome that human capital variables reveal in general a positive and statistically significant impact on economic growth is in line with a theoretical structural model that points to the important role of human capital in economic growth. The countries where population is less educated record on average slower pace of GDP dynamics.

It is necessary to point out the negative impact of inflation on economic growth. Estimated coefficient standing for inflation turns out to be negative and statistically significant in almost all the model specifications meaning that inflation hampers economic growth. When interpreting this outcome one should take into account that although high (notably, a two- or three-digit) inflation is detrimental to economic development, deflation is not a good outcome either. It is likely that if nonlinear impact of inflation on economic growth was accounted for, there would be the most favorable inflation rate from the point of view of economic growth at a specified low positive level – probably that corresponding with official inflation target of most central banks.

Among exogenous variables referring to population and fertility (life expectancy has already been discussed), the results show, inter alia, that the share of working age population is positively related with economic growth in the full sample of countries while fertility rate exhibits a negative impact.

While defining the dataset used in the analysis, it has been mentioned that the institutional variables would be treated as endogenous, as it reflects authors' views and most literature. However, a relatively simple, though not fully formal procedure could be carried out in order to motivate this choice. Table 21 contains the results of estimation of four selected models: model 5, 7, 13 and 14. Those, however, are

given in two variants: in the first one the institutions are allowed to be endogenous (as it is given in previous tables containing the estimates of particular models) while in the second one they are treated as exogenous.

It is the Hausman specification test that is conventionally used for testing an additional assumption imposed in the model, such as the no individual effects-exogenous variables correlation in the fixed effects vs. random effects comparisons that this test is mostly used for. However, a model with exogenous institutional variables can be viewed as a special case of the model with institutional variables allowed to be endogenous *plus* an additional assumption of their exogeneity. The problem lies in obtaining the full covariance matrix for the estimators in particular models, however variances for estimators of particular parameters are available. These can be used to obtain "partial" Hausman statistics for particular parameters, that neglect inter-variables estimator covariance, as it is done e.g. by Owusu-Gyapong (1986):

$$q = (\beta_{end} - \beta_{ex})(V(\beta_{end}) - V(\beta_{ex}))^{-1}(\beta_{end} - \beta_{ex}),$$

which under the null hypothesis of exogeneity is distributed $\chi^2$ with 1 degree of freedom. The results in the last column of Table 21 clearly suggest, that in all but one cases the exogeneity hypothesis should be rejected on virtually any significance level. That is a confirmation of the endogeneity of institutional variables.

Finally it should be added that when interpreting some unexpected results where a positive link between institutions and economic growth was not evidenced, it is worth referring to the fact that maybe high GDP growth is not the most desirable goal for the society and for the general welfare. Democracy and good governance are likely to achieve broader social and economic outcomes than only rapid GDP growth. Maybe the aim of government policy is to increase the happiness of the society, or to decrease income inequalities, or something else. However, these broad concepts are often very hard to measure or the data are incomplete as in the case of income inequalities. But even if extending GDP per capita for a few other variables such as life expectancy and education (the components which are included in the human development index – HDI), the measure is still imperfect. Hence, GDP per capita is the most often used variable in empirical studies of this type.

# 6. Conclusions

The study examines the relationship between the regulatory variables and economic growth on the basis of Bayesian model pooling applied to Blundell and Bond's GMM system estimator. The areas of regulations (institutions) are measured by the following indicators: a) index of economic freedom (from Heritage Foundation and Fraser Institute), b) worldwide governance indicators (World Bank), c) democracy index (Freedom House), d) doing business indicators (World Bank), and e) transition indicators (EBRD). Most of the models are estimated based on overlapping panel data. All the models include nonlinearities to account for a possible nonlinear impact of regulations on economic growth. The calculations are carried out for the whole world and two groups of countries (EU27 countries and transition economies) during the 1970-2012 period (but for some models and countries the analyzed period is much shorter).

The results show, in general, that regulatory environment is an important determinant of economic growth. The direction of the relationship is the following: to achieve a more rapid economic growth, it is necessary to increase the scope of economic freedom, to improve the quality of governance, and to accelerate progress in structural (market) reforms. Moreover, the models indicate that the association between the analyzed regulatory variables and GDP dynamics is mostly nonlinear.

However, the results are not robust in a lot of areas. First, the outcomes are not robust with regard to the sample of countries and that is why country subgroups often behave differently as compared with the whole world. Second, the results are not fully robust to the exact measure of the regulatory variable. Even the indices of economic freedom coming from different sources, which should have theoretically a similar coverage, yield different outcomes. Third, the results are sometimes ambiguous as to the type of nonlinear impact between regulatory variables and economic growth. For some models, the function is concave, but for the other ones it is convex; moreover, a few models suggest the existence of a linear rather than nonlinear relationship. Hence, differences in the results from various BMA models suggest that the relationship between regulations and economic growth is

multidimensional, deep and cannot be easily explained by econometrical models. There are a lot of factors affecting both regulations and GDP dynamics as well as many transmission channels between these areas and it is possible to obtain sometimes mixed results.

As regards the individual variables, the most interesting results are the following. The calculations demonstrate that the level of and the change in economic freedom both reveal a positive and nonlinear association with the pace of economic growth. This is confirmed by both the Heritage Foundation and Fraser Institute indices. The countries with greater scope of economic freedom record on average more rapid GDP growth but a given increase in economic freedom has a higher impact on economic growth in those countries that are economically not (or partly) free. This means that the function showing the relationship between the level of economic freedom and the pace of economic growth is concave. Moreover, it turns out that the higher the increase of economic freedom is, the more rapid economic growth is but the acceleration of GDP growth due to the increase in economic freedom is not proportional. Despite many similarities, there are also some differences between the results for the Heritage Foundation and Fraser Institute indices (including the component indicators). These differences may be partly explained by different time periods and the length of subperiods but also by the fact that the results are not fully robust to the choice of institutional variables and their coverage.

These results are in line with the law of diminishing returns which means that marginal productivity of the input is decreasing. Economic freedom can be interpreted as the additional institutional input to the production function (similarly to the institutions-augmented Solow model proposed by Hall and Jones (1999)). Hence, economic freedom is another factor of production and it reveals the highest productivity in those countries where it is relatively scarce. That is good news for the authorities of many underdeveloped countries: rapid acceleration of economic growth may be achieved there simply by institutional reforms aiming at increasing the scope of economic freedom. This important finding could not be achieved in the model which would not account for nonlinearities.

The relationship between the level of quality of governance and economic growth is nonlinear and generally positive. However, unlike the majority of the outcomes concerning economic freedom, the function is convex confirming the ambiguities of the results as to the curvature of the function. Nevertheless, this outcome is in line with the theoretical structural model saying that institutions, regulations and good governance are important sources of economic growth.

The lack of robustness between the respective BMA models is also well visible based on the democracy index. Democracy reveals a statistically significant and nonlinear impact on GDP dynamics, but the association between the level of democracy and output growth seems to be negative at the first view. This finding could be spurious, but the detailed analysis implies that this shape may also reflect the view appearing in the literature, namely that democracy reveals a nonlinear impact on economic growth and the fastest-growing countries are those which are the most and the least democratic. This again shows that the institutional environment is a very wide economic, political and social concept and even considering relatively similar (but surely not the same) indices measuring regulations we do not obtain the same results. This finding is also confirmed by the examination of the component indices of various aggregated indicators.

The progress in structural (market) reforms shows a positive impact on output growth. It has important policy implications; namely, transition countries, to accelerate economic growth and to come closer to Western Europe in terms of the level of development, should undertake market reforms in the areas of privatization, enterprise restructuring, international trade and foreign exchange system, price liberalization etc.

The study also gives some interesting findings on the impact of the other growth determinants. All the models confirm the existence of conditional $\beta$-convergence. The $\beta$-convergence coefficients are: $\beta$ = 1.0-3.9% for the world, $\beta$ = 1.1-6.9% for the EU27 countries, and $\beta$ = 0.9-4.4% for transition economies. These results are partly in line with the other studies on convergence, including those on the basis of Bayesian methods, as well as with the common view in the literature that EU countries catch up at a faster rate than the world as a whole.

The study reveals that government expenditures on consumption do not contribute to faster economic growth and that there are highly beneficial effects of investment on economic growth. The results also indicate in general the positive impact of human capital on economic growth (with some exceptions) and the negative impact of inflation.

Comparing these results with the literature, it turns out that this study reinforces findings obtained e.g. by Pääkkönen (2010). He concludes that in the case of insufficient institutions or private capital, improvements in institutions and investment tend to boost productivity growth. This is in line with our results – the countries that have insufficient institutions are those with low scope of economic freedom and in such a case improving institutions or making the country more economically free leads to higher economic growth. This research goes even further because it shows that economic freedom impacts economic growth in a nonlinear direct way – unlike Pääkkönen who revealed that nonlinear impact of economic freedom was realized through interactions with i.a. investment or government consumption, this study confirms a direct nonlinear relationship. Similarly to Pääkkönen, the current research also finds that government consumption has a negative impact on GDP growth.

This analysis also supplements the study conducted by Peev and Mueller (2012). They find that democracy can also have an adverse effect on economic growth, by producing larger public sectors and public deficits, which lead to higher taxes and a greater fiscal drag on the economy. From the current study it turns out that democracy (but also some other institutional variables) indeed may have an adverse impact on GDP growth and the transmission channel may, but needn't, be different. For example, according to Peev and Mueller, strong democratic institutions are associated with greater economic freedoms and larger public sectors and public deficits; although stronger economic freedoms lead to more rapid economic growth, large public sectors and public deficits have adverse effects on output dynamics.

Finally, it is necessary to emphasize that the method applied in the current study corresponds to the findings obtained by Goczek (2012). He concludes that, in

the case of econometric modeling, the preferable estimation method of dynamic models of economic growth for panel data is the generalized method of moments (GMM).

This research is a good initial step to the examination of the impact of institutions on economic growth. To fully analyze the institutional influence, it is necessary to continue this type of analysis by using more indicators and applying new economic and econometric models.

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World Bank (2013c), *World Development Indicators Database* (http://databank.worldbank.org/).

**Table 1**
**Analyzed models (in the BMA sense)**

| Model no. | Regulatory variable(s) | Data transformation |
|---|---|---|
| *Heritage Foundation* | | |
| 1 | Level of the index of economic freedom | 5-year overlapping panel |
| 2 | Levels of the components of the index of economic freedom | |
| 3 | Change in the index of economic freedom | |
| 4 | Changes in the components of the index of economic freedom | |
| *Fraser Institute* | | |
| 5 | Level of the index of economic freedom | 10-year overlapping panel |
| 6 | Change in the index of economic freedom | |
| 7 | Levels of the components of the index of economic freedom | |
| 8 | Changes in the components of the index of economic freedom | |
| *World Bank* | | |
| 9 | Level of the worldwide governance indicator | 5-year overlapping panel |
| 10 | Levels of the components of the worldwide governance indicator | |
| 11 | Change in the worldwide governance indicator | |
| 12 | Changes in the components of the worldwide governance indicator | |
| *Freedom House* | | |
| 13 | Level of the democracy index | 10-year overlapping panel |
| 14 | Levels of the components of the democracy index and freedom of the press | |
| 15 | Change in the democracy index | |
| 16 | Changes in the components of the democracy index and freedom of the press | |
| *World Bank* | | |
| 17 | Levels of the doing business indicators | Cross-sectional data |
| 18 | Changes in the doing business indicators | |
| *EBRD* | | |
| 19 | Level of the transition indicator | 5-year overlapping panel |
| 20 | Levels of the components of the transition indicator | |
| 21 | Change in the transition indicator | |
| 22 | Changes in the components of the transition indicator | |

Source: Heritage Foundation (2013), *Index of Economic Freedom Database* (http://www.heritage.org/index/); Fraser Institute (2013), *Economic Freedom of the World Database* (http://www.freetheworld.com/); World Bank (2013a), *Worldwide Governance Indicators Database* (http://data.worldbank.org/data-catalog/worldwide-governance-indicators); Freedom House (2013), *Freedom in the World Database* (http://www.freedomhouse.org/); World Bank (2013b), *Doing Business Indicators Database* (http://data.worldbank.org/data-catalog/doing-business-database); EBRD (2013), *Transition Indicators Database* (http://www.ebrd.com/pages/research/economics/data/macro.shtml#ti).

**Table 2**
**The list of control variables**

| Name | Description | Type[a] |
|---|---|---|
| lngdp0 | Lagged log GDP per capita at PPP (constant prices) | E |
| inv | Investment (% of GDP) | E |
| school_tot | Average years of total schooling (population ages 15+) | E |
| school_ter | Percentage of population (ages 15+) with completed tertiary education | E |
| edu_exp | Education expenditure (% of GNI) | E |
| gov_cons | General government consumption expenditure (% of GDP) | E |
| gov_rev | General government revenue (% of GDP) | E |
| gov_bal | General government balance (% of GDP) | E |
| open | Openness ((exports + imports) / GDP) | E |
| cab | Current account balance (% of GDP) | E |
| fdi | Net FDI inflow (% of GDP) | E |
| cred | Annual change (in % points) of the domestic credit provided by banking sector in % of GDP | E |
| inf | Inflation (annual %) | E |
| serv | Services value added (% of GDP) | E |
| life | Log of life expectancy at birth (years) | X |
| fert | Log of fertility rate (births per woman) | X |
| pop_15_64 | Population ages 15-64 (% of total) | X |
| pop_den | Log of population density (people per sq. km of land area) | X |
| pop_gr | Population growth (annual %) | X |
| pop_tot | Log of population, total | X |

[a] E – endogenous variable; X – exogenous variable.

Source: A. Heston, R. Summers, B. Aten (2012), *Penn World Table Version 7.1*, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, November (https://pwt.sas.upenn.edu/); World Bank (2013c), *World Development Indicators Database* (http://databank.worldbank.org/); R.J. Barro, J.-W. Lee (2013), *Education Statistics Database* (http://databank.worldbank.org/); IMF (2012), *World Economic Outlook Database*, October (http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx).

**Table 3**
**Control variables included in the respective BMA models**

| Variable | Model 1-4 | Model 5-8 | Model 9-12 | Model 13-16 | Model 17-18 | Model 19-22 |
|---|---|---|---|---|---|---|
| lngdp0 | x | x | x | x | x | x |
| inv | x | x | x | x | x | x |
| school_tot | x | x | | x | | |
| school_ter | x | x | | x | | |
| edu_exp | x | | x | x | | |
| gov_cons | x | x | x | x | x | x |
| gov_rev | | | x | | x | |
| gov_bal | | | x | | x | |
| open | x | x | x | x | x | x |
| cab | | | | x | | |
| fdi | x | | x | x | x | |
| cred | x | | x | x | | |
| inf | x | x | x | x | x | |
| serv | | | | x | | |
| life | x | x | x | x | x | |
| fert | x | x | x | x | x | |
| pop_15_64 | x | x | x | x | x | x |
| pop_den | x | | x | x | x | x |
| pop_gr | x | x | x | x | x | x |
| pop_tot | x | x | x | x | x | x |

"x" means that a given variable is included.

Source: Own elaboration.

