Jarko Fidrmuc
Corresponding author

Henan University in Kaifeng,
China;

Zeppelin University in Friedrichshafen,
Germany;

Charles University in Prague,
Institute of Economic Studies,
Czech Republic;

Kaunas University of Technology,
Lithuania

✉ jarko.fidrmuc@zu.de

**Svatopluk
Kapounek**

Mendel University in Brno,
Czech Republic;

Kaunas University of Technology,
Lithuania

✉ kapounek@mendelu.cz

Martin Siddiqui

Zeppelin University in Friedrichshafen,
Germany

✉ m.siddiqui@zeppelin-university.net

Which Institutions Are Important for Firms Performance? Evidence from Bayesian Model Averaging Analysis

Summary: Using a rich dataset on individual firms in selected EU countries between 2005 and 2012, we document a surprisingly high share of assets tied in highly inefficient firms. Moreover, we discuss different channels through which institutions may affect firm financial developments and thus the long-run growth. Using Bayesian model averaging analysis, we discuss the importance of different types of economic, financial and political institutions. We show that high institutional quality improves the financial conditions of firms. However, too lax business regulations may worsen firms' performance possibly due to excessive risk taking behavior.

Key words: Institutional quality, Insolvency, Inefficient firms, Bayesian model averaging.

JEL: C33, K23, O43.

Institutions are now generally believed to be a major precondition for ownership rights, investment security, and long-term growth. However, a precise definition of institutions has still remained surprisingly vague despite the intense debate in the recent literature. The majority of institutional indices have remained nebulous as they often hide behind general terms like freedom, property rights, or constraints of different types. Other indices concentrate on possible policy failures like corruption, shadow economy, or excessive taxation.

We try to contribute to this literature by including several indices covering hopefully the vast majority aspects of economic, political and financial institutions. Our findings indicate that high institutional quality ensures an efficient use of assets by firms in general. However, some indices are found to be less detrimental than other. Actually, some institutions (e.g. business regulations) may even have an ambigu-

ous impact on firms' behavior. Our findings imply that institutional quality can be understood as the ability to guarantee property rights and to resolve insolvency by the owners. Thus, weak institutions may reduce the ability to clean up the economy from an unproductive use of assets and we show that this adverse effect is one of the channels through which institutions affect income *per capita* in the long-run. At the same time, insufficient business regulations may worsen the economic performance of firms.

Our measurement for efficiency at the firm-level is provided by the interest coverage ratio. Firms should be able to serve at least their interest payments from their current earnings. By contrast, firms falling below this benchmark for one or even for two years in a row are wasting resources because they have to use internal sources for interest payments. Therefore, Arturo Bris, Yrjö Koskinen, and Vicente Pons (2001) link the interest coverage ratio to corporate performance. Building upon this argument, we try to show that the existence of highly inefficient firms is result of inefficient institutions. Indeed, we document that there are comparably large shares of inefficient firms in Central and Eastern European countries (CEECs) but we find also surprisingly high shares of inefficient companies in Western European countries including France, Austria, and Germany. This development is far from being optimal from the macroeconomic perspective, although some economic players (especially the employees and regional government) may have short-run interests in maintaining inefficient firms.

The paper is structured as follows. We start with a literature review on the complex relationship between institutions and growth in the first section. Section 2 presents analyzed data and descriptive statistics. The methodology and estimation of Bayesian model averaging is described in Section 3. The last section concludes and discusses implications for future research. Finally, detailed data definitions are presented in the Appendix.

1. Literature Review

The literature witnesses many attempts to measure the quality of economic and political institutions in order to empirically employ a numerical variable. In this context, Rafael La Porta et al. (1998) prove in their path-breaking contribution a decisive effect of legal origins on financial markets and growth. Daron Acemoglu, Simon Johnson, and James A. Robinson (2001) paved the way for an intensive discussion of the relationship between institutions, efficiency and long-run income.

Various authors distinguish between *de jure* and *de facto* institutions reflecting the distinction between the legal rules *per se* and their enforcement (Alberto Alesina and Paola Giuliano 2015). However, there is still little understanding about how institutions have an impact on growth. Acemoglu, Fransisco Gallego, and Robinson (2014) point out that institutions are a fundamental determinant working through several channels while the empirical literature on this topic is largely agnostic about exact channels *via* which institutions influence long-run growth.

The traditional approach argues that the quality of institutions predispose the productivity of entrepreneurial activities (William J. Baumol 1990; Harry P. Bowen and Dirk De Clercq 2008). Moreover, recent theoretical and empirical studies exam-

ine the role of expectations and the stability of the environment from the perspective of firm efficiency, investment, and profitability (e.g. Mahmut Yasar, Catherine J. Morrison Paul, and Michael R. Ward 2011). Witold J. Henisz (2004) takes a similar approach focusing on the stability of the political environment as a central source for higher infrastructure investment. In addition, Yaxuan Qi, Lukas Roth, and John K. Wald (2010) show how the development of the legal system can lead to different reductions in the cost of debt for firms. Finally, according to Hans Pitlik and Luděk Kouba (2015) matured informal institutions, e.g. high level of social trust, can reduce transaction costs both at macroeconomic and at firm-level.

Besides these most well-known contributions, many different variables are constructed to gauge the relationship between the quality of government and the functioning of the public sector, efficiency of bureaucracy, corruption etc. Traditionally, the original institutional indices focused both on broad economic and political categories (Henisz 2002, 2004). La Porta et al. (1998) thereby emphasize the role of legal origins with respect to current investor protection. Their property rights index shows the protection against expropriation. This index is commonly used (e.g. Acemoglu, Johnson, and Robinson 2001). However, Edward Glaeser et al. (2004) criticize that a country under dictatorship can achieve the same level of protection against expropriation like a democratic country.

The economic freedom index tries to shed more light on the discussion of institutions by presenting the individual component indices describing various aspects of economic institutions (rule of law, limited government, regulatory efficiency and open markets) which are summarized into a joint index of economic freedom (Terry Miller, Kim R. Holmes, and Edwin J. Feulner 2013). Following this approach, other institutions and authors tried to identify special economic institutions such as different aspects of globalization and labor markets (Milan Vodopivec, Andreas Wörgötter, and Dhushyanth Raju 2005).