## Table 4
## List of countries

| | | | | | |
|---|---|---|---|---|---|
| 1 | Afghanistan | 58 | Germany | 115 | Oman |
| 2 | Albania | 59 | Ghana | 116 | Pakistan |
| 3 | Algeria | 60 | Greece | 117 | Panama |
| 4 | Angola | 61 | Grenada | 118 | Papua New Guinea |
| 5 | Argentina | 62 | Guatemala | 119 | Paraguay |
| 6 | Armenia | 63 | Guinea | 120 | Peru |
| 7 | Australia | 64 | Guinea-Bissau | 121 | Philippines |
| 8 | Austria | 65 | Guyana | 122 | Poland |
| 9 | Azerbaijan | 66 | Haiti | 123 | Portugal |
| 10 | Bahamas | 67 | Honduras | 124 | Qatar |
| 11 | Bahrain | 68 | Hong Kong | 125 | Romania |
| 12 | Bangladesh | 69 | Hungary | 126 | Russia |
| 13 | Barbados | 70 | Iceland | 127 | Rwanda |
| 14 | Belarus | 71 | India | 128 | Samoa |
| 15 | Belgium | 72 | Indonesia | 129 | Sao Tome & Principe |
| 16 | Belize | 73 | Iran | 130 | Saudi Arabia |
| 17 | Benin | 74 | Iraq | 131 | Senegal |
| 18 | Bhutan | 75 | Ireland | 132 | Serbia |
| 19 | Bolivia | 76 | Israel | 133 | Sierra Leone |
| 20 | Bosnia & Herzegovina | 77 | Italy | 134 | Singapore |
| 21 | Botswana | 78 | Jamaica | 135 | Slovakia |
| 22 | Brazil | 79 | Japan | 136 | Slovenia |
| 23 | Brunei | 80 | Jordan | 137 | Solomon Islands |
| 24 | Bulgaria | 81 | Kazakhstan | 138 | South Africa |
| 25 | Burkina Faso | 82 | Kenya | 139 | Spain |
| 26 | Burundi | 83 | Korea | 140 | Sri Lanka |
| 27 | Cambodia | 84 | Kuwait | 141 | St. Lucia |
| 28 | Cameroon | 85 | Kyrgyzstan | 142 | St. Vincent & Grenadines |
| 29 | Canada | 86 | Laos | 143 | Sudan |
| 30 | Cape Verde | 87 | Latvia | 144 | Suriname |
| 31 | Central African Rep. | 88 | Lesotho | 145 | Swaziland |
| 32 | Chad | 89 | Liberia | 146 | Sweden |
| 33 | China | 90 | Lithuania | 147 | Switzerland |
| 34 | Colombia | 91 | Luxembourg | 148 | Syria |
| 35 | Comoros | 92 | Macedonia | 149 | Tajikistan |
| 36 | Congo Dem. Rep. | 93 | Madagascar | 150 | Tanzania |
| 37 | Congo Rep. | 94 | Malawi | 151 | Thailand |
| 38 | Costa Rica | 95 | Malaysia | 152 | Timor Leste |
| 39 | Cote d'Ivoire | 96 | Maldives | 153 | Togo |
| 40 | Croatia | 97 | Mali | 154 | Tonga |
| 41 | Cyprus | 98 | Malta | 155 | Trinidad & Tobago |
| 42 | Czech Rep. | 99 | Mauritania | 156 | Tunisia |
| 43 | Denmark | 100 | Mauritius | 157 | Turkey |
| 44 | Djibouti | 101 | Mexico | 158 | Turkmenistan |
| 45 | Dominican Rep. | 102 | Moldova | 159 | Uganda |
| 46 | Ecuador | 103 | Mongolia | 160 | Ukraine |
| 47 | Egypt | 104 | Montenegro | 161 | United Arab Emirates |
| 48 | El Salvador | 105 | Morocco | 162 | United Kingdom |
| 49 | Equatorial Guinea | 106 | Mozambique | 163 | United States |
| 50 | Estonia | 107 | Namibia | 164 | Uruguay |
| 51 | Ethiopia | 108 | Nepal | 165 | Uzbekistan |
| 52 | Fiji | 109 | Netherlands | 166 | Vanuatu |
| 53 | Finland | 110 | New Zealand | 167 | Venezuela |
| 54 | France | 111 | Nicaragua | 168 | Vietnam |
| 55 | Gabon | 112 | Niger | 169 | Yemen |
| 56 | Gambia | 113 | Nigeria | 170 | Zambia |
| 57 | Georgia | 114 | Norway | 171 | Zimbabwe |

Source: Own elaboration.

**Table 5**
**Data coverage of the respective BMA models**

| Model | Number of observations | Number of countries | Number of observations per country (avg.) | Maximum period[a] |
|---|---|---|---|---|
| 1 | 1856 | 134 | 13.9 | (1992)1997-2012 |
| 2 | 1856 | 134 | 13.9 | (1992)1997-2012 |
| 3 | 1500 | 129 | 11.6 | (1995)2000-2012 |
| 4 | 1500 | 129 | 11.6 | (1995)2000-2012 |
| 5 | 2584 | 111 | 23.3 | (1970)1980-2010 |
| 6 | 2584 | 111 | 23.3 | (1970)1980-2010 |
| 7 | 2136 | 110 | 19.4 | (1970)1980-2010 |
| 8 | 2136 | 110 | 19.4 | (1970)1980-2010 |
| 9 | 1985 | 160 | 12.4 | (1993)1998-2012 |
| 10 | 1985 | 160 | 12.4 | (1993)1998-2012 |
| 11 | 1557 | 160 | 9.7 | (1996)2001-2011 |
| 12 | 1557 | 160 | 9.7 | (1996)2001-2011 |
| 13 | 2726 | 123 | 22.2 | (1970)1980-2012 |
| 14 | 1569 | 122 | 12.9 | (1988)1998-2012 |
| 15 | 2535 | 123 | 20.6 | (1972)1982-2011 |
| 16 | 989 | 119 | 8.3 | (1993)2003-2011 |
| 17 | 154 | 154 | 1 | 2005-2012 |
| 18 | 154 | 154 | 1 | 2005-2012 |
| 19 | 456 | 27 | 16.9 | (1989)1994-2012 |
| 20 | 456 | 27 | 16.9 | (1989)1994-2012 |
| 21 | 456 | 27 | 16.9 | (1989)1994-2012 |
| 22 | 456 | 27 | 16.9 | (1989)1994-2012 |

[a] The earliest year for which initial GDP is included (in the case of panel data) is given in brackets.

Source: Own elaboration.

## Table 6
## Estimation results for the level of the Heritage Foundation index of economic freedom (model 1)

| Regressor | World countries | | | EU27 countries | | | 20 post-socialist countries | | |
|---|---|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t |
| EF | 0.0285 | 0.0034 | 8.37 | 0.0718 | 0.0050 | 14.36 | 0.0408 | 0.0131 | 3.10 |
| $(EF)^2$ | –0.0002 | 0.0000 | –5.69 | –0.0005 | 0.0000 | –12.69 | –0.0003 | 0.0001 | –2.47 |
| lngdp0 | 0.8281 | 0.0071 | 117.21 | 0.7734 | 0.0096 | 80.40 | 0.8011 | 0.0144 | 55.62 |
| inv | 0.0045 | 0.0003 | 14.45 | 0.0187 | 0.0006 | 31.98 | 0.0115 | 0.0011 | 10.58 |
| school_tot | 0.0321 | 0.0026 | 12.49 | –0.0411 | 0.0037 | –11.10 | 0.1013 | 0.0117 | 8.69 |
| school_ter | 0.0006 | 0.0005 | 1.27 | –0.0073 | 0.0008 | –8.95 | 0.0060 | 0.0018 | 3.26 |
| edu_exp | –0.0414 | 0.0020 | –20.69 | 0.0226 | 0.0034 | 6.67 | –0.0475 | 0.0070 | –6.83 |
| gov_cons | –0.0031 | 0.0009 | –3.68 | –0.0233 | 0.0021 | –10.93 | –0.0066 | 0.0030 | –2.22 |
| open | 0.0005 | 0.0001 | 10.32 | –0.0003 | 0.0001 | –5.54 | –0.0006 | 0.0002 | –3.23 |
| fdi | 0.0041 | 0.0002 | 17.46 | 0.0027 | 0.0002 | 13.83 | –0.0020 | 0.0014 | –1.38 |
| cred | 0.0031 | 0.0003 | 12.04 | 0.0059 | 0.0004 | 15.49 | 0.0038 | 0.0012 | 3.27 |
| inf | –0.0005 | 0.0000 | –10.21 | –0.0011 | 0.0001 | –14.81 | –0.0015 | 0.0002 | –8.54 |
| life | 0.8036 | 0.0289 | 27.77 | –0.6578 | 0.1819 | –3.62 | 0.1600 | 0.2314 | 0.69 |
| fert | –0.5024 | 0.0092 | –54.62 | 0.0763 | 0.0167 | 4.58 | –0.3143 | 0.0289 | –10.87 |
| pop_15_64 | 0.0090 | 0.0005 | 19.12 | –0.0134 | 0.0011 | –12.62 | 0.0166 | 0.0034 | 4.88 |
| pop_den | –0.0314 | 0.0013 | –24.91 | 0.0048 | 0.0020 | 2.44 | –0.0645 | 0.0075 | –8.56 |
| pop_gr | 0.0600 | 0.0014 | 42.70 | 0.0890 | 0.0044 | 20.27 | –0.0397 | 0.0091 | –4.34 |
| pop_tot | –0.0107 | 0.0007 | –15.03 | 0.0123 | 0.0014 | 8.75 | 0.0353 | 0.0058 | 6.06 |

EF – the Heritage Foundation index of economic freedom. The remaining variables are defined in Table 2.

Source: Own calculations.

**Table 7**
**Estimation results for the change in the Heritage Foundation index of economic freedom (model 3)**

| Regressor | World countries | | | EU27 countries | | | 19 post-socialist countries | | |
|---|---|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t |
| ΔEF | 0.0025 | 0.0003 | 7.85 | 0.0063 | 0.0009 | 6.94 | 0.0144 | 0.0013 | 11.10 |
| $(\Delta EF)^2$ | –0.0003 | 0.0000 | –6.55 | –0.0003 | 0.0001 | –3.01 | –0.0010 | 0.0001 | –9.19 |
| lngdp0 | 0.8225 | 0.0056 | 146.16 | 0.7070 | 0.0127 | 55.74 | 0.8452 | 0.0096 | 88.19 |
| inv | 0.0034 | 0.0004 | 8.59 | 0.0157 | 0.0008 | 20.40 | 0.0154 | 0.0009 | 17.16 |
| school_tot | 0.0376 | 0.0031 | 12.32 | –0.0250 | 0.0043 | –5.81 | 0.1422 | 0.0101 | 14.11 |
| school_ter | 0.0008 | 0.0005 | 1.60 | –0.0064 | 0.0009 | –7.10 | 0.0121 | 0.0013 | 9.22 |
| edu_exp | –0.0330 | 0.0022 | –15.30 | 0.0130 | 0.0047 | 2.75 | –0.0275 | 0.0061 | –4.51 |
| gov_cons | –0.0103 | 0.0009 | –10.96 | –0.0235 | 0.0026 | –9.19 | –0.0115 | 0.0024 | –4.87 |
| open | 0.0004 | 0.0000 | 8.80 | –0.0000 | 0.0001 | –0.30 | –0.0004 | 0.0001 | –2.58 |
| fdi | 0.0034 | 0.0002 | 15.31 | 0.0033 | 0.0002 | 13.94 | 0.0011 | 0.0010 | 1.17 |
| cred | 0.0028 | 0.0003 | 10.07 | 0.0057 | 0.0004 | 12.69 | 0.0139 | 0.0009 | 14.77 |
| inf | –0.0010 | 0.0000 | –25.97 | –0.0013 | 0.0002 | –7.84 | –0.0021 | 0.0002 | –9.39 |
| life | 0.7296 | 0.0276 | 26.41 | –1.2265 | 0.2129 | –5.76 | 1.1420 | 0.1835 | 6.22 |
| fert | –0.6441 | 0.0149 | –43.37 | 0.0561 | 0.0220 | 2.55 | –0.3050 | 0.0208 | –14.65 |
| pop_15_64 | 0.0113 | 0.0005 | 25.11 | –0.0288 | 0.0016 | –17.74 | 0.0272 | 0.0025 | 10.91 |
| pop_den | –0.0254 | 0.0008 | –30.27 | –0.0029 | 0.0022 | –1.30 | –0.0687 | 0.0050 | –13.60 |
| pop_gr | 0.0759 | 0.0020 | 37.06 | 0.1553 | 0.0068 | 22.99 | –0.0610 | 0.0072 | –8.52 |
| pop_tot | –0.0106 | 0.0008 | –13.78 | 0.0110 | 0.0016 | 7.09 | 0.0065 | 0.0030 | 2.15 |

EF – the Heritage Foundation index of economic freedom. The remaining variables are defined in Table 2.

Source: Own calculations.

## Table 8
## Estimation results for the level of the Fraser Institute index of economic freedom (model 5)

| Regressor | World countries | | | EU27 countries | | | 14 post-socialist countries | | |
|---|---|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t |
| EF | 0.5148 | 0.0122 | 42.08 | 0.0451 | 0.0038 | 11.99 | 0.6608 | 0.0592 | 11.17 |
| $(EF)^2$ | –0.0418 | 0.0010 | –40.25 | 0.0064 | 0.0017 | 3.67 | –0.0404 | 0.0051 | –7.97 |
| lngdp0 | 0.9034 | 0.0031 | 295.58 | 0.8934 | 0.0052 | 170.88 | 0.7229 | 0.0126 | 57.16 |
| inv | 0.0083 | 0.0003 | 29.14 | 0.0280 | 0.0005 | 50.94 | 0.0073 | 0.0015 | 4.92 |
| school_tot | –0.0111 | 0.0019 | –5.92 | 0.0291 | 0.0013 | 22.45 | 0.0528 | 0.0092 | 5.73 |
| school_ter | 0.0041 | 0.0004 | 10.48 | 0.0117 | 0.0005 | 21.97 | 0.0104 | 0.0013 | 8.01 |
| gov_cons | –0.0013 | 0.0006 | –2.31 | –0.0255 | 0.0012 | –21.64 | –0.0349 | 0.0023 | –15.00 |
| open | 0.0002 | 0.0001 | 2.96 | 0.0019 | 0.0000 | 44.29 | 0.0013 | 0.0002 | 5.35 |
| inf | –0.0002 | 0.0000 | –42.52 | –0.0033 | 0.0001 | –56.55 | –0.0016 | 0.0001 | –13.67 |
| life | 0.8928 | 0.0222 | 40.17 | 0.9593 | 0.0702 | 13.66 | –0.9919 | 0.1463 | –6.78 |
| fert | –0.5320 | 0.0092 | –57.82 | –0.0733 | 0.0084 | –8.69 | –0.4211 | 0.0273 | –15.40 |
| pop_15_64 | 0.0292 | 0.0005 | 57.12 | 0.0142 | 0.0007 | 21.27 | 0.0414 | 0.0029 | 14.10 |
| pop_gr | 0.0739 | 0.0019 | 39.64 | 0.0073 | 0.0034 | 2.14 | 0.0847 | 0.0136 | 6.24 |
| pop_tot | 0.0053 | 0.0008 | 6.70 | –0.0344 | 0.0010 | –33.25 | 0.0395 | 0.0048 | 8.29 |

EF – the Fraser Institute index of economic freedom. The remaining variables are defined in Table 2.

Source: Own calculations.

**Table 9**
**Estimation results for the change in the Fraser Institute index of economic freedom (model 6)**

| Regressor | World countries | | | EU27 countries | | | 14 post-socialist countries | | |
|---|---|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t |
| ΔEF | 0.0167 | 0.0021 | 8.05 | 0.3627 | 0.0192 | 18.91 | 0.2206 | 0.0137 | 16.16 |
| $(\Delta EF)^2$ | 0.0075 | 0.0009 | 8.58 | –0.0176 | 0.0015 | –11.73 | –0.0431 | 0.0048 | –9.05 |
| lngdp0 | 0.8902 | 0.0032 | 282.08 | 0.7590 | 0.0055 | 139.04 | 0.7829 | 0.0157 | 49.72 |
| inv | 0.0102 | 0.0003 | 33.74 | 0.0091 | 0.0004 | 21.72 | 0.0358 | 0.0010 | 35.06 |
| school_tot | –0.0108 | 0.0018 | –5.90 | –0.0119 | 0.0013 | –8.99 | 0.2456 | 0.0075 | 32.61 |
| school_ter | 0.0013 | 0.0003 | 3.65 | 0.0045 | 0.0005 | 8.78 | 0.0288 | 0.0016 | 18.35 |
| gov_cons | –0.0081 | 0.0005 | –14.90 | –0.0387 | 0.0009 | –44.10 | –0.0621 | 0.0024 | –25.78 |
| open | 0.0002 | 0.0000 | 3.99 | 0.0012 | 0.0000 | 27.80 | 0.0050 | 0.0002 | 31.16 |
| inf | –0.0003 | 0.0000 | –66.08 | –0.0028 | 0.0001 | –38.66 | –0.0029 | 0.0001 | –30.91 |
| life | 0.9090 | 0.0212 | 42.84 | 1.0372 | 0.0679 | 15.27 | 2.0301 | 0.1528 | 13.29 |
| fert | –0.5056 | 0.0087 | –57.89 | 0.0771 | 0.0071 | 10.89 | –0.5830 | 0.0317 | –18.40 |
| pop_15_64 | 0.0262 | 0.0005 | 52.11 | 0.0044 | 0.0007 | 6.34 | 0.0655 | 0.0031 | 21.30 |
| pop_gr | 0.0646 | 0.0018 | 35.81 | 0.0594 | 0.0025 | 23.73 | 0.0572 | 0.0164 | 3.49 |
| pop_tot | 0.0042 | 0.0007 | 5.64 | –0.0241 | 0.0009 | –27.40 | –0.0297 | 0.0046 | –6.49 |

EF – the Fraser Institute index of economic freedom. The remaining variables are defined in Table 2.

Source: Own calculations.

**Table 10**
**Estimation results for the level of the World Bank worldwide governance indicator (model 9)**

| Regressor | World countries | | | EU27 countries | | | 24 post-socialist countries | | |
|---|---|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t |
| WGI | 0.0377 | 0.0087 | 4.34 | 0.2237 | 0.0360 | 6.21 | 0.0669 | 0.0126 | 5.32 |
| $(WGI)^2$ | 0.0400 | 0.0053 | 7.53 | 0.0173 | 0.0150 | 1.15 | 0.1100 | 0.0161 | 6.85 |
| lngdp0 | 0.8304 | 0.0047 | 174.96 | 0.7191 | 0.0079 | 91.48 | 0.8115 | 0.0102 | 79.82 |
| inv | 0.0041 | 0.0003 | 13.75 | 0.0166 | 0.0006 | 27.04 | 0.0252 | 0.0008 | 32.30 |
| edu_exp | –0.0550 | 0.0024 | –22.59 | –0.0504 | 0.0036 | –13.89 | –0.1061 | 0.0050 | –21.19 |
| gov_cons | –0.0063 | 0.0005 | –11.66 | 0.0013 | 0.0020 | 0.64 | 0.0050 | 0.0021 | 2.43 |
| gov_rev | –0.0018 | 0.0004 | –4.39 | –0.0100 | 0.0006 | –17.19 | –0.0031 | 0.0008 | –4.00 |
| gov_bal | 0.0220 | 0.0005 | 46.66 | 0.0214 | 0.0007 | 29.46 | 0.0448 | 0.0013 | 34.93 |
| open | 0.0006 | 0.0000 | 12.89 | 0.0008 | 0.0001 | 15.30 | –0.0009 | 0.0001 | –6.52 |
| fdi | 0.0062 | 0.0003 | 22.55 | 0.0026 | 0.0002 | 15.03 | 0.0075 | 0.0006 | 12.18 |
| cred | 0.0006 | 0.0003 | 2.16 | 0.0056 | 0.0003 | 17.27 | 0.0223 | 0.0010 | 23.07 |
| inf | –0.0017 | 0.0002 | –11.36 | –0.0056 | 0.0006 | –9.34 | –0.0014 | 0.0002 | –6.18 |
| life | 0.0570 | 0.0232 | 2.46 | 0.1106 | 0.1564 | 0.71 | –0.2112 | 0.1401 | –1.51 |
| fert | –0.3961 | 0.0090 | –43.98 | –0.1258 | 0.0191 | –6.58 | –0.3384 | 0.0201 | –16.85 |
| pop_15_64 | 0.0043 | 0.0007 | 6.05 | –0.0070 | 0.0014 | –5.17 | 0.0091 | 0.0024 | 3.78 |
| pop_den | 0.0030 | 0.0012 | 2.63 | 0.0115 | 0.0019 | 5.90 | –0.0381 | 0.0049 | –7.71 |
| pop_gr | –0.0653 | 0.0018 | –36.05 | 0.1172 | 0.0052 | 22.44 | 0.0356 | 0.0061 | 5.87 |
| pop_tot | –0.0172 | 0.0010 | –16.58 | 0.0203 | 0.0012 | 16.38 | 0.0346 | 0.0037 | 9.31 |

WGI – the World Bank worldwide governance indicator. The remaining variables are defined in Table 2.

Source: Own calculations.

**Table 11**
**Estimation results for the change in the World Bank worldwide governance indicator (model 11)**

| Regressor | World countries | | | EU27 countries | | | 24 post-socialist countries | | |
|---|---|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t |
| ΔWGI | 0.1655 | 0.0109 | 15.24 | 0.0487 | 0.0191 | 2.54 | 0.2676 | 0.0307 | 8.72 |
| $(\Delta WGI)^2$ | 0.0284 | 0.0340 | 0.83 | –0.0162 | 0.0784 | –0.21 | –0.0336 | 0.0676 | –0.50 |
| lngdp0 | 0.9162 | 0.0085 | 107.42 | 0.7668 | 0.0104 | 74.07 | 0.8785 | 0.0129 | 68.23 |
| inv | 0.0104 | 0.0004 | 24.83 | 0.0064 | 0.0009 | 7.27 | 0.0201 | 0.0011 | 19.00 |
| edu_exp | –0.0502 | 0.0030 | –16.69 | –0.0214 | 0.0049 | –4.39 | –0.0470 | 0.0078 | –6.03 |
| gov_cons | –0.0001 | 0.0007 | –0.10 | 0.0027 | 0.0029 | 0.93 | –0.0088 | 0.0022 | –4.03 |
| gov_rev | –0.0082 | 0.0005 | –15.27 | –0.0076 | 0.0008 | –9.41 | 0.0041 | 0.0012 | 3.51 |
| gov_bal | 0.0260 | 0.0007 | 38.52 | 0.0249 | 0.0009 | 27.40 | 0.0343 | 0.0015 | 23.06 |
| open | 0.0015 | 0.0001 | 24.78 | –0.0003 | 0.0001 | –3.81 | 0.0004 | 0.0002 | 2.15 |
| fdi | 0.0034 | 0.0003 | 12.31 | 0.0020 | 0.0002 | 8.83 | 0.0067 | 0.0008 | 8.79 |
| cred | 0.0031 | 0.0004 | 7.65 | 0.0010 | 0.0004 | 2.37 | 0.0157 | 0.0013 | 12.41 |
| inf | –0.0018 | 0.0002 | –11.47 | –0.0053 | 0.0009 | –6.18 | –0.0003 | 0.0003 | –1.00 |
| life | –0.6847 | 0.0553 | –12.37 | –1.0995 | 0.2410 | –4.56 | –2.0435 | 0.1838 | –11.12 |
| fert | –0.1744 | 0.0097 | –17.90 | –0.0979 | 0.0255 | –3.84 | –0.1059 | 0.0228 | –4.64 |
| pop_15_64 | 0.0095 | 0.0008 | 12.70 | –0.0232 | 0.0018 | –13.15 | 0.0057 | 0.0025 | 2.30 |
| pop_den | –0.0045 | 0.0013 | –3.61 | 0.0098 | 0.0026 | 3.76 | 0.0111 | 0.0075 | 1.49 |
| pop_gr | –0.0160 | 0.0012 | –12.84 | 0.0868 | 0.0067 | 12.99 | 0.0355 | 0.0070 | 5.08 |
| pop_tot | 0.0061 | 0.0013 | 4.70 | –0.0005 | 0.0015 | –0.31 | 0.0050 | 0.0039 | 1.28 |

WGI – the World Bank worldwide governance indicator. The remaining variables are defined in Table 2.

Source: Own calculations.

## Table 12
## Estimation results for the level of the Freedom House democracy index (model 13)

| Regressor | World countries | | | EU27 countries[a] | | | 19 post-socialist countries | | |
|---|---|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t |
| DEM | –0.0549 | 0.0099 | –5.56 | 0.3558 | 0.0314 | 11.33 | –0.2417 | 0.0277 | –8.72 |
| $(DEM)^2$ | 0.0049 | 0.0012 | 4.13 | –0.0251 | 0.0028 | –9.09 | 0.0313 | 0.0029 | 10.74 |
| lngdp0 | 0.8888 | 0.0036 | 247.77 | 0.8403 | 0.0070 | 120.28 | 0.7997 | 0.0103 | 77.99 |
| inv | 0.0027 | 0.0002 | 11.33 | 0.0044 | 0.0004 | 10.20 | 0.0105 | 0.0009 | 12.10 |
| school_tot | –0.0270 | 0.0020 | –13.73 | 0.0039 | 0.0012 | 3.22 | 0.1441 | 0.0072 | 19.89 |
| school_ter | –0.0001 | 0.0003 | –0.20 | 0.0051 | 0.0005 | 10.21 | 0.0109 | 0.0013 | 8.13 |
| edu_exp | –0.0441 | 0.0018 | –24.18 | 0.0024 | 0.0022 | 1.13 | –0.0628 | 0.0051 | –12.26 |
| gov_cons | –0.0101 | 0.0006 | –17.40 | –0.0191 | 0.0011 | –17.20 | –0.0292 | 0.0018 | –16.00 |
| open | 0.0009 | 0.0000 | 19.71 | 0.0001 | 0.0000 | 2.09 | –0.0013 | 0.0002 | –7.94 |
| cab | 0.0049 | 0.0004 | 13.67 | 0.0059 | 0.0004 | 13.71 | 0.0086 | 0.0014 | 6.38 |
| fdi | 0.0061 | 0.0005 | 11.46 | 0.0052 | 0.0005 | 11.39 | –0.0019 | 0.0012 | –1.61 |
| cred | 0.0019 | 0.0005 | 4.02 | 0.0029 | 0.0004 | 6.84 | 0.0093 | 0.0008 | 11.42 |
| inf | –0.0000 | 0.0000 | –2.68 | –0.0015 | 0.0001 | –23.51 | –0.0008 | 0.0001 | –14.01 |
| serv | –0.0035 | 0.0003 | –11.91 | 0.0026 | 0.0003 | 7.82 | 0.0025 | 0.0005 | 4.64 |
| life | 0.6368 | 0.0204 | 31.23 | 0.8363 | 0.0896 | 9.34 | –0.1246 | 0.1359 | –0.92 |
| fert | –0.3132 | 0.0068 | –46.28 | –0.1347 | 0.0128 | –10.51 | –0.4783 | 0.0246 | –19.41 |
| pop_15_64 | 0.0164 | 0.0004 | 44.61 | –0.0010 | 0.0007 | –1.44 | –0.0042 | 0.0026 | –1.63 |
| pop_den | –0.0118 | 0.0008 | –14.69 | –0.0028 | 0.0014 | –2.03 | –0.1073 | 0.0063 | –16.98 |
| pop_gr | –0.0015 | 0.0017 | –0.90 | –0.0243 | 0.0029 | –8.39 | –0.0481 | 0.0071 | –6.80 |
| pop_tot | –0.0043 | 0.0007 | –6.29 | –0.0052 | 0.0013 | –3.96 | 0.0268 | 0.0031 | 8.60 |

[a] Without Greece.
DEM – the Freedom House democracy index. The remaining variables are defined in Table 2.

Source: Own calculations.

**Table 13**
**Estimation results for the change in the Freedom House democracy index (model 15)**

| Regressor | World countries | | | EU27 countries[a] | | | 19 post-socialist countries | | |
|---|---|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t |
| ΔDEM | –0.0059 | 0.0018 | –3.26 | 0.0230 | 0.0031 | 7.36 | –0.0175 | 0.0064 | –2.72 |
| $(\Delta DEM)^2$ | –0.0057 | 0.0006 | –9.44 | –0.0150 | 0.0008 | –18.54 | –0.0045 | 0.0015 | –3.05 |
| lngdp0 | 0.8776 | 0.0046 | 192.82 | 0.8241 | 0.0116 | 71.07 | 0.9094 | 0.0107 | 85.03 |
| inv | 0.0015 | 0.0003 | 5.18 | 0.0028 | 0.0005 | 6.03 | 0.0121 | 0.0011 | 10.91 |
| school_tot | –0.0136 | 0.0019 | –7.28 | 0.0090 | 0.0014 | 6.67 | 0.0851 | 0.0104 | 8.21 |
| school_ter | –0.0001 | 0.0004 | –0.37 | 0.0085 | 0.0006 | 15.08 | 0.0038 | 0.0017 | 2.26 |
| edu_exp | –0.0292 | 0.0021 | –13.88 | 0.0175 | 0.0024 | 7.20 | –0.0203 | 0.0058 | –3.52 |
| gov_cons | –0.0033 | 0.0005 | –6.12 | –0.0060 | 0.0012 | –5.17 | –0.0198 | 0.0022 | –8.90 |
| open | 0.0002 | 0.0001 | 4.42 | 0.0006 | 0.0001 | 10.95 | –0.0010 | 0.0002 | –5.24 |
| cab | 0.0034 | 0.0004 | 9.31 | 0.0082 | 0.0006 | 14.80 | 0.0017 | 0.0013 | 1.31 |
| fdi | 0.0066 | 0.0006 | 10.96 | 0.0079 | 0.0005 | 16.93 | –0.0002 | 0.0015 | –0.15 |
| cred | 0.0028 | 0.0005 | 5.14 | 0.0022 | 0.0005 | 4.50 | 0.0067 | 0.0011 | 5.97 |
| inf | –0.0000 | 0.0000 | –2.12 | –0.0012 | 0.0001 | –14.07 | –0.0006 | 0.0001 | –6.81 |
| serv | –0.0040 | 0.0004 | –10.71 | 0.0031 | 0.0004 | 8.71 | 0.0022 | 0.0007 | 3.02 |
| life | 0.3435 | 0.0210 | 16.36 | 0.4807 | 0.1278 | 3.76 | 0.1029 | 0.1461 | 0.70 |
| fert | –0.3617 | 0.0139 | –26.00 | –0.0680 | 0.0083 | –8.21 | –0.2877 | 0.0263 | –10.93 |
| pop_15_64 | 0.0037 | 0.0005 | 7.14 | 0.0021 | 0.0011 | 1.81 | 0.0054 | 0.0030 | 1.82 |
| pop_den | –0.0115 | 0.0009 | –13.04 | –0.0054 | 0.0015 | –3.70 | –0.0384 | 0.0060 | –6.42 |
| pop_gr | 0.0470 | 0.0025 | 18.47 | –0.0345 | 0.0031 | –11.08 | –0.0616 | 0.0075 | –8.17 |
| pop_tot | –0.0031 | 0.0007 | –4.32 | –0.0087 | 0.0012 | –7.03 | 0.0102 | 0.0038 | 2.65 |

[a] Without Greece.
DEM – the Freedom House democracy index. The remaining variables are defined in Table 2.