Alternatively, other authors concentrated on institutional weaknesses that restrict the free market, growth and entrepreneurship. These aspects include the size of the shadow economy (Friedrich Schneider 2003, 2013; Schneider, Andreas Buehn, and Claudio E. Montenegro 2010), top marginal tax rate (Florian Heider and Alexander Ljungqvist 2015), and labor market restrictions (Dan Andrews and Frederico Cingano 2014). Aya S. Chacar, William Newburry, and Balagopal Vissa (2010) point out that institutions, for example antitrust laws, improve market access and prevent collusions between firms. They also argue that labor market institutions reduce legal constraints imposed on residual claimants to enhance profitability and performance.

Financial institutions have often received special attention in this research field. Better developed financial institutions should support investment by improving access to external finance (Jarko Fidrmuc and Johann Scharler 2013; Dominykas Poderys 2015). However, developed financial systems can be based on largely different institutional frameworks, e.g. being rather bank or market based (Ross Levine and Sara Zervos 1998; Thorsten Beck and Levine 2004). Moreover, countries with the prevailing market-based financial system might have better institutional characteristics than countries with the bank-based financial system (Zuzana Kučerová and

Michela Tichá 2013). Therefore, financial institutions are even more difficult to measure than other economic and political institutions. In order to solve this problem, some authors tried to identify comparable financial institutions using expert evaluations for different countries. The World Bank, for example, publishes several indices for special institutions related to the starting business, construction permits, contract enforcement, and debt enforcement (Simeon Djankov et al. 2008).

From our perspective, the index on resolving insolvencies is especially interesting, because it is directly related to firm restructuring. Using data on time, cost, and the likely disposition of assets, Djankov et al. (2008) construct a measure for the efficiency of debt enforcement for 88 countries. In order to construct the index, they present insolvency practitioners with a standardized case of an insolvent firm. This example assumes that a midsize firm has a limited liability legal form. It has one major shareholder and one large secured creditor. Hence, the firm will default on straight debt and there is no financial complexity which could help to circumvent formal default. It is assumed that the firm is facing the possibility of a temporary downturn for the next two years if it cannot serve the bank debt. Employees want the firm to continue in business while tax administration will follow the procedure that maximizes its expected recovery rate. There are three possible procedures in place, namely foreclosure, reorganization, and liquidation. The liquidation can be followed by two possible outcomes: going concern or piecemeal sale.

Based on this example, Djankov et al. (2008) provide a measure for efficiency which is defined as the present value of the terminal value of the firm after bankruptcy costs, referred to as a *recovery rate*. This measure does not only reflect the institutional quality. In addition, we understand this measure to create incentives for different parties at stake when considering whether to enter formal bankruptcy or not. A high recovery rate means that different parties at stake may initiate a formal bankruptcy procedure rather sooner than later. By contrast, a low recovery rate creates an incentive to keep a firm operating even if its assets cannot be employed productively anymore. Thereby, market entry of new firms is prevented which is economically not desirable. Ability to resolve insolvency ensures that such inefficient firms will not be kept artificially operating and that their share in the market will be low.

To sum up, one channel through which institutional quality works are assets tied up in highly inefficient firms. Hence, we address the question to which degree the existence of assets tied up in highly inefficient firms can be explained by institutional ability to resolve insolvency.

2. Data and Descriptive Statistics

2.1 Descriptive Statistics at Firm-Level

We collect detailed firm data for eleven member states of the European Union. We thereby focus on 7 CEECs, namely Bulgaria, Czech Republic, Hungary, Latvia, Poland, Romania, Slovenia, and Slovak Republic. We concentrate on CEECs because this region shows large differences in institutional quality that have been created to a large extent in the past, actually before the reform process and even also before the communist intermezzo (Sascha Becker et al. 2016). Moreover, their institutions have

improved mainly stepwise in the process of the accession to the EU which included the adoption of the *acquis communautaire* (Jens Matthias Arnold and Wörgötter 2011). Thus, the institutional quality can be viewed as exogenous. Moreover, we include Austria, France, Germany, and Sweden as examples of mature developed economies in the European Union and represent different origins of law (La Porta et al. 1998). Relatively detailed firm data are available from 2005 to 2012 for all countries except Latvia for which there is only data after 2008.

We select domestic firms which are mostly dependent on domestic institutions and mainly cover small and medium firms as they are more sensitive to institutional weaknesses than large firms. Therefore, we focus on non-listed companies because only large and international firms have access to capital markets as the domestic capital markets are generally underdeveloped. Nearly all analyzed countries in Central and Eastern Europe are less dependent on capital markets. Market capitalization is only between 5 *per cent* (Slovakia) and 35 *per cent* of GDP (Slovenia), while average market capitalization in the EU is with 70 *per cent* of GDP at least twice higher (World Bank 2016)[1]. In order to avoid financial complexity and multinational firms, we additionally restrict our analysis to companies that are bank financed and affected by the quality of institutions within the domestic country.

We use the Amadeus databank of Bureau van Dijk, which provides detailed data including balance sheets, profit and loss accounts, the legal form for European firms, and the industrial code (NACE Rev. 2). We use the following information for each firm: cash flow (*CF*), total assets (*TA*), long-term debt (*LTD*), short-term debt (*STD*), interest expenses (*IE*), depreciation (*DP*), and earnings before interest, taxes, depreciation and amortization (*EBITDA*). Using these inputs for each firm, *i*, in period *t*, we define the interest coverage ratio (*ICR*) which equals to:

$$ICR_{it} = \frac{EBITDA_{it}}{IE_{it}}. \tag{1}$$

This will be the key variable for further analysis which will be used for the definition of highly inefficient firms. Following International Monetary Fund - IMF (2013), we identify inefficient firms as the firms with interest expenditures below their *EBITDA*, that is, with *ICR* below unity. In order to repay the debt, these firms have to exploit internal sources in order to serve their interest payments. This is an intuitive measure to identify firms facing debt servicing difficulties. IMF (2013) points out that inefficient firms will become insolvent unless they introduce necessary adjustments measures such as reducing debt and costs or increasing capital expenditures. Correspondingly, the allocation of assets in such firms is not efficient. In turn, the inefficiency at firm-level causes potential growth slowdown in the economy.

The interest coverage ratio is increasingly used in the literature on firm performance and financial risk. Creditors often impose a minimum interest coverage ratio for the borrowing firms (Michael Dothan 2006). The firms should be able to serve at least their interest payments from their current earnings. By contrast, the

---

[1] **World Bank.** 2016. Market Capitalization of Listed Domestic Companies. http://data.worldbank.org/indicator/CM.MKT.LCAP.GD.ZS/countries (accessed July 24, 2015).

firms falling below this benchmark for one or even two years in a row are wasting resources because they have to use internal sources for interest payments. Bris, Koskinen, and Pons (2001) link the interest coverage ratio to corporate performance and Fotini Voulgaris and Athanasia Rizonaki (2011) relate the interest coverage ratio to financial risk of firms.