Source: Own calculations.

**Table 14**
**Estimation results for the level of and the change in the EBRD transition indicator (models 19 and 21)**

| Regressor | Model 19: 27 post-socialist countries | | | Model 21: 27 post-socialist countries | | |
|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | beta | st. dev. | pseudo t |
| TRAN | –0.1836 | 0.0506 | –3.63 | | | |
| $(TRAN)^2$ | 0.0515 | 0.0092 | 5.61 | | | |
| ΔTRAN | | | | 0.0111 | 0.0209 | 0.53 |
| $(\Delta TRAN)^2$ | | | | –0.1237 | 0.0135 | –9.14 |
| lngdp0 | 0.8851 | 0.0110 | 80.68 | 0.8755 | 0.0101 | 86.39 |
| inv | 0.0119 | 0.0007 | 16.90 | 0.0172 | 0.0009 | 19.83 |
| gov_cons | –0.0384 | 0.0018 | –21.36 | –0.0272 | 0.0018 | –15.10 |
| open | 0.0009 | 0.0002 | 5.42 | 0.0015 | 0.0002 | 8.05 |
| pop_15_64 | 0.0656 | 0.0014 | 48.28 | 0.0641 | 0.0016 | 40.16 |
| pop_den | –0.1151 | 0.0039 | –29.83 | –0.0073 | 0.0046 | –1.58 |
| pop_gr | 0.0034 | 0.0034 | 1.01 | –0.0506 | 0.0042 | –11.94 |
| pop_tot | –0.0123 | 0.0027 | –4.48 | –0.0048 | 0.0031 | –1.54 |

TRAN – the EBRD transition indicator. The remaining variables are defined in Table 2.

Source: Own calculations.

**Table 15**
**Estimation results for the component indicators of the Heritage Foundation index of economic freedom (models 2 and 4)**

| Regressor | Model 2: World countries | | | Regressor | Model 4: World countries | | |
|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | | beta | st. dev. | pseudo t |
| Business | 0.0126 | 0.0011 | 11.07 | ΔBusiness | 0.0012 | 0.0001 | 8.28 |
| $(\text{Business})^2$ | –0.0001 | 0.0000 | –13.74 | $(\Delta\text{Business})^2$ | 0.0001 | 0.0000 | 8.90 |
| Trade | 0.0054 | 0.0007 | 8.07 | ΔTrade | 0.0006 | 0.0002 | 3.27 |
| $(\text{Trade})^2$ | –0.0001 | 0.0000 | –9.64 | $(\Delta\text{Trade})^2$ | –0.0000 | 0.0000 | –0.88 |
| Fiscal | –0.0015 | 0.0013 | –1.13 | ΔFiscal | 0.0024 | 0.0003 | 9.50 |
| $(\text{Fiscal})^2$ | 0.0000 | 0.0000 | 2.16 | $(\Delta\text{Fiscal})^2$ | –0.0000 | 0.0000 | –4.07 |
| Gov't spending | –0.0030 | 0.0005 | –5.78 | ΔGov't spending | 0.0013 | 0.0001 | 10.23 |
| $(\text{Gov't spending})^2$ | 0.0000 | 0.0000 | 4.92 | $(\Delta\text{Gov't spending})^2$ | –0.0001 | 0.0000 | –11.75 |
| Monetary | 0.0064 | 0.0005 | 12.89 | ΔMonetary | 0.0015 | 0.0001 | 11.49 |
| $(\text{Monetary})^2$ | –0.0000 | 0.0000 | –7.20 | $(\Delta\text{Monetary})^2$ | –0.0000 | 0.0000 | –13.82 |
| Investment | 0.0046 | 0.0006 | 7.75 | ΔInvestment | –0.0003 | 0.0001 | –3.48 |
| $(\text{Investment})^2$ | –0.0001 | 0.0000 | –10.04 | $(\Delta\text{Investment})^2$ | –0.0000 | 0.0000 | –1.25 |
| Financial | –0.0115 | 0.0007 | –15.66 | ΔFinancial | 0.0018 | 0.0001 | 20.33 |
| $(\text{Financial})^2$ | 0.0001 | 0.0000 | 17.69 | $(\Delta\text{Financial})^2$ | 0.0000 | 0.0000 | 0.41 |
| Property rights | 0.0054 | 0.0005 | 10.00 | ΔProperty rights | –0.0000 | 0.0002 | –0.06 |
| $(\text{Property rights})^2$ | –0.0001 | 0.0000 | –10.50 | $(\Delta\text{Property rights})^2$ | –0.0000 | 0.0000 | –1.98 |
| Corruption | –0.0018 | 0.0006 | –3.17 | ΔCorruption | 0.0002 | 0.0001 | 1.44 |
| $(\text{Corruption})^2$ | 0.0000 | 0.0000 | 6.89 | $(\Delta\text{Corruption})^2$ | 0.0000 | 0.0000 | 4.92 |

Parameter estimates for the other explanatory variables are not reported in the table.

Source: Own calculations.

**Table 16**
**Estimation results for the component indicators of the Fraser Institute index of economic freedom (models 7 and 8)**

| Regressor | Model 7: World countries | | | Regressor | Model 8: World countries | | |
|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | | beta | st. dev. | pseudo t |
| Size of gov't | 0.0320 | 0.0088 | 3.64 | ΔSize of gov't | –0.0007 | 0.0014 | –0.45 |
| (Size of gov't)$^2$ | –0.0010 | 0.0008 | –1.29 | (ΔSize of gov't)$^2$ | –0.0037 | 0.0006 | –5.89 |
| Legal structure, property rights | 0.0886 | 0.0063 | 14.03 | ΔLegal structure, property rights | 0.0075 | 0.0012 | 6.30 |
| (Legal structure, property rights)$^2$ | –0.0054 | 0.0005 | –10.66 | (ΔLegal structure, property rights)$^2$ | –0.0005 | 0.0006 | –0.84 |
| Sound money | 0.1485 | 0.0034 | 43.86 | ΔSound money | 0.0133 | 0.0009 | 14.31 |
| (Sound money)$^2$ | –0.0111 | 0.0003 | –39.30 | (ΔSound money)$^2$ | –0.0013 | 0.0002 | –6.98 |
| Int'l trade | –0.0015 | 0.0040 | –0.37 | ΔInt'l trade | 0.0135 | 0.0014 | 10.01 |
| (Int'l trade)$^2$ | 0.0013 | 0.0004 | 3.63 | (ΔInt'l trade)$^2$ | –0.0033 | 0.0003 | –10.56 |
| Regul. of credit, labor, business | 0.1699 | 0.0118 | 14.35 | ΔRegul. of credit, labor, business | –0.0033 | 0.0024 | –1.36 |
| (Regul. of credit, labor, business)$^2$ | –0.0137 | 0.0010 | –13.78 | (ΔRegul. of credit, labor, business)$^2$ | 0.0009 | 0.0010 | 0.93 |

Parameter estimates for the other explanatory variables are not reported in the table.

Source: Own calculations.

**Table 17**
**Estimation results for the component indices of the World Bank worldwide governance indicator (models 10 and 12)**

| Regressor | Model 10: World countries | | | Regressor | Model 12: World countries | | |
|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | | beta | st. dev. | pseudo t |
| Voice & accountability | –0.0156 | 0.0049 | –3.19 | ΔVoice & accountability | 0.0065 | 0.0067 | 0.97 |
| (Voice & accountability)$^2$ | 0.1113 | 0.0059 | 19.02 | (ΔVoice & accountability)$^2$ | –0.1005 | 0.0133 | –7.56 |
| Political stability | 0.1984 | 0.0083 | 23.81 | ΔPolitical stability | 0.0336 | 0.0049 | 6.82 |
| (Political stability)$^2$ | 0.0365 | 0.0043 | 8.58 | (ΔPolitical stability)$^2$ | –0.0220 | 0.0073 | –3.01 |
| Gov't effectiveness | 0.0338 | 0.0069 | 4.88 | ΔGov't effectiveness | 0.1022 | 0.0079 | 12.87 |
| (Gov't effectiveness)$^2$ | –0.0548 | 0.0039 | –14.20 | (ΔGov't effectiveness)$^2$ | 0.0927 | 0.0162 | 5.72 |
| Regulatory quality | –0.0083 | 0.0061 | –1.36 | ΔRegulatory quality | 0.1389 | 0.0064 | 21.77 |
| (Regulatory quality)$^2$ | 0.0574 | 0.0042 | 13.59 | (ΔRegulatory quality)$^2$ | –0.0695 | 0.0108 | –6.41 |
| Rule of law | –0.0215 | 0.0086 | –2.50 | ΔRule of law | 0.0861 | 0.0080 | 10.80 |
| (Rule of law)$^2$ | 0.0581 | 0.0058 | 10.09 | (ΔRule of law)$^2$ | –0.1598 | 0.0197 | –8.12 |
| Corruption | –0.0448 | 0.0071 | –6.31 | ΔCorruption | 0.0251 | 0.0064 | 3.91 |
| (Corruption)$^2$ | 0.0039 | 0.0041 | 0.96 | (ΔCorruption)$^2$ | –0.0103 | 0.0143 | –0.72 |

Parameter estimates for the other explanatory variables are not reported in the table.

Source: Own calculations.

**Table 18**
**Estimation results for the component indicators of the Freedom House democracy index and freedom of the press index (models 14 and 16)**

| Regressor | Model 14: World countries | | | Regressor | Model 16: World countries | | |
|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | | beta | st. dev. | pseudo t |
| Political rights | –0.1646 | 0.0123 | –13.39 | ΔPolitical rights | –0.0516 | 0.0048 | –10.73 |
| (Political rights)$^2$ | 0.0240 | 0.0013 | 18.49 | (ΔPolitical rights)$^2$ | –0.0021 | 0.0014 | –1.45 |
| Civil liberties | 0.1593 | 0.0135 | 11.84 | ΔCivil liberties | 0.0673 | 0.0078 | 8.62 |
| (Civil liberties)$^2$ | –0.0186 | 0.0014 | –13.79 | (ΔCivil liberties)$^2$ | –0.0061 | 0.0041 | –1.50 |
| Freedom of the press | –0.0075 | 0.0010 | –7.40 | ΔFreedom of the press | 0.0019 | 0.0004 | 4.80 |
| (Freedom of the press)$^2$ | 0.0000 | 0.0000 | 3.93 | (ΔFreedom of the press)$^2$ | –0.0001 | 0.0000 | –4.55 |

Parameter estimates for the other explanatory variables are not reported in the table.

Source: Own calculations.

**Table 19**
**Estimation results for the World Bank doing business indicators (models 17 and 18)**

| Regressor | Model 17: World countries | | | Reg-ressor | Model 18: World countries | | |
|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | | beta | st. dev. | pseudo t |
| Cost to build a warehouse (% of income per capita) | –0.0000 | 0.0000 | –1.13 | Δ… | –0.0000 | 0.0000 | –1.09 |
| (Cost to build a warehouse)$^2$ | 0.0000 | 0.0000 | 1.02 | (Δ…)$^2$ | –0.0000 | 0.0000 | –1.41 |
| Extent of disclosure index (0 to 10) | –0.0126 | 0.0198 | –0.64 | Δ… | 0.0040 | 0.0273 | 0.14 |
| (Extent of disclosure index)$^2$ | 0.0008 | 0.0018 | 0.46 | (Δ…)$^2$ | 0.0000 | 0.0049 | 0.01 |
| Time to start a business (days) | 0.0007 | 0.0006 | 1.21 | Δ… | –0.0013 | 0.0005 | –2.46 |
| (Time to start a business)$^2$ | –0.0000 | 0.0000 | –1.27 | (Δ…)$^2$ | –0.0000 | 0.0000 | –1.79 |
| Credit: Strength of legal rights index (0=weak to 10=strong) | 0.0259 | 0.0269 | 0.97 | Δ… | –0.0206 | 0.0188 | –1.10 |
| (Credit: Strength of legal rights index)$^2$ | –0.0020 | 0.0023 | –0.86 | (Δ…)$^2$ | 0.0042 | 0.0037 | 1.15 |
| Tax payments (number) | –0.0007 | 0.0019 | –0.36 | Δ… | –0.0006 | 0.0016 | –0.36 |
| (Tax payments)$^2$ | 0.0000 | 0.0000 | 0.07 | (Δ…)$^2$ | 0.0000 | 0.0000 | 0.37 |
| Procedures to build a warehouse (number) | 0.0059 | 0.0053 | 1.11 | Δ… | 0.0016 | 0.0043 | 0.38 |
| (Procedures to build a warehouse)$^2$ | –0.0000 | 0.0001 | –0.37 | (Δ…)$^2$ | 0.0003 | 0.0003 | 1.01 |
| Trade: Cost to import (US$ per container) | –0.0000 | 0.0000 | –0.02 | Δ… | 0.0000 | 0.0000 | 1.14 |
| (Trade: Cost to import)$^2$ | –0.0000 | 0.0000 | –0.37 | (Δ…)$^2$ | –0.0000 | 0.0000 | –1.30 |
| Cost to enforce a contract (% of claim) | –0.0012 | 0.0018 | –0.68 | Δ… | –0.0008 | 0.0039 | –0.20 |
| (Cost to enforce a contract)$^2$ | 0.0000 | 0.0000 | 0.91 | (Δ…)$^2$ | 0.0000 | 0.0000 | 0.17 |
| Time to prepare and pay taxes (hours) | 0.0001 | 0.0001 | 1.47 | Δ… | –0.0004 | 0.0001 | –2.94 |
| (Time to prepare and pay taxes)$^2$ | –0.0000 | 0.0000 | –1.24 | (Δ…)$^2$ | –0.0000 | 0.0000 | –2.17 |
| Depth of credit information index (0=low to 6=high) | 0.0131 | 0.0230 | 0.57 | Δ… | 0.0535 | 0.0223 | 2.40 |
| (Depth of credit information index)$^2$ | 0.0011 | 0.0037 | 0.30 | (Δ…)$^2$ | –0.0067 | 0.0050 | –1.36 |
| Time to build a warehouse (days) | 0.0003 | 0.0002 | 1.23 | Δ… | –0.0001 | 0.0003 | –0.18 |
| (Time to build a warehouse)$^2$ | –0.0000 | 0.0000 | –1.12 | (Δ…)$^2$ | –0.0000 | 0.0000 | –0.94 |
| Trade: Documents to export (number) | 0.0086 | 0.0398 | 0.22 | Δ… | –0.0028 | 0.0173 | –0.16 |
| (Trade: Documents to export)$^2$ | 0.0004 | 0.0027 | 0.16 | (Δ…)$^2$ | –0.0015 | 0.0028 | –0.53 |
| Minimum paid-in capital to start a business (% of income per capita) | –0.0003 | 0.0001 | –2.50 | Δ… | 0.0001 | 0.0001 | 0.92 |
| (Minimum paid-in capital to start a business)$^2$ | 0.0000 | 0.0000 | 1.57 | (Δ…)$^2$ | 0.0000 | 0.0000 | 0.00 |
| Procedures to enforce a contract (number) | 0.0038 | 0.0172 | 0.22 | Δ… | –0.0067 | 0.0139 | –0.48 |
| (Procedures to enforce a contract)$^2$ | –0.0001 | 0.0002 | –0.34 | (Δ…)$^2$ | –0.0048 | 0.0046 | –1.04 |
| Trade: Documents to import (number) | –0.0167 | 0.0272 | –0.61 | Δ… | 0.0108 | 0.0122 | 0.89 |
| (Trade: Documents to import)$^2$ | 0.0007 | 0.0015 | 0.44 | (Δ…)$^2$ | 0.0012 | 0.0014 | 0.85 |
| Cost to register property (% of property value) | –0.0149 | 0.0068 | –2.18 | Δ… | 0.0044 | 0.0092 | 0.48 |
| (Cost to register property)$^2$ | 0.0002 | 0.0003 | 0.58 | (Δ…)$^2$ | 0.0002 | 0.0013 | 0.17 |
| Total tax rate (% of profit) | –0.0007 | 0.0010 | –0.68 | Δ… | –0.0008 | 0.0012 | –0.65 |

| Regressor | Model 17: World countries | | | Reg-ressor | Model 18: World countries | | |
|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | | beta | st. dev. | pseudo t |
| (Total tax rate)$^2$ | 0.0000 | 0.0000 | 0.12 | $(\Delta\ldots)^2$ | –0.0000 | 0.0000 | –0.66 |
| Ease of shareholder suits index (0 to 10) | 0.0094 | 0.0247 | 0.38 | $\Delta\ldots$ | 0.0234 | 0.0334 | 0.70 |
| (Ease of shareholder suits index)$^2$ | 0.0004 | 0.0021 | 0.18 | $(\Delta\ldots)^2$ | 0.0011 | 0.0091 | 0.12 |
| Time to enforce a contract (days) | –0.0003 | 0.0002 | –2.20 | $\Delta\ldots$ | –0.0003 | 0.0002 | –1.44 |
| (Time to enforce a contract)$^2$ | 0.0000 | 0.0000 | 2.15 | $(\Delta\ldots)^2$ | –0.0000 | 0.0000 | –1.14 |
| Procedures to register property (number) | 0.0113 | 0.0221 | 0.51 | $\Delta\ldots$ | –0.0198 | 0.0180 | –1.10 |
| (Procedures to register property)$^2$ | –0.0008 | 0.0016 | –0.50 | $(\Delta\ldots)^2$ | 0.0004 | 0.0048 | 0.09 |
| Trade: Time to export (day) | –0.0039 | 0.0042 | –0.92 | $\Delta\ldots$ | –0.0019 | 0.0033 | –0.57 |
| (Trade: Time to export)$^2$ | 0.0001 | 0.0000 | 1.59 | $(\Delta\ldots)^2$ | 0.0001 | 0.0001 | 0.52 |
| Cost to start a business (% of income per capita) | –0.0004 | 0.0003 | –1.19 | $\Delta\ldots$ | 0.0000 | 0.0002 | 0.10 |
| (Cost to start a business)$^2$ | 0.0000 | 0.0000 | 0.71 | $(\Delta\ldots)^2$ | 0.0000 | 0.0000 | 0.16 |
| Strength of investor protection index (0 to 10) | 0.0373 | 0.0441 | 0.85 | $\Delta\ldots$ | 0.0335 | 0.0462 | 0.72 |
| (Strength of investor protection index)$^2$ | –0.0018 | 0.0038 | –0.47 | $(\Delta\ldots)^2$ | –0.0047 | 0.0139 | –0.34 |
| Trade: Cost to export (US$ per container) | 0.0000 | 0.0001 | 0.17 | $\Delta\ldots$ | 0.0000 | 0.0000 | 1.04 |
| (Trade: Cost to export)$^2$ | 0.0000 | 0.0000 | 0.07 | $(\Delta\ldots)^2$ | –0.0000 | 0.0000 | –0.56 |
| Extent of director liability index (0 to 10) | 0.0190 | 0.0206 | 0.92 | $\Delta\ldots$ | 0.0179 | 0.0312 | 0.57 |
| (Extent of director liability index)$^2$ | –0.0022 | 0.0021 | –1.05 | $(\Delta\ldots)^2$ | –0.0031 | 0.0058 | –0.53 |
| Time to register property (days) | 0.0006 | 0.0005 | 1.21 | $\Delta\ldots$ | –0.0004 | 0.0002 | –1.80 |
| (Time to register property)$^2$ | –0.0000 | 0.0000 | –0.80 | $(\Delta\ldots)^2$ | –0.0000 | 0.0000 | –1.89 |
| Procedures to start a business (number) | 0.0098 | 0.0171 | 0.58 | $\Delta\ldots$ | 0.0029 | 0.0112 | 0.26 |
| (Procedures to start a business)$^2$ | –0.0007 | 0.0009 | –0.75 | $(\Delta\ldots)^2$ | –0.0005 | 0.0014 | –0.36 |
| Trade: Time to import (days) | 0.0037 | 0.0037 | 1.02 | $\Delta\ldots$ | 0.0007 | 0.0025 | 0.29 |
| (Trade: Time to import)$^2$ | –0.0000 | 0.0000 | –0.71 | $(\Delta\ldots)^2$ | 0.0000 | 0.0001 | 0.74 |

Parameter estimates for the other explanatory variables are not reported in the table.

Source: Own calculations.

**Table 20**
**Estimation results for the component indices of the EBRD transition indicator (models 20 and 22)**

| Regressor | Model 20: 27 post-socialist countries | | | Regressor | Model 22: 27 post-socialist countries | | |
|---|---|---|---|---|---|---|---|
| | beta | st. dev. | pseudo t | | beta | st. dev. | pseudo t |
| Competition policy | 0.3578 | 0.0379 | 9.44 | ΔCompetition policy | 0.1636 | 0.0313 | 5.23 |
| (Competition policy)$^2$ | –0.0610 | 0.0086 | –7.06 | (ΔCompetition policy)$^2$ | –0.1833 | 0.0246 | –7.44 |
| Governance and enterprise restructuring | 0.3493 | 0.0377 | 9.26 | ΔGovernance and enterprise restructuring | 0.0721 | 0.0211 | 3.41 |
| (Governance and enterprise restructuring)$^2$ | –0.0373 | 0.0079 | –4.72 | (ΔGovernance and enterprise restructuring)$^2$ | –0.1598 | 0.0162 | –9.88 |
| Large privatisation | –0.1871 | 0.0354 | –5.29 | ΔLarge privatisation | –0.0396 | 0.0171 | –2.31 |
| (Large privatisation)$^2$ | 0.0562 | 0.0068 | 8.29 | (ΔLarge privatisation)$^2$ | –0.0439 | 0.0093 | –4.74 |
| Price liberalisation | –2.1921 | 0.1071 | –20.46 | ΔPrice liberalisation | –0.0140 | 0.0100 | –1.39 |
| (Price liberalisation)$^2$ | 0.3372 | 0.0158 | 21.33 | (ΔPrice liberalisation)$^2$ | 0.0055 | 0.0048 | 1.14 |
| Small privatisation | –0.4411 | 0.0741 | –5.95 | ΔSmall privatisation | –0.0924 | 0.0122 | –7.56 |
| (Small privatisation)$^2$ | 0.0951 | 0.0116 | 8.22 | (ΔSmall privatisation)$^2$ | –0.0276 | 0.0057 | –4.82 |
| Trade and forex | –0.0106 | 0.0317 | –0.33 | ΔTrade and forex | 0.0352 | 0.0112 | 3.14 |
| (Trade and forex)$^2$ | 0.0130 | 0.0055 | 2.37 | (ΔTrade and forex)$^2$ | –0.0640 | 0.0055 | –11.69 |

Parameter estimates for the other explanatory variables are not reported in the table.

Source: Own calculations.

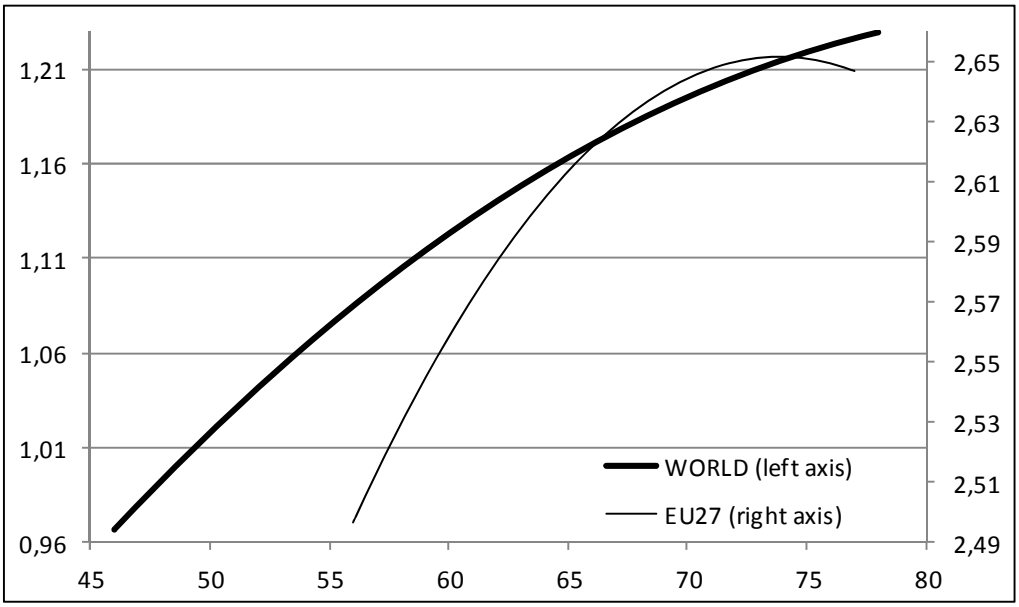
**Table 21**
**Estimation results for selected models (whole sample of countries) with exogenous / endogenous institutions**

| Variable | Exogenous institutions | | Endogenous institutions | | q |
|---|---|---|---|---|---|
| | beta | sd | beta | sd | |
| **Model 5** | | | | | |
| EF | 0.338967 | 0.006969 | 0.514848 | 0.012234 | 305.971 |
| $EF^2$ | –0.024535 | 0.000638 | –0.041774 | 0.001038 | 443.214 |
| **Model 7** | | | | | |
| Size of gov't | 0.030656 | 0.004819 | 0.031967 | 0.008779 | 0.032 |
| (Size of gov't)$^2$ | –0.001071 | 0.000397 | –0.000976 | 0.000756 | 0.022 |
| Legal structure, property rights | 0.159395 | 0.003742 | 0.088607 | 0.006315 | 193.674 |
| (Legal structure, property rights)$^2$ | –0.012775 | 0.000332 | –0.005377 | 0.000505 | 378.536 |
| Sound money | 0.125075 | 0.002351 | 0.148536 | 0.003387 | 92.628 |
| (Sound money)$^2$ | –0.008599 | 0.000213 | –0.011087 | 0.000282 | 180.605 |
| Int'l trade | –0.047473 | 0.002846 | –0.001490 | 0.004049 | 254.944 |
| (Int'l trade)$^2$ | 0.004454 | 0.000252 | 0.001327 | 0.000366 | 139.342 |
| Regul. of credit, labor, business | –0.007202 | 0.007020 | 0.169907 | 0.011844 | 344.739 |
| (Regul. of credit, labor, business)$^2$ | 0.000656 | 0.000590 | –0.013682 | 0.000993 | 322.588 |
| **Model 13** | | | | | |
| DEM | –0.027583 | 0.004021 | –0.054874 | 0.009872 | 9.163 |
| $DEM^2$ | 0.005225 | 0.000554 | 0.004854 | 0.001174 | 0.128 |
| **Model 14** | | | | | |
| Political rights | –0.036282 | 0.005603 | –0.164639 | 0.012294 | 137.576 |
| (Political rights)$^2$ | 0.005492 | 0.000625 | 0.024036 | 0.001300 | 264.626 |
| Civil liberties | –0.043407 | 0.007310 | 0.159349 | 0.013461 | 321.753 |
| (Civil liberties)$^2$ | 0.004520 | 0.000824 | –0.018634 | 0.001351 | 467.739 |
| Freedom of the press | –0.000782 | 0.000544 | –0.007550 | 0.001020 | 61.486 |
| (Freedom of the press)$^2$ | 0.000014 | 0.000005 | 0.000035 | 0.000009 | 8.176 |

EF – the Fraser Institute index of economic freedom, DEM – the Freedom House democracy index. Estimates for the institutional variables given only. Columns 1-2 contain the estimates (beta) and errors of estimation (sd) for the models with institutional variables treated as exogenous, columns 3-4 contain the estimates of parameters and errors of estimation for the models in which institutions are treated as exogenous. Last column (q) contains the partial Hausman specification statistics for particular variables. All models based on the complete sample of world countries.

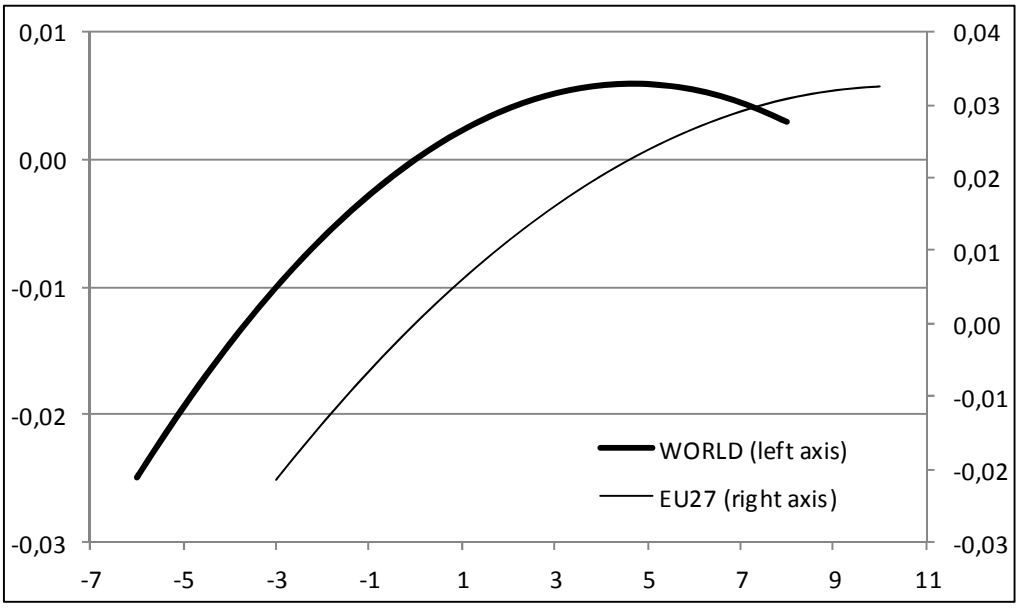
Source: Own calculations.