We test whether economies with higher institutional quality suffer less from unproductive assets tied up in firms with debt servicing difficulties. Moreover, we include different institutions which can show which institutional aspects are influencing financial performance of the firms.

Both control variables (cash flow divided by total assets and debt divided by total assets) follow the findings of previous literature (Benoit Mojon, Frank Smets, and Philip Vermeulen 2002; Andrew Benito and John Whitley 2003). In total, we collect nearly 1 million observations across countries (after outlier adjustment) between 2005 and 2012.

Table 1 illustrates pair wise correlations of the analyzed variables using individual data. The interest coverage ratio is as expected significantly positively correlated with the ratio of cash flow to total assets and negatively and significantly correlated to the debt to total assets ratio. The chosen macroeconomic variables show the expected signs (positive for GDP growth and negative for policy interest rate) but the correlations remain weak and insignificant.

Table 1   Correlation Matrix

	Interest cov. ratio	Cash flows	Debt to assets	Policy rate	GDP growth	Business reg.	Corrupt. percept.	Property rights	Fiscal freedom	Business freedom	Labor freedom	Monetary freedom	Trade freedom	Investment freedom	Fin. freedom	Shadow econ.	Starting business
Interest cov. ratio	1.000																
Cash flows to assets	0.0510*	1.000															
Debt to assets	-0.0251*	-0.1138*	1.000														
Policy rate	-0.003	0.0683*	-0.0292*	1.000													
GDP growth	0.001	0.0701*	-0.0128*	0.2373*	1.000												
Business regulations	0.0048*	-0.0533*	0.1931*	-0.2410*	-0.1908*	1.000											
Corruption perceptions	0.0131*	-0.0811*	0.1744*	-0.4563*	-0.1396*	0.8037*	1.000										
Property rights	0.0166*	-0.0990*	0.1854*	-0.5260*	-0.1334*	0.6440*	0.9101*	1.000									
Fiscal freedom	-0.0050*	0.0590*	-0.0103*	0.3897*	0.0961*	-0.6572*	-0.8596*	-0.7298*	1.000								
Business freedom	0.000	-0.0602*	0.1559*	-0.3553*	-0.2312*	0.5934*	0.6993*	0.6164*	-0.5658*	1.000							
Labor freedom	-0.003	0.0732*	-0.2212*	0.0815*	0.0700*	-0.4369*	-0.5793*	-0.5861*	0.4217*	-0.5497*	1.000						
Monetary freedom	0.0090*	-0.0617*	0.0863*	-0.3363*	0.1200*	0.4174*	0.6411*	0.6593*	-0.5439*	0.2417*	-0.2843*	1.000					
Trade freedom	0.0188*	-0.0489*	0.0980*	-0.0598*	-0.1287*	-0.0609*	0.0042*	0.1122*	0.2761*	0.0439*	-0.0396*	0.0501*	1.000				
Investment freedom	0.0235*	-0.0399*	0.3076*	-0.0684*	-0.0183*	0.4397*	0.4343*	0.4981*	-0.0411*	0.2013*	-0.3082*	0.3577*	0.4108*	1.000			
Financial freedom	0.002	-0.0181*	-0.1323*	-0.4822*	-0.0312*	-0.1370*	0.0401*	0.2029*	-0.1421*	-0.0364*	0.3581*	0.0636*	-0.0420*	-0.0636*	1.000		
Shadow economy	-0.002	0.0924*	-0.0149*	0.5644*	0.1856*	-0.4703*	-0.7780*	-0.8312*	0.7633*	-0.6022*	0.4251*	-0.5572*	0.0703*	-0.0985*	-0.3114*	1.000	
Starting business	0.0167*	-0.0040*	0.1886*	-0.0390*	0.1869*	-0.2610*	-0.0103*	0.2213*	0.2774*	-0.1920*	-0.2048*	0.2095*	0.2591*	0.4391*	-0.0451*	-0.0037*	1.000
Recovery share	0.0216*	-0.0630*	0.3131*	-0.3835*	-0.0943*	0.6784*	0.8086*	0.8031*	-0.4736*	0.6350*	-0.5520*	0.5247*	0.2642*	0.7137*	-0.1016*	-0.5134*	0.3206*

Notes: * denotes significance at 1%-level.

Institutional indices show a surprising degree of variation. The average correlation is only 0.06 if we include all institutional indices. This is only in part due to differences between indices of institutional quality and indices of institutional weaknesses (in particular, the size of shadow economy). Also, if we exclude the size of shadow economy, the average correlation is only slightly positive (0.11). Moreover, it ranges between -0.9 (correlation between the index of corruption perception and the index of fiscal freedom) and +0.9 (correlation between again the index of corruption perception and the property rights index). Actually, excluding the index of corruption perception cannot stabilize the picture because other correlations are very close to these extreme values. This demonstrates again that it is difficult to define institutional quality properly.

The interest coverage ratio is positively and significantly correlated with the index of business regulations, corruption perceptions, property rights, monetary freedom, trade freedom, investment freedom, starting business and recovery share. In turn, it is negatively and significantly correlated with the index of fiscal freedom. The remaining institutional indices show low and insignificant correlation being either with positive or negative sign.
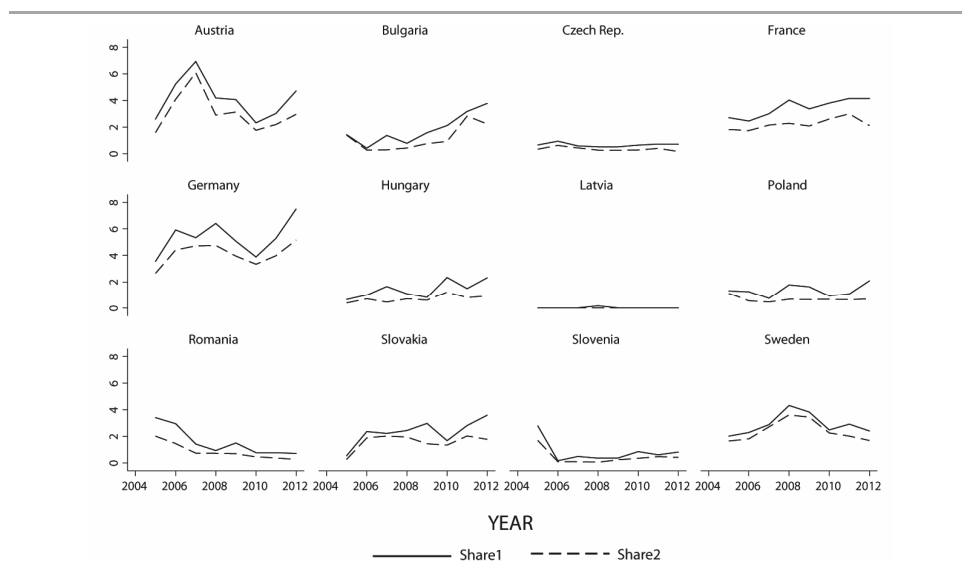
Notes: Share1 - inefficient firms for 1 year; Share2 - inefficient firms for 2 consecutive years.