**Figure 1. The impact of the level of economic freedom (Heritage Foundation index) on economic growth (model 1)**



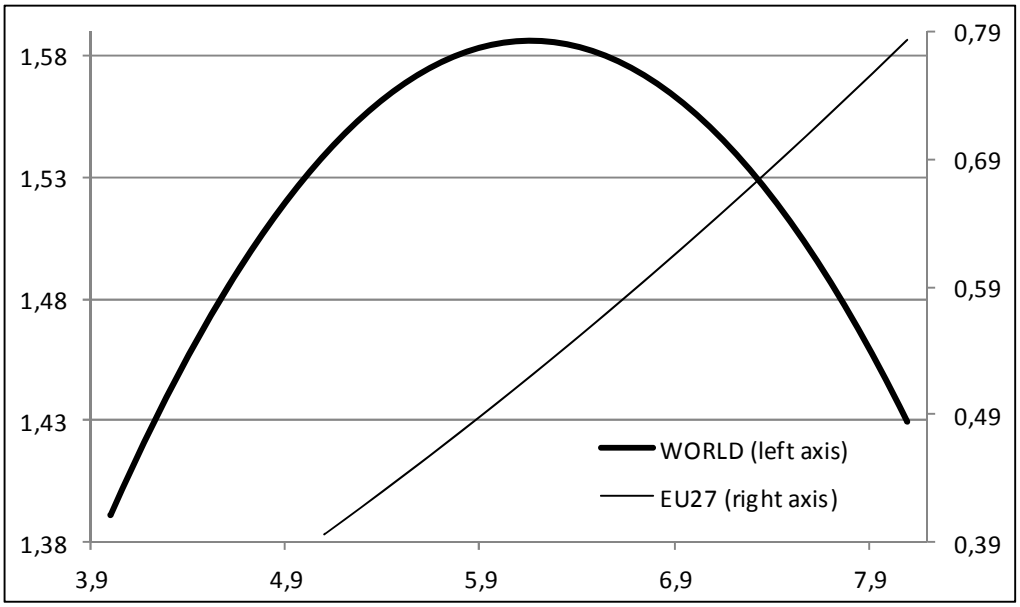

Source: Own calculations.

**Figure 2. The impact of the change in economic freedom (Heritage Foundation index) on economic growth (model 3)**



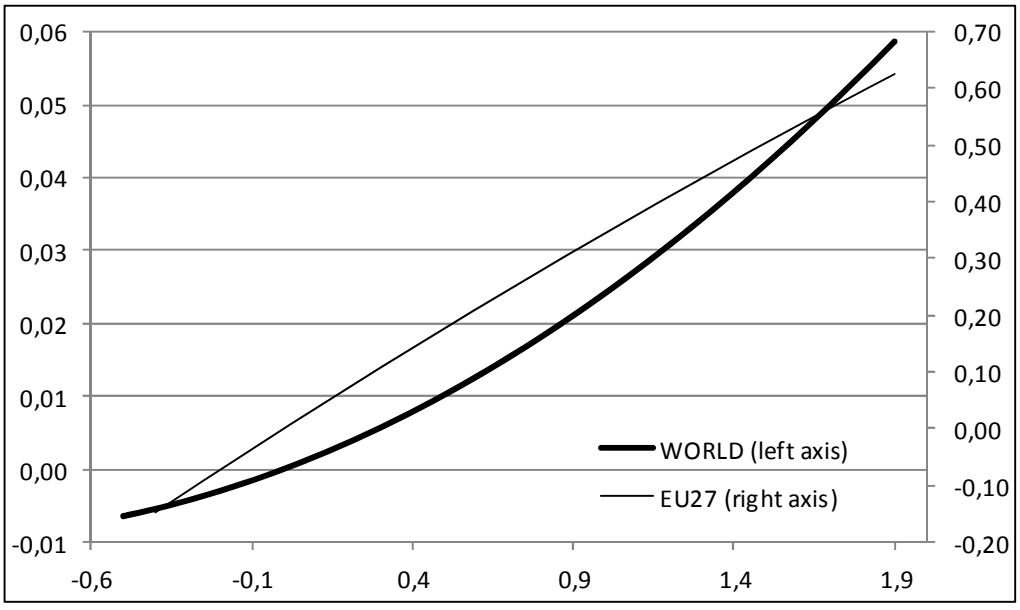

Source: Own calculations.

**Figure 3. The impact of the level of economic freedom (Fraser Institute index) on economic growth (model 5)**



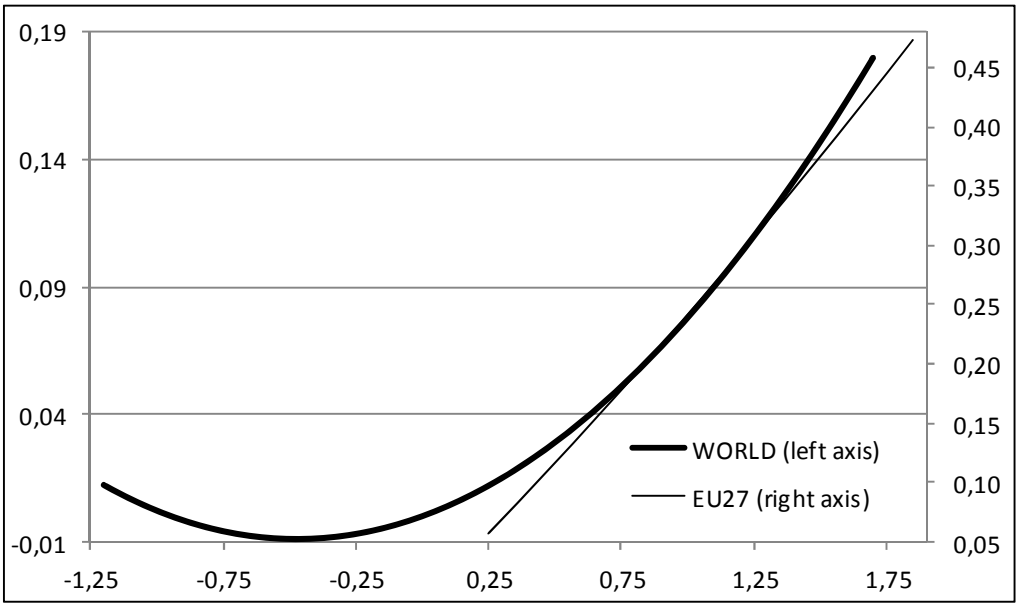

Source: Own calculations.

**Figure 4. The impact of the change in economic freedom (Fraser Institute index) on economic growth (model 6)**



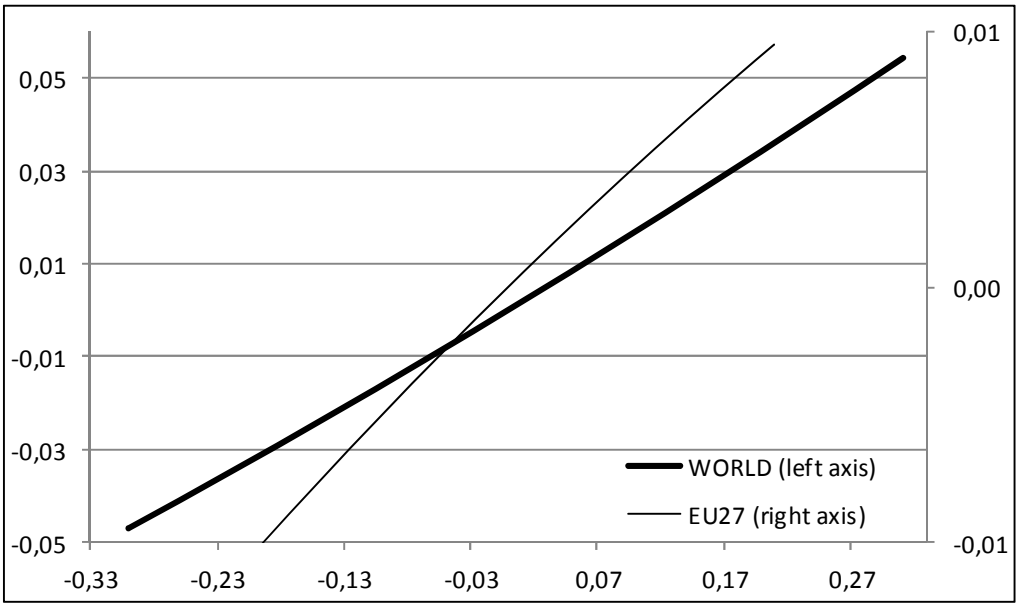

Source: Own calculations.

**Figure 5. The impact of the level of governance quality (the World Bank worldwide governance indicator) on economic growth (model 9)**



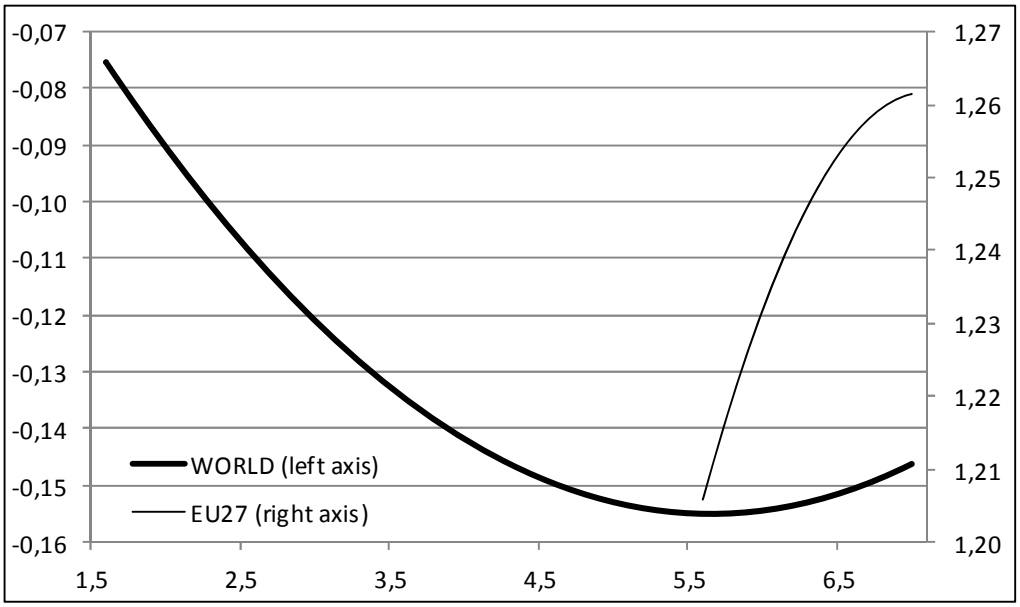

Source: Own calculations.

**Figure 6. The impact of the change in governance quality (the World Bank worldwide governance indicator) on economic growth (model 11)**



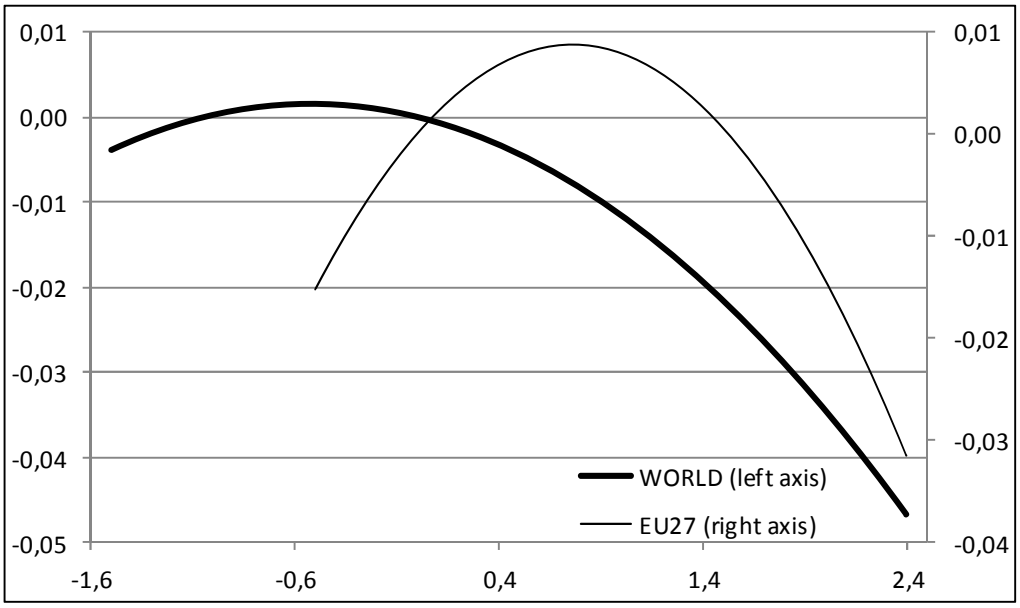

Source: Own calculations.

**Figure 7. The impact of the level of democracy (Freedom House index) on economic growth (model 13)**



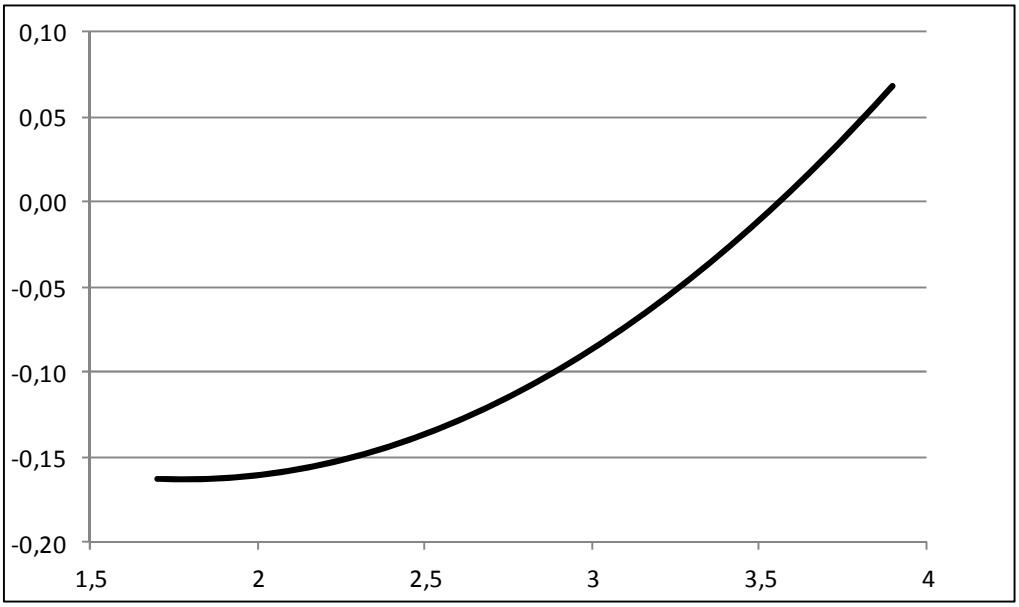

Source: Own calculations.

**Figure 8. The impact of the change in democracy (Freedom House index) on economic growth (model 15)**



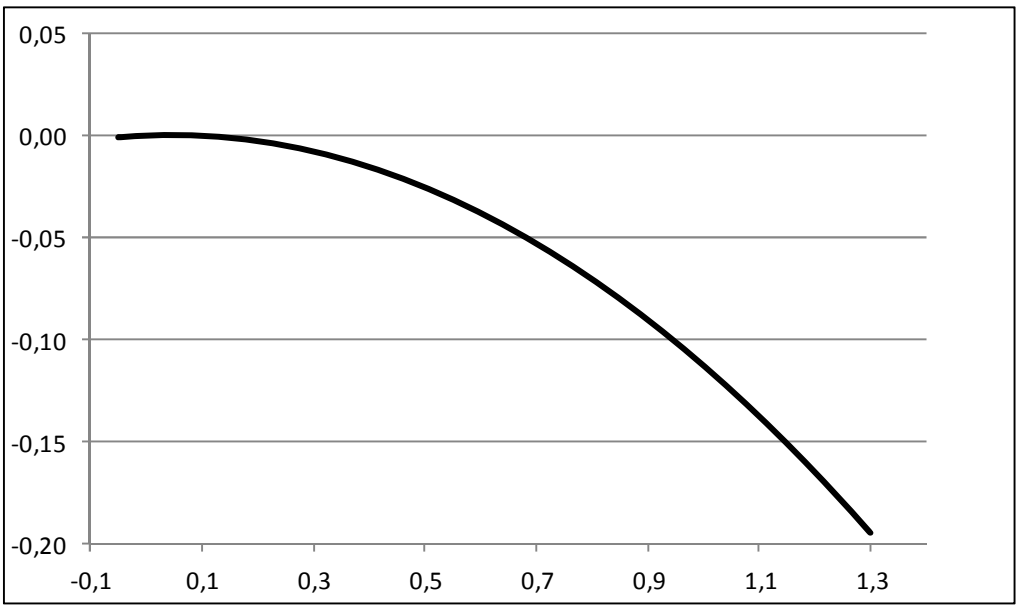

Source: Own calculations.

**Figure 9. The impact of the level in the progress of market reforms (the EBRD transition indicator) on economic growth in the post-socialist countries (model 19)**



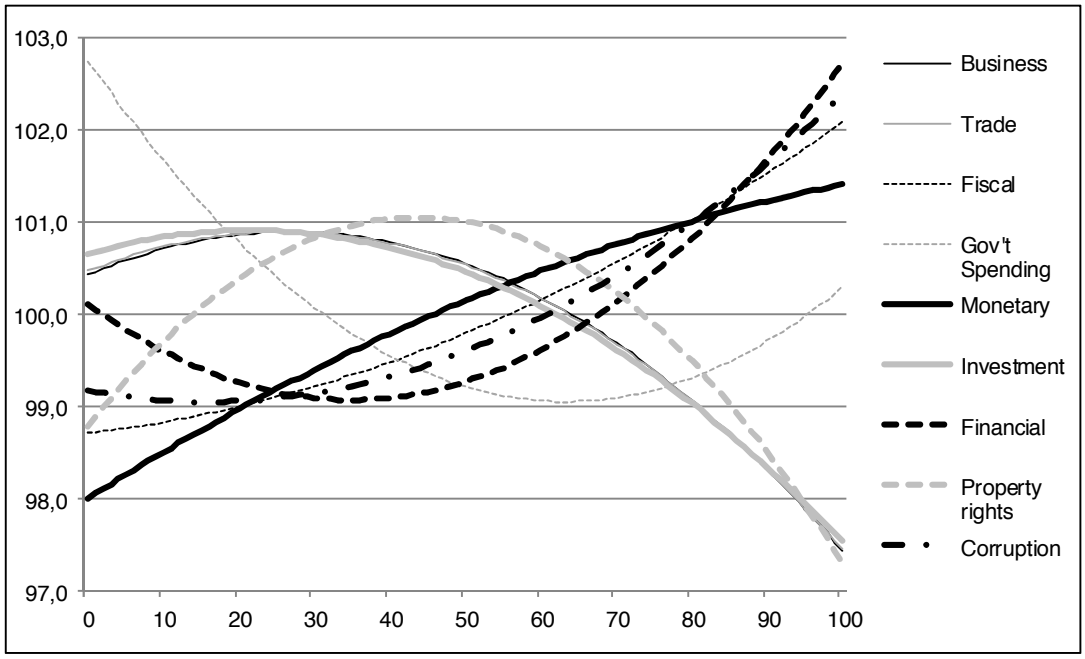

Source: Own calculations.

**Figure 10. The impact of the change in the progress of market reforms (the EBRD transition indicator) on economic growth in the post-socialist countries (model 21)**



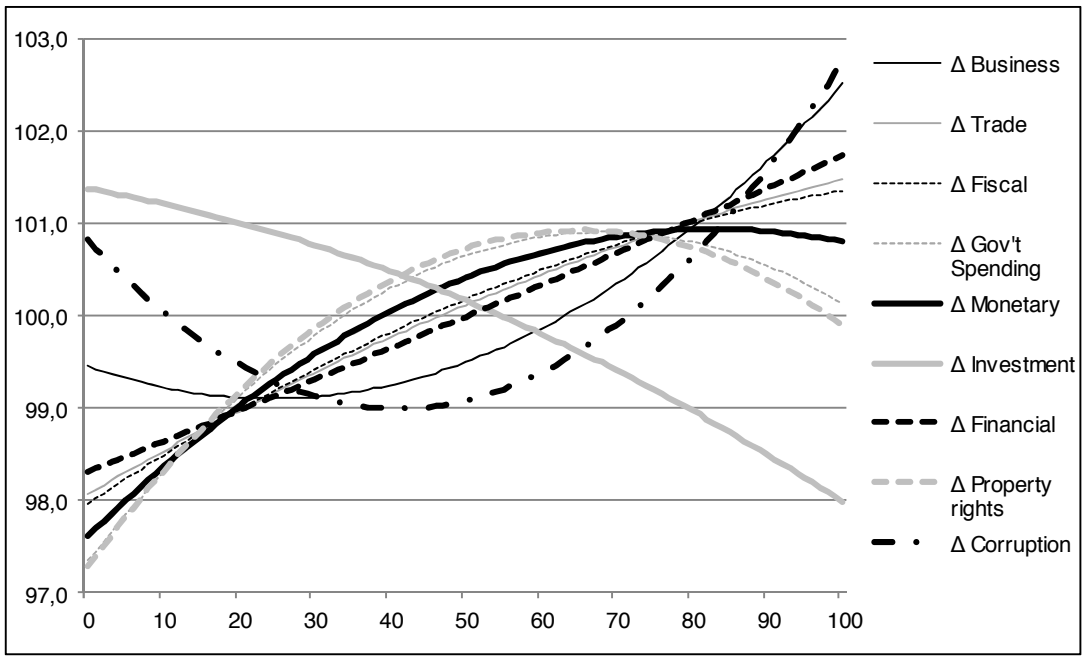

Source: Own calculations.

**Figure 11. The impact of the level of component indicators of the Heritage Foundation index of economic freedom on economic growth (standardized functions, world countries) – model 2**



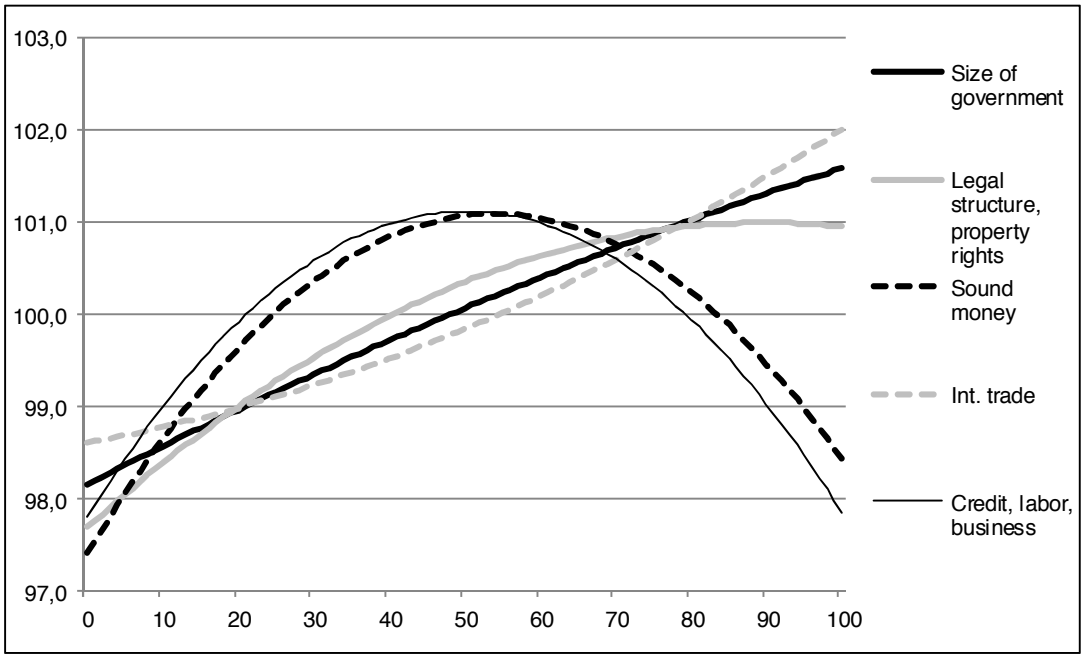

Source: Own calculations.

**Figure 12. The impact of the change in component indicators of the Heritage Foundation index of economic freedom on economic growth (standardized functions, world countries) – model 4**



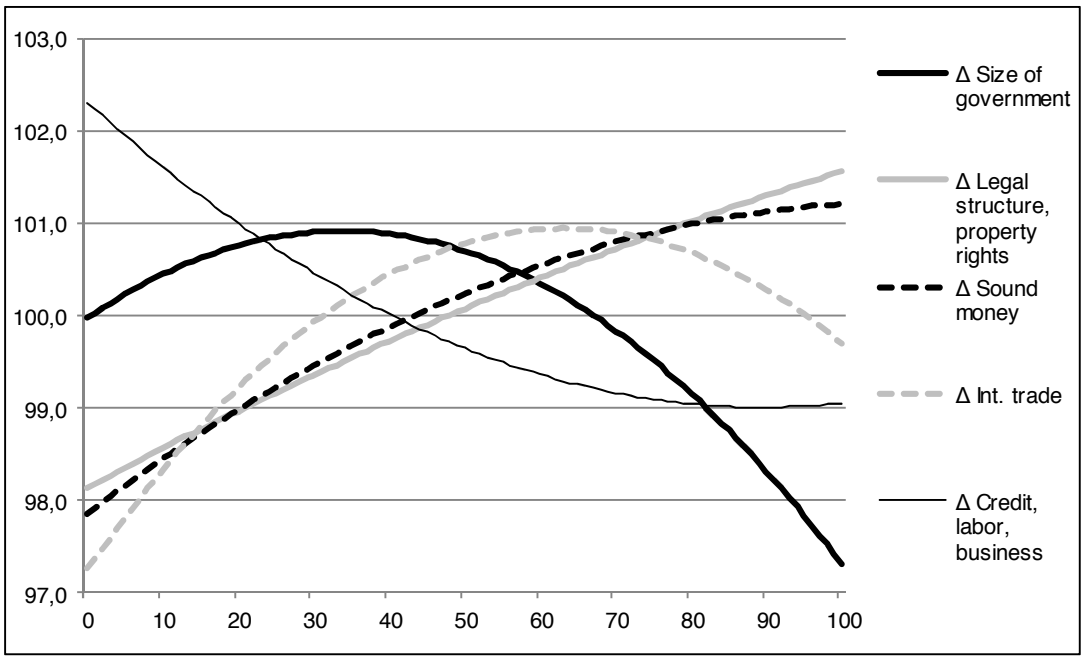

Source: Own calculations.

**Figure 13. The impact of the level of component indicators of the Fraser Institute index of economic freedom on economic growth (standardized functions, world countries) – model 7**



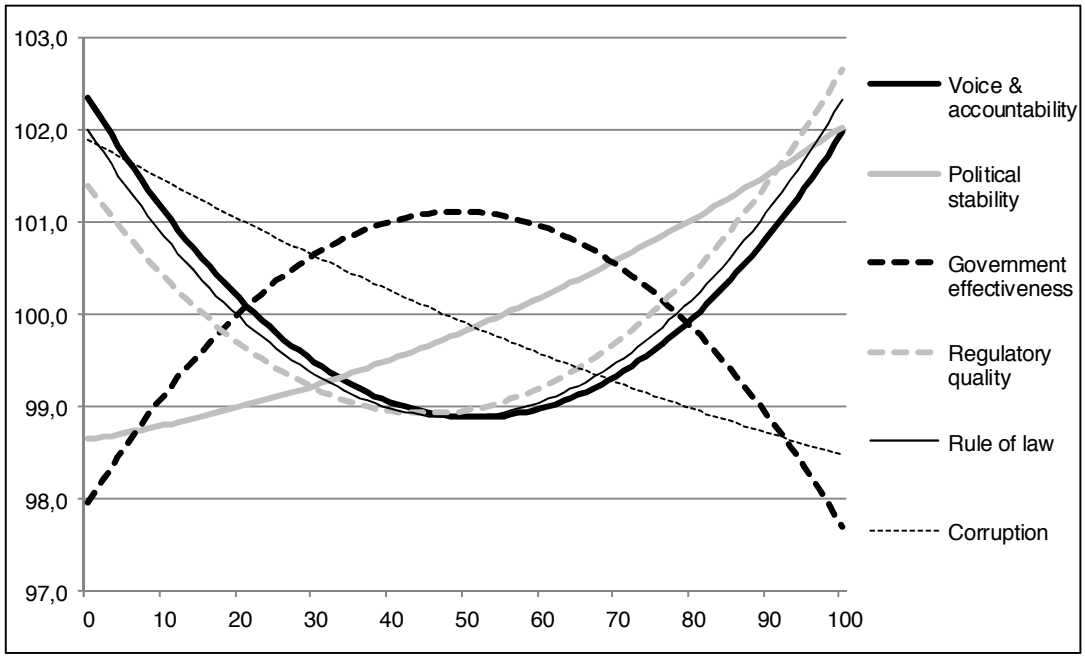

Source: Own calculations.

**Figure 14. The impact of the change in component indicators of the Fraser Institute index of economic freedom on economic growth (standardized functions, world countries) – model 8**



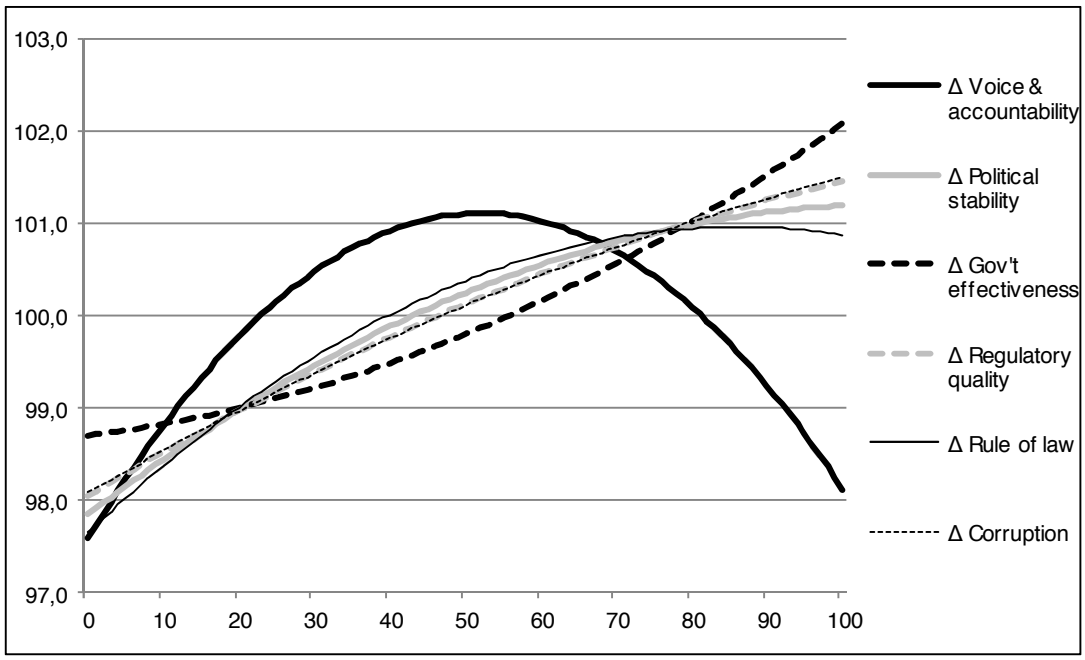

Source: Own calculations.