Source: Own estimations.

Figure 1 Average Inefficiency

2.2 Firm Inefficiency at Country-Level

In addition to firm analysis it is interesting to see the levels of inefficiency at the country-level. We focus on the inefficient use of assets by firms facing debt servicing difficulties which are not declared bankrupt due to weak insolvency frameworks. If a firm is in financial distress, defined by an interest coverage ratio below one, it will

use internal sources to repay credits. In the long-run, such firms will starve slowly to death and its assets will eventually be fully wasted (Fidrmuc and Martin Siddiqui 2015). Moreover, we distinguish between firms which face financial distress for only one period and those which do so for two consecutive observations, thus, we try to distinguish between firms with some and no long-term prospects respectively.

Using individual firm data, we define asset share, *share*, which is the share of assets tied up in firms facing financial distress within the individual countries. This variable is constructed based on firms which face debt servicing difficulties for either one period or two consecutive observations, denoted by *share1* and *share2* respectively.

The shares of assets which are bound in inefficient firms for one or two consecutive years, presented in Figure 1, are surprisingly high. In all countries, the shares of financially inefficient firms reach up to 8% of total assets in our sample. The financial crisis caused a slight increase in insolvency problems in all countries. But the differences between the shares of firms with efficiency problems either in one or two years are surprisingly small. It may appear especially surprising that the share of inefficient firms is slightly higher in Germany and Austria than in the analyzed Central and Eastern European countries.

3. Bayesian Model Averaging

3.1 Methodology

Our data set of individual data includes more than 1.5 million observations, however, we exclude observations with extreme values (the top and bottom percentiles of all selected indicators). After having undergone the cleaning procedure of omitting all observations related to an outlier firm in any indicator or year the dataset is reduced to slightly less than 1 million observations.

The interest coverage ratio is our key variable which identifies firms facing debt servicing difficulties causing them to use assets inefficiently. We use Bayesian model averaging methodology in order to find out which variables, especially which institutional indices, are the most important determinants of firm efficiency. In a typical regression, we regress interest coverage ratio on institutional variables and a set of control variables:

$$ICR_{it} = \beta_1 \frac{CF_{it}}{A_{it}} + \beta_2 \frac{D_{it}}{A_{it}} + \beta_3 GDP_{ct} + \beta_4 IR_{ct} + \beta_5 INST_{ct} + \theta_t + \varepsilon_{it}, \tag{2}$$

where cash flow, *CF*, and debt, *D*, divided by total assets, *A*, are included as the firm-specific control variables describing the financial situation of the analyzed firms. To include country-specific shocks, we include real GDP growth, *GDP*, and policy interest rate, *IR*, for country *c*. Moreover, we include time fixed effects denoted by θ which control for unobserved effects across different countries being equal across periods of time. Most importantly, $INST_{ct}$, reflects country-specific institutional indicators. However, there is no appropriate theory to select the indicators of institutional quality have been involved in the model (Svatopluk Kapounek 2016). Therefore we use methodology that reflect this uncertainty and apply Bayesian model averaging.

We follow the framework provided by Giuseppe De Luca and Jan R. Magnus (2011) where a regression model is defined by:

$$y_{it} = X_{1it}\beta_1 + X_{2it}\beta_{2ct} + u_{it}, \tag{3}$$

where y_{it} represents interest coverage ratio of firm $i = 1, ..., n$ and time t. We assume that $k_1 \geq 1$, $k_2 \geq 0$, $k = k_1 + k_2 \leq n - 1$, and the design matrix $X = (X_1, X_2)$ has full column-rank k. The deterministic regressors X_j represents $n \times k_j$ matrices of observations on two subsets of regressors X_1 and X_2. β_1 and β_2 are unknown regression parameters and $u \sim N(0, \sigma^2)$. The first subset of regressors X_1 contains time dummies and constants which we take as focus regressors and X_2 contains all other explanatory variables (auxiliary variables) to which model uncertainty is confined. Thus, we involve more regressors than the traditional model to reduce the risk of omitting some important regressors (Roman Horváth 2013).

There are 2^{k_2} possible models, thus, there are 2^{k_2} possible choices for X_2. We consider up to 17 regressors to be included in the model that means 2^{17}, that is 131.072, individual models. A model-averaging estimate of β_1 is given by:

$$\hat{\beta}_1 = \sum_{i=1}^{I} \lambda_i \hat{\beta}_{1i}, \tag{4}$$

where λ_i represent nonnegative random weights which reflect our confidence in model M_i based on prior beliefs. We employed an estimator developed by Magnus, Owen Powell, and Patricia Prüfer (2010) based on the distinction between focus and auxiliary regressors. The conditional posterior distribution $p(\beta_1, \beta_{2i}, \sigma^2 | y, M_i)$ is given by sample likelihood function:

$$p(y | \beta_1, \beta_{2i}, \sigma^2, M_i) \propto (\sigma^2)^{-n/2} \exp\left(-\frac{\varepsilon_i^\tau \varepsilon_i}{2\sigma^2}\right), \tag{5}$$

with the conditional joint prior distribution:

$$p(\beta_1, \beta_2, \sigma^2 | M_i) \propto (\sigma^2)^{(k_{2i}+2)/2} \exp\left(-\frac{\beta_{2i}^\tau V_{0i}^{-1} \beta_{2i}}{2\sigma^2}\right), \tag{6}$$

where $V_{0i}^{-1} = g X_{2i} M_1 X_{2i}$ was proposed by Arnold Zellner (1986) and Carmen Fernández, Eduardo Ley, and Mark F. J. Steel (2001) and $g = 1/max(n, k_2^2)$ is a constant scalar for each model M_i. Then we obtain results for every model considered and average them where the weights in the averaging are the posterior model probabilities:

$$\lambda_i = p(M_i | y) = \frac{p(M_i)p(y | M_i)}{\sum_{j=1}^{I} p(M_j)p(y | M_j)}, \tag{7}$$

where $p(M_i)$ is the prior probability of model M_i and $p(y|M_i)$ is the marginal likelihood of y given model M_i. The unconditional estimates of β_1 and β_2 are computed as:

$$\hat{\beta}_1 = E(\beta_1 \mid y) = \sum_{i=1}^{I} \lambda_i \hat{\beta}_{1i}, \tag{8}$$

$$\hat{\beta}_2 = E(\beta_2 \mid y) = \sum_{i=1}^{I} \lambda_i T_i \hat{\beta}_{2i}, \tag{9}$$

where the T_i are $k_2 \times k_{2i}$ matrices defined by $T_i^\tau = \left(I_{k_{2i}}, 0\right)$ transforming the conditional estimates $\hat{\beta}_{2i}$ in $k_2 \times 1$ vectors by setting to zero the elements of β_2 which are excluded from model M_i.

3.2 Results

Table 2 reports the posterior results for estimates of (2). The coefficients of firm-specific variables show the expected signs and are statistically significant. The cash flow has a posterior probability of 1 to be included in the model and its mean coefficient is positive indicating that high cash flows lower the interest burden for the firm. Similarly, the posterior probability for debt is also 1, while its negative mean coefficient confirms that debt increases significantly the financial burden for the firms. Time effects are important and show a classical cyclical pattern. In turn, the posterior probabilities for country-specific macroeconomic shocks (policy interest rate and GDP growth) are very low. It seems that macroeconomic policy is less important for financial performance at the firm-level than institutional quality.

Finally, institutions are confirmed to be an important determinant of firm financial developments. This finding is especially important when considering that country-specific variables are often insignificant. Nearly all institutional variables have posterior probabilities equal or very close to 1 and their coefficients are positive which means that the institutional quality in general contributes positively to financial health of firms. The exceptions include some rather general indices like corruption perception, fiscal, and investment freedom which have all low posterior probabilities of model inclusion. Moreover, business regulations, business freedom, and indices of monetary and financial freedom, as well as the World Bank index of starting business conditions are found to contribute negatively to firms' financial situation. Thus, our findings confirm that some business regulations may reduce the possibilities for adverse behavior of the firms and stabilize the economy. The size of the shadow economy accordingly may have an ambiguous character (Angela De Martiis 2015). Our results show that some degree of shadow economy can improve the financial situation of firms.

Thus, our results show that only property rights (time necessary for property registration according to the World Bank), trade and labor (however, with slightly lower posterior probability which is 66%) freedom, and recovery ratio robustly improve the financial conditions of firms in Europe. Finally, our Bayesian model averaging estimations confirm a superior performance of the recently constructed institutional indices provided by the World Bank, especially the recovery ratio, as a part of the *Doing-Business* project.

Table 2 Institutions and Firm Performance, Bayesian Model Averaging Analysis

	Mean coef.	Std. error	PIP
Number of observation	**963227**		
Regressors always included in the model:			
Constant	56.218	62.766	1.00
Year 2008	-6.776	5.790	1.00
Year 2009	-16.264	11.978	1.00
Year 2010	-31.838	5.574	1.00
Year 2011	-25.387	5.610	1.00
Year 2012	-22.984	6.351	1.00
Auxiliary variables:			
Cash flow to total assets	5.755	0.120	1.00
Debt to total assets	-0.015	0.001	1.00
Policy interest rate	0.123	0.546	0.05
GDP growth real	-0.576	1.185	0.21
Business regulations	-50.871	5.401	1.00
Corruption perceptions index	1.263	3.943	0.10
Property rights index (index of economic freedom)	3.825	0.440	1.00
Fiscal freedom (index of economic freedom)	-0.027	0.147	0.04
Business freedom (index of economic freedom)	-1.949	0.224	1.00
Labor freedom (index of economic freedom)	0.577	0.450	0.66
Monetary freedom (index of economic freedom)	-3.359	0.444	1.00
Trade freedom (index of economic freedom)	3.950	0.475	1.00
Investment freedom (index of economic freedom)	0.000	0.008	0.00
Financial freedom (index of economic freedom)	-0.418	0.394	0.56
Shadow economy size	5.089	0.398	1.00
Starting business (procedures)	-6.987	1.426	0.99
Resolving insolvency (share)	1.824	0.184	1.00

Source: Own estimations.

3.3 Robustness Analysis - Interaction Effects of Institutions and Firm Controls

Using the BMA results, we select a preferred specification base on the median probability model (Maria Maddalena Barbieri and James O. Berger 2004) that includes only variables with a posterior inclusion probability above 50%. We report the preferred specification using OLS with robust standard errors in Table 3. We can see that all variables remain significant and keep the signs as in the BMA analysis.

Moreover, we can use the preferred specification for further robustness analysis. For example, we include interactive variables between firm controls. In particular, we compute multiplicative terms between institutions as well as either cash flows or debt (both indicators are taken again as ratios to total assets). Thus, we generate firm-level variation also in "institutional" variables through the inclusion of interaction terms. For a smaller number of institutional variables, the interactive terms could be included also directly in the BMA analysis. However, given the dimension of the presented analysis, this approach would not be feasible.

Table 3, columns (2) and (3) report the OLS results for the interaction terms with cash flows and debt respectively. Actually, we can see that the results are quite sensitive to this extension. Firstly, debt to assets ratio becomes positive if interaction terms between institutions and debt to assets ratio are included. Thus, this specification may be biased by a possible relationship between institutional quality and debt.