**Figure 15. The impact of the level of component indices of the World Bank worldwide governance indicator on economic growth (standardized functions, world countries) – model 10**



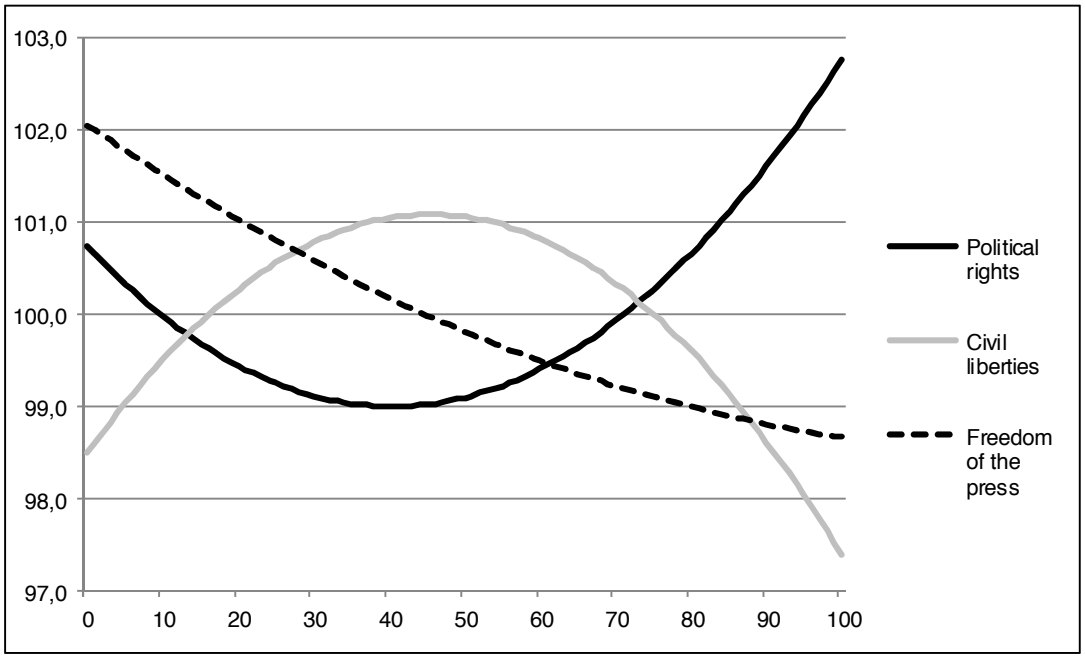

Source: Own calculations.

**Figure 16. The impact of the change in component indices of the World Bank worldwide governance indicator on economic growth (standardized functions, world countries) – model 12**



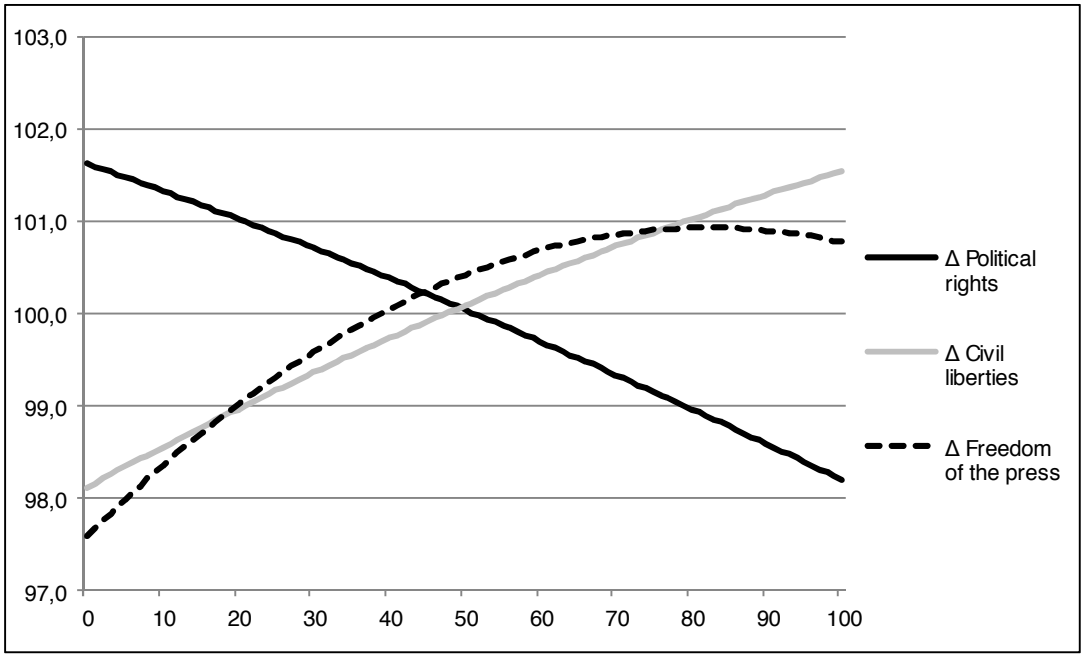

Source: Own calculations.

**Figure 17. The impact of the level of component indicators of the Freedom House democracy index and freedom of the press index on economic growth (standardized functions, world countries) – model 14**



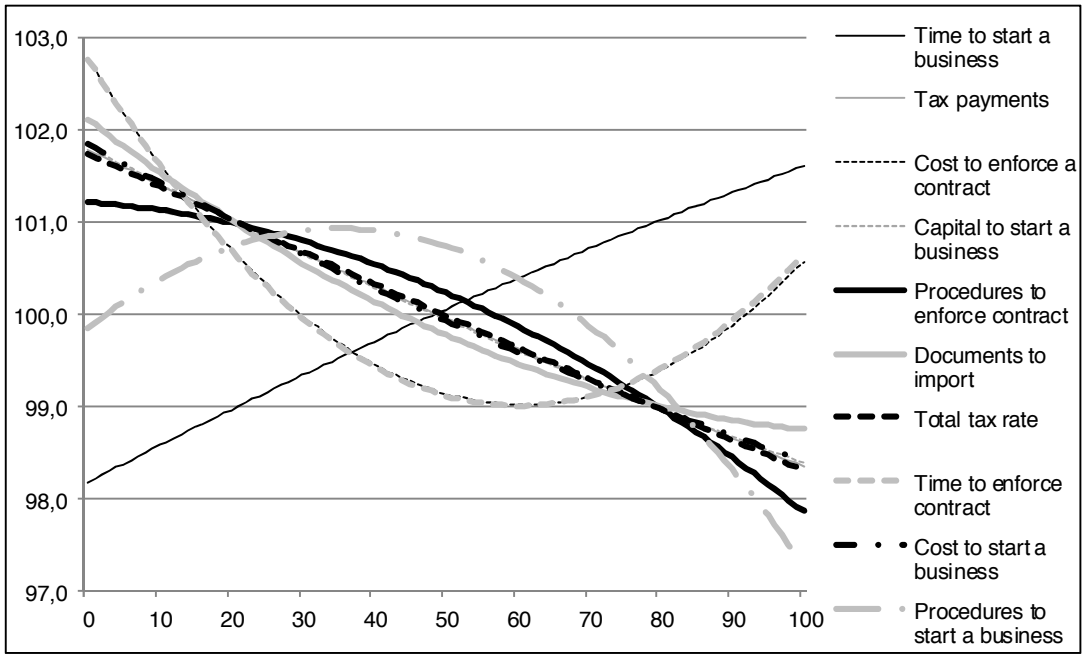

Source: Own calculations.

**Figure 18. The impact of the change in component indicators of the Freedom House democracy index and freedom of the press index on economic growth (standardized functions, world countries) – model 16**



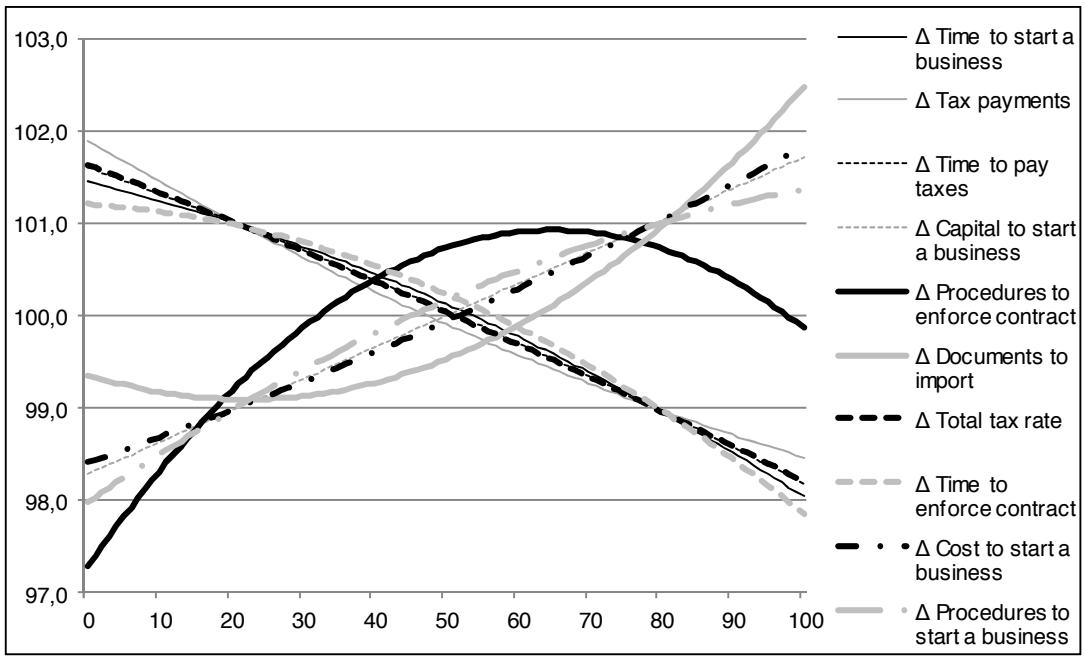

Source: Own calculations.

**Figure 19. The impact of the level of selected doing business indicators (World Bank) on economic growth (standardized functions, world countries) – model 17**



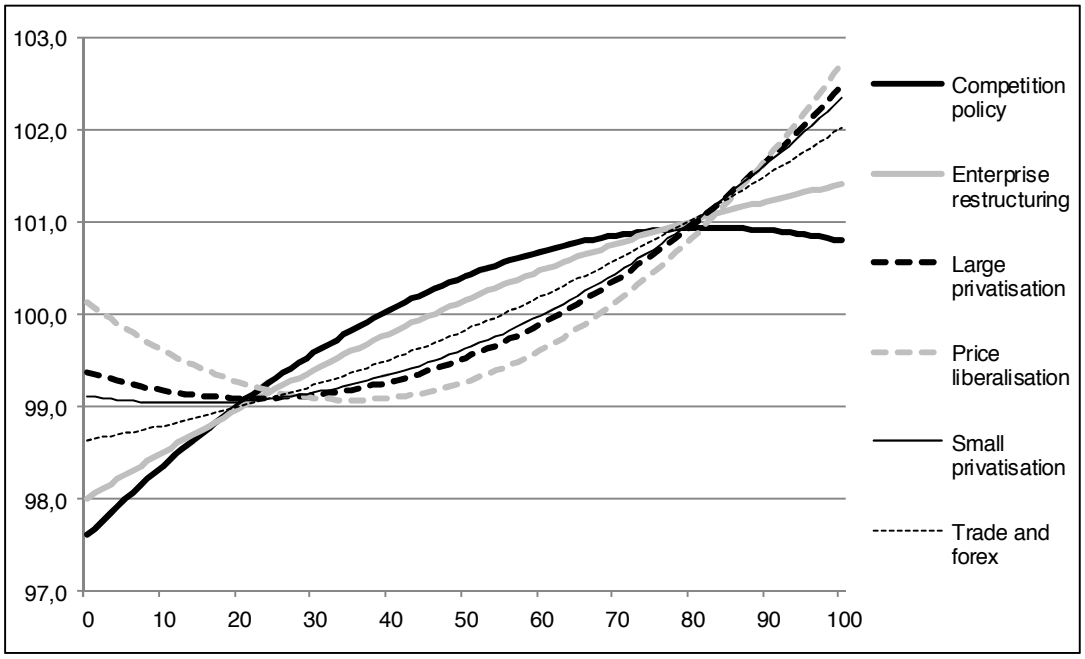

Source: Own calculations.

**Figure 20. The impact of the change in selected doing business indicators (World Bank) on economic growth (standardized functions, world countries) – model 18**



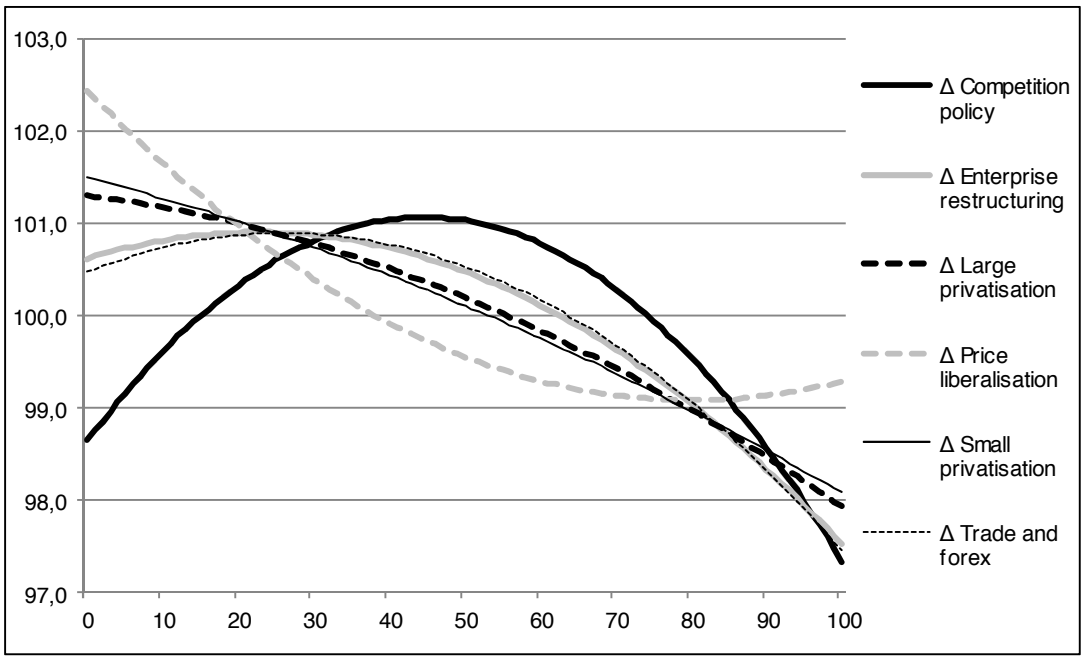

Source: Own calculations.

**Figure 21. The impact of the level of component indices of the EBRD transition indicator on economic growth (standardized functions, post-socialist countries) – model 20**




Source: Own calculations.

**Figure 22. The impact of the change in component indices of the EBRD transition indicator on economic growth (standardized functions, post-socialist countries) – model 22**




Source: Own calculations.

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