Table 3 Interaction Effects of Institutions and Firm Controls

	Preferred specification	Interaction terms with	
		Cash flow	Debt
	(1)	(2)	(3)
Cash flow to total assets	5.753***	15.404***	5.773***
	(0.116)	(4.086)	(0.119)
Debt to total assets	-0.015***	-0.015***	0.056**
	(0.000)	(0.000)	(0.027)
Business regulations	-50.790***	-16.706***	-55.995***
	(3.639)	(5.575)	(4.361)
Property rights index (index of ec. freedom)	4.161***	1.002***	4.365***
	(0.241)	(0.372)	(0.229)
Business freedom (index of ec. freedom)	-1.870***	0.033	-1.772***
	(0.167)	(0.263)	(0.175)
Labor freedom (index of ec. freedom)	0.922***	-0.510	-0.221
	(0.227)	(0.327)	(0.223)
Monetary freedom (index of ec. freedom)	-3.364***	-1.226*	-2.603***
	(0.539)	(0.736)	(0.393)
Trade freedom (index of ec. freedom)	3.771***	2.287***	4.383***
	(0.456)	(0.550)	(0.442)
Financial freedom (index of ec. freedom)	-0.755***	-0.523	0.223
	(0.172)	(0.321)	(0.168)
Shadow economy size	5.148***	2.696***	7.129***
	(0.308)	(0.456)	(0.351)
Starting business (procedures)	-7.213***	-1.166	-7.115***
	(0.741)	(1.113)	(1.025)
Resolving insolvency (share)	1.748***	0.822***	2.121***
	(0.125)	(0.165)	(0.152)
Interaction term with business regulations		-2.650***	4.423**
		(0.417)	(1.852)
Interaction term with property rights index		0.255***	-0.143
		(0.023)	(0.110)
Interaction term with business freedom		-0.154***	-0.008
		(0.020)	(0.107)
Interaction term with labor freedom		0.119***	0.609***
		(0.025)	(0.167)
Interaction term with monetary freedom		-0.207***	-0.491**
		(0.037)	(0.234)
Interaction term with trade freedom		0.097***	-0.233***
		(0.022)	(0.088)
Interaction term with financial freedom		-0.019	-0.557***
		(0.021)	(0.122)
Interaction term with shadow economy size		0.206***	-1.178***
		(0.035)	(0.192)
Interaction term with starting business (procedures)		-0.450***	0.285
		(0.092)	(0.355)
Interaction term with resolving insolvency (share)		0.077***	-0.152**
		(0.012)	(0.065)
Time effects	yes	yes	yes
Country effects	no	no	no
Observations	963,227	963,227	963,227
R^2	0.005	0.006	0.005

Notes: Robust standard errors in parentheses. Time and country fixed effects and constant are not reported.

Source: Own estimations.

Second, only few institutional variables (without the interaction terms) remain significant in the specification with cash flows interaction terms. Therefore, we can summarize that model uncertainty and the risk of omitting important regressors was minimized.

Only property rights, monetary and trade freedom, shadow economy and the World Bank indicator of insolvency resolvement remain significant and signed as before. Finally, these indicators are also significant when included as interaction

terms with the cash flow ratio. Hence, we can argue that the impact of cash flow on the interest coverage ratio is strengthened by the quality of the institutional environment.

In sum, the robustness analysis confirms the significance of the previous indicators but with the exclusion of business regulations; business, financial and labor freedom; and the indicator of starting business. The cross-check with the previous results of the BMA analysis shows that labor and financial freedom have a posterior probability relatively close to the threshold of 50%.

4. Conclusions

Starting with the seminal contributions by La Porta et al. (1998), Acemoglu, Johnson, and Robinson (2001), and other authors, institutions have become increasingly popular in economics since the last two decades. This has led to a surge of research using different institutional indices documenting their potential importance for various factors of economic development. We actually document surprisingly high correlations of different institutional indices. Therefore, it is often not clear which aspects of institutional quality are proxied by a particular institutional index. Moreover, even the sign might be ambiguous because several indices show high but negative correlations. We scrutinize the impact of different aspects of institutional quality on corporate financial performance in Europe. We employ a Bayesian model averaging approach to reduce model uncertainty related to the selection of involved institutional quality indicators.

This is a particularly interesting regional example because growth of several European economies remained surprisingly low while their institutions are generally considered to be superior to other world regions. Moreover, Central and Eastern European countries did not see accelerated growth since the accession to the EU nor an improvement of their institutions.

We start with the analysis of the financial situation at the firm-level in selected Eastern and Western European countries. On the aggregate level, the shares of financially inefficient firms with 8% or more are surprisingly high. Moreover, the financial situation of firms has worsened in all countries since the financial crisis. This observation does not only hold true for Central and Eastern European countries but also for selected Western European economies. It seems that efficiency problems do not receive the necessary attention by economic policy in Europe.

Subsequently, we try to identify which institutional aspects may affect firms' financial situation in Europe. On the one hand, we find that high institutional quality related to property rights, trade freedom, and recovery ratio reduces the share of assets tied up unproductively in firms. On the other hand, however, we can also see that insufficient business regulations may induce adverse behavior of the firms with negative consequences on their financial developments in the long-run. Our findings show that expert evaluations of institutions, e.g. the *Doing-Business* project of the World Bank, provide institutional indices which are particularly appropriate for deeper empirical analysis. Finally, several institutions taking a prominent place in the general discussion, including corruption or investment freedom, show only weak impact on firms' performance.

Overall, these results underline the necessity to achieve further improvements in terms of institutional quality especially with regard to business regulations not only in Central and Eastern Europe but also in Western European countries. Our results indicate that although the European countries are characterized by high general institutional quality, they suffer under insufficient liberalization of business markets.

References

Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review*, 91(5): 1369-1401. http://dx.doi.org/10.1257/aer.91.5.1369

Acemoglu, Daron, Francisco Gallego, and James A. Robinson. 2014. "Institutions, Human Capital and Development." *Annual Review of Economics*, 6(1): 875-912. http://dx.doi.org/10.1146/annurev-economics-080213-041119

Alesina, Alberto, and Paola Giuliano. 2015. "Culture and Institutions." *Journal of Economic Literature*, 53(4): 898-944. http://dx.doi.org/10.1257/jel.53.4.898

Andrews, Dan, and Frederico Cingano. 2014. "Public Policy and Resource Allocation: Evidence from Firms in OECD Countries." *Economic Policy*, 29(78): 253-296. http://dx.doi.org/10.1111/1468-0327.12028

Arnold, Jens Matthias, and Andreas Wörgötter. 2011. "Structural Reforms and the Benefits of the Enlarged EU Internal Market: Still Much to Be Gained." *Applied Economics Letters*, 18(13): 1231-1235. http://dx.doi.org/10.1080/13504851.2010.532096

Barbieri, Maria Maddalena, and James O. Berger. 2004. "Optimal Predictive Model Selection." *Annals of Statistics*, 32(3): 870-897. http://dx.doi.org/10.1214/009053604000000238

Baumol, William J. 1990. "Entrepreneurship: Productive, Unproductive and Destructive." *Journal of Political Economy*, 98(5): 893-921. http://dx.doi.org/10.1086/261712

Beck, Thorsten, and Ross Levine. 2004. "Stock Markets, Banks, and Growth: Panel Evidence." *Journal of Banking and Finance*, 28(3): 423-442. http://dx.doi.org/10.1016/S0378-4266(02)00408-9

Becker, Sascha, Katrin Boeckh, Christa Hainz, and Ludger Woessmann. 2016. "The Empire Is Dead, Long Live the Empire! Values and Human Interactions 90 Years after the Fall of the Habsburg Empire." *Economic Journal*, 126(590): 40-74. http://dx.doi.org/10.1111/ecoj.12220

Benito, Andrew, and John Whitley. 2003. "Implicit Interest Rates and Corporate Balance Sheets: An Analysis Using Aggregate and Disaggregated UK Data." Bank of England Working Paper 193. http://dx.doi.org/10.2139/ssrn.502584

Bowen, Harry P., and Dirk De Clercq. 2008. "Institutional Context and the Allocation of Entrepreneurial Effort." *Journal of International Business Studies*, 39(4): 747-767. http://dx.doi.org/10.1057/palgrave.jibs.8400343

Bris, Arturo, Yrjö Koskinen, and Vicente Pons. 2001. "Corporate Financial Policies and Performance Prior to Currency Crises." William Davidson Institute at the University of Michigan Working Paper 386. http://dx.doi.org/10.2139/ssrn.270643

Chacar, Aya S., William Newburry, and Balagopal Vissa. 2010. "Bringing Institutions into Performance Persistence Research: Exploring the Impact of Product, Financial, and Labor Market Institutions." *Journal of International Business Studies*, 41(7): 1119-1140. http://dx.doi.org/10.1057/jibs.2010.3

De Luca, Giuseppe, and Jan R. Magnus. 2011. "Bayesian Model Averaging and Weighted-Average Least Squares: Equivariance, Stability, and Numerical Issues." *Stata Journal*, 11(4): 518-544.

De Martiis, Angela. 2015. "Shadow Economy, Poverty and Institutional Quality." *Quadernidel Premio Giorgio Rota*, 3(3): 11-22.

Djankov, Simeon, Oliver Hart, Caralee McLiesh, and Andrei Schleifer. 2008. "Debt Enforcement around the World." *Journal of Political Economy*, 116(6): 1105-1149. http://dx.doi.org/10.1086/595015

Dothan, Michael. 2006. "Costs of Financial Distress and Interest Coverage Ratios." *Journal of Financial Research*, 29(2): 147-162. http://dx.doi.org/10.1111/j.1475-6803.2006.00171.x

Fernández, Carmen, Eduardo Ley, and Mark F. J. Steel. 2001. "Model Uncertainty in Cross-Country Growth Regressions." *Journal of Applied Econometrics*, 16(5): 563-576. http://dx.doi.org/10.1002/jae.623

Fidrmuc, Jarko, and Johann Scharler. 2013. "Financial Development and the Magnitude of Business Cycle Fluctuations in OECD Countries." *Applied Economics Letters*, 20(6): 530-533. http://dx.doi.org/10.1080/13504851.2012.718055

Fidrmuc, Jarko, and Martin Siddiqui. 2015. "Institutions and Creative Destruction in CEECs: Determinants of Inefficient Use of Assets." Institute of East and Southeast European Studies Regensburg Working Paper 353.

Glaeser, Edward, Rafael La Porta, Florencio López-de Silanes, and Andrei Shleifer. 2004. "Do Institutions Cause Growth?" *Journal of Economic Growth*, 9(3): 271-303. http://dx.doi.org/10.1023/B:JOEG.0000038933.16398.ed

Heider, Florian, and Alexander Ljungqvist. 2015. "As Certain as Debt and Taxes: Estimating the Tax Sensitivity of Leverage from State Tax Changes." *Journal of Financial Economics*, 118(3): 684-712. http://dx.doi.org/10.1016/j.jfineco.2015.01.004

Henisz, Witold J. 2002. "The Institutional Environment for Infrastructure Investment." *Industrial and Corporate Change*, 11(2): 355-389. http://dx.doi.org/10.1093/icc/11.2.355

Henisz, Witold J. 2004. "Political Institutions and Policy Volatility." *Economics & Politics*, 16(1): 1-27. http://dx.doi.org/10.1111/j.1468-0343.2004.00129.x

Horváth, Roman. 2013. "Does Trust Promote Growth?" *Journal of Comparative Economics*, 41(3): 777-788. http://dx.doi.org/10.1016/j.jce.2012.10.006

International Monetary Fund. 2013. *Global Financial Stability Report: Transition Challenges to Stability*. Washington, D.C.: International Monetary Fund. http://dx.doi.org/10.5089/9781475524970.082

Kapounek, Svatopluk. 2016. "Determinants of Bank Lending in CEECs: Evidence from Bayesian Model Averaging." In *Proceedings of the 18th International Conference on Enterprise and the Competitive Environment*, ed. Svatopluk Kapounek, 359-366. Brno: Mendel University in Brno, Faculty of Business and Economics.

Kučerová, Zuzana, and Michela Tichá. 2013. "Institutional Aspects of Financial Integration: Bank-Based vs. Market-Based Financial Systems." In *Proceedings of the 11th International Conference Economic Policy in the European Union Member Countries: Selected Papers*, ed. Zuzana Machová and Natalie Uhrová, 160-173. Ostrava: Technical University of Ostrava.

La Porta, Rafael, Florencio López-de Silanes, Andrei Schleifer, and Robert Vishny. 1998. "Law and Finance." *Journal of Political Economy*, 106: 1113-1155. http://dx.doi.org/10.1086/250042

Levine, Ross, and Sara Zervos. 1998. "Stock Markets, Banks, and Economic Growth." *American Economic Review*, 88(3): 537-558.

Magnus, Jan R., Owen Powell, and Patricia Prüfer. 2010. "A Comparison of Two Model Averaging Techniques with an Application to Growth Empirics." *Journal of Econometrics*, 154(2): 139-153. http://dx.doi.org/10.1016/j.jeconom.2009.07.004

Miller, Terry, Kim R. Holmes, and Edwin J. Feulner. 2013. *Index of Economic Freedom: Promoting Economic Opportunity and Prosperity*. Washington, D.C.: The Heritage Foundation.

Mojon, Benoit, Frank Smets, and PhilipVermeulen. 2002. "Investment and Monetary Policy in the Euro Area." *Journal of Banking & Finance*, 26(11): 2111-2129. http://dx.doi.org/10.1016/S0378-4266(02)00202-9

Pitlik, Hans, and Luděk Kouba. 2015. "Does Social Distrust Always Lead to a Stronger Support for Government Intervention?" *Public Choice*, 163(3-4): 355-377. http://dx.doi.org/10.1007/s11127-015-0258-7

Poderys, Dominykas. 2015. "Does Access to External Finance Affect Development of Small and Medium Enterprises and Economic Growth?" *European Journal of Business Science and Technology*, 1(1): 43-53.

Qi, Yaxuan, Lukas Roth, and John K. Wald. 2010. "Political Rights and Cost of Debt." *Journal of Financial Economics*, 95(2): 202-226. http://dx.doi.org/10.1016/j.jfineco.2009.10.004

Schneider, Friedrich. 2003. "The Development of the Shadow Economies and Shadow Labor Force of 22 Transition and 21 OECD Countries." *Journal for Institutional Comparison*, 1(1): 17-23.

Schneider, Friedrich, Andreas Buehn, and Claudio E. Montenegro. 2010. "New Estimates for the Shadow Economies all over the World." *International Economic Journal*, 24(4): 443-461. http://dx.doi.org/10.1080/10168737.2010.525974

Schneider, Friedrich. 2013. "Size and Development of the Shadow Economy of 31 European and 5 Other OECD Countries from 2003 to 2013: A Further Decline." http://www.econ.jku.at/members/Schneider/files/publications/2013/ShadEcEurope31_Jan2013.pdf.

Vodopivec, Milan, Andreas Wörgötter, and Dhushyanth Raju. 2005. "Unemployment Benefit Systems in Central and Eastern Europe: A Review of the 1990s." *Comparative Economic Studies*, 47(4): 615-651.

Voulgaris, Fotini, and Athanasia Rizonaki. 2011. "On the Relationship between Systematic Risk and Financial and Operating Risk: The Case of the Greek Listed Firms." *Global Business and Economics Review*, 13(3-4): 204-221. http://dx.doi.org/10.1504/GBER.2011.041849

Yasar, Mahmut, Catherine J. Morrison Paul, and Michael R. Ward. 2011. "Property Rights Institutions and Firm Performance: A Cross-Country Analysis." *World Development*, 39(4): 648-661. http://dx.doi.org/10.1016/j.worlddev.2010.09.009

Zellner, Arnold. 1986. "On Assessing Prior Distributions and Bayesian Regression Analysis with G-Prior Distributions." In *Bayesian Inference and Decision Techniques: Essays in Honor of Bruno de Finetti*, ed. Prem K. Goel and Arnold Zellner, 233-243. Amsterdam: North-Holland.

Appendix

Table A1 Definition of Institutional Indices

Name and source	Definition
Political constraints index V Henisz (2002, 2004) http://www-management.wharton.upenn.edu/henisz/	The index measures political constraint, that is, to identify underlying political structures and to measure their ability to support credible policy commitments.
Business regulations, Frazer institute economic freedom of the world index http://www.freetheworld.com/index.html	The index covers price controls, administrative requirements, bureaucracy costs, requirements for starting a business, extra payments (bribes) licensing restriction, and tax compliance. The more widespread different regulations are mirrored in a lower value of the index.
Corruption perceptions index http://www.transparency.org/policy_research/surveys_indices/cpi	The index is a composite index based on expert evaluations and business surveys, ranging between 0 (highly corrupt) and 10 (very clean).
Property rights index, comp. of economic freedom index http://www.heritage.org/index/explore	The index indicates the freedom to accumulate private property, secured by laws and enforced by the state including the likelihood of expropriation. It covers also the independence of the judiciary, corruption, and contract enforcement.
Fiscal freedom, comp. of economic freedom index http://www.heritage.org/index/explore	Fiscal freedom measures the fiscal burden in terms of the top income tax for households and firms and tax revenues in GDP.
Government spending index, comp. of economic freedom index http://www.heritage.org/index/explore	This index is based on the level of government expenditures in GDP, $GEI = 100 - \alpha$ $(G/GDP)^2$. Thus, large governments receive over-proportionally low scores.
Business freedom, comp. of economic freedom index http://www.heritage.org/index/explore	This index shows the ability to start, operate, and close a business that represents the overall burden of regulation and the efficiency of government regulations. The score is based on ten factors from the World Bank's *Doing-Business* study.
Labor freedom, comp. of economic freedom index http://www.heritage.org/index/explore	The index considers the legal and regulatory framework of labor market, including minimum wages, laws inhibiting layoffs, severance requirements, and measurable regulatory restraints on hiring and hours worked.
Monetary freedom, comp. of economic freedom index http://www.heritage.org/index/explore	Monetary freedom combines price stability (weighted average inflation for previous three years) with an assessment of price controls (a penalty up to 20% if price controls are important).
Trade freedom, comp. of economic freedom index http://www.heritage.org/index/explore	Trade freedom is a composite measure of the absence of tariff (based on the weighted average tariff) and non-tariff barriers (a penalty up to 20% if non-tariff barriers are important).
Investment freedom, comp. of economic freedom index http://www.heritage.org/index/explore	The index evaluates the severity of restrictions related to investment including rules for foreign and domestic investment, restrictions on payments, transfers, foreign exchange and capital transactions, labor regulations, corruption, red tape, weak infrastructure, and political and security conditions.
Financial freedom, comp. of economic freedom index http://www.heritage.org/index/explore	The index is a measure of banking security and independence from government control. It is based on the following five areas: government regulation of financial services; state intervention through direct and indirect ownership; the extent of financial and capital market development; government influence on the allocation of credit; and the openness to foreign competition.
Freedom to trade internationally, comp. of economic freedom index http://www.heritage.org/index/explore	The index measures a wide variety of restraints that affect international exchange: tariffs, quotas, hidden administrative restraints, and exchange rate and capital controls. The index ranges from least free to most free.
Shadow economy size Schneider (2013)	Size as percentage of official GDP according to Schneider (2013).
Starting business (procedures) World Bank (2016) www.doingbusiness.org	The index records all procedures officially required, or commonly practiced, for an entrepreneur to start and formally operate an industrial or commercial business. These procedures include obtaining all necessary licenses and permits and completing required notifications, verifications or inscriptions for the company and employees with relevant authorities. The ranking on the ease of starting a business is determined by sorting their distance to frontier scores for starting a business.
Recovery ratio (per cent) World Bank (2016) www.doingbusiness.org	The index is based on a hypothetical case evaluated by country experts. The recovery rate is recorded as cents on the dollar recouped by secured creditors through reorganization, liquidation or debt enforcement proceedings.

Source: Own estimations.