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Do Financial Markets Reward Government Spending Efficiency?*

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Abstract

We link governments' spending efficiency scores, to sovereign debt assessments made by financial markets´, more specifically by three rating agencies (Standard & Poors, Moody´s and Fitch). Public efficiency scores are computed via data envelopment analysis. Then, we rely notably on ordered response models to estimate the response of sovereign ratings to changes in efficiency scores. Covering 34 OECD countries over the period 2007-2018, we find that increased public spending efficiency is rewarded by financial markets via higher sovereign debt ratings. In addition, higher inflation and government indebtedness lead to sovereign rating downgrades, while higher foreign reserves contribute to rating upgrades.

JEL: C14, C23, E44, G15, H11, H50
Keywords: government spending efficiency, DEA, panel analysis, ordered probit (logit); sovereign ratings, rating agencies

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1. Introduction

Capital markets typically consider fiscal developments, notably governments´ policy announcements and their fiscal stance, when asking for higher or lower sovereign yields to buy nation´s sovereign debt. This assessment also finds echo in sovereign rating notations made by key rating agencies, where downgrades and negative economic outlooks are usually more aligned with less sound fiscal policies (see, for instance, Afonso et al., 2011). On the other hand, given the context of scarce budgetary resources—an aspect that will become even more relevant in the post-Covid19 period since many governments have heavily engaged in counter-cyclical policies contributing to record high deficit and debt levels—,special attention is also given to the more efficient use of public resources, with better performance and efficiency being the outcome preferred/desired by policymakers and, ultimately, by taxpayers (see, notably, Afonso et al., 2019).

In this paper, we contribute to the literature by linking governments´ spending efficiency and performance, proxied by efficiency scores, to sovereign debt assessments made by financial markets´ participants. More specifically, we consider sovereign ratings notations provided by the three main rating agencies: Standard & Poors, Moody´s and Fitch Ratings. Governments´ efficiency scores are computed via data envelopment analysis (DEA), while ordered response models are employed to estimate the effect of efficiency scores on sovereign ratings throughout time. Sample-wise, in our empirical analysis we look at 34 OECD countries over the period 2007-2016.

Our key result answers positively to the question in the paper's title. Indeed, better public spending efficiency developments are rewarded by financial markets notably with an upgrade of sovereign debt ratings, for all the three main rating agencies covered in the analysis. Results are robust to several sensitivity and robustness checks. Moreover, higher inflation and government indebtedness lead to sovereign rating downgrades, while higher foreign reserves contribute to rating upgrades.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 presents the data. Section 4 develops the empirical methodology and discusses the main results. The last section concludes.

2. Related Literature

In this section, we bring together two strands of the literature, one dealing with public sector efficiency and another with the study of the determinants of sovereign debt ratings.

The relevance of public sector efficiency has been a topic of growing interest in the literature (see, for example, the works by Gupta and Verhoeven, 2001; Tanzi and Schuknecht, 1997, 2000; Afonso et al., 2005). Several studies assess the degree of efficiency of the public sector by looking at different sample and time spans but most tend to focus on OCDE and European countries (Adam at al., 2011; Dutu and Sicari, 2016; Afonso and Kazemi, 2017; Antonelli and de Bonis, 2019). All studies have identified substantial public spending efficiency differences between countries and also scope for spending savings, suggesting that government spending efficiency could be improved. This typically implies that more public services could be provided with the same amount of public resources, or conversely, the same level of public resources might be provided with fewer public resources. Hence, fiscal improvements also in that respect can be good news towards better financial markets assessments. To explain this cross-country efficiency differences, studies have examined factors such as: population, education, income level, quality of institutions (property right security and level of corruption), quality of the country's governance level, government size, government´s political orientation, voter participation rate, civil service competence (Afonso et al., 2005; Hauner and Kyobe, 2010; Antonelli and de Bonis, 2019). More recently, Afonso et al. (2019, 2020) evaluated the role of tax structures and tax reforms in explaining cross-country efficiency differences.

Turning to the relevance of fiscal developments for financial markets assessments, via notably changes in sovereign ratings, several studies found support for a relevant link. See, for instance, Afonso (2003), with OLS approaches, or Bissoondoyal-Bheenick (2005) with ordered probit models.[1] In this vein, Afonso et al. (2011) analysed the determinants of sovereign ratings by using a linear regression framework and an ordered probit response framework.[2] In addition, Afonso et al. (2012) reported that logistic and exponential transformations to ratings provide little improvement over a linear transformation. They also mentioned that GDP per capita, GDP growth, government debt and budget balance had a short-term impact, whereas government effectiveness, external debt, foreign reserves and default history influenced ratings in the long-run. Moreover, Amstad and Packer (2015) used several explanatory variables as proxies for fiscal, economic and institutional strength, monetary regime, external position and default history and concluded that a small set of factors can largely explain the rating scale. Finally,

[1] An OLS regression with a linear transformation of the ratings assumes a constant distance between adjacent rating notches. However, ratings represent a qualitative ordinal assessment of a sovereign credit risk, thus the distance between two adjacent ratings may not be the same

[2] Instead of assuming a rigid shape of the ratings scale, this model estimates the threshold values between rating notches, defining the shape of the ratings curve.

Vu et al. (2017) reported that political risk can contribute to explain rating mismatches in a country.

3. Data and Variables

3.1. Data

We gather data from several sources. Data on information from the three main rating agencies, Standard & Poors (S&P), Moody´s and Fitch Ratings attributed at 31st December was retrieved from Datastream and Bloomberg. This data is available for 100 countries for the period 2007-2020.

To compute the public sector efficiency scores, we use publicly available data from World Economic Forum, World Bank, World Health Organization, IMF World Economic Outlook and OECD database. When data was not available for a specific year, we assumed that the data was equal to that of the previous year. We compute the efficiency scores for 35 OECD countries[3] for the period between 2006 and 2017.

Data on the set of control variables were also retrieved from the IMF´s World Economic Outlook, the World Economic Forum and the World Bank´s World Development Indicators.

After merging the rating and efficiency data, we end up with a cross-sectional sample of 34 OECD countries and a total number of 408 observations.[4]

3.2. Variables

3.2.1. Sovereign Debt Ratings

Our key dependent variables are sovereign debt ratings, which we transform from a qualitative to a quantitative scale in order to apply an ordered response model. Indeed, a simple linear transformation, implicitly assumes that the difference between any two adjacent categories is always equal, while that might not be the case. More specifically, the unobserved latent variable R_{it}^{*} has a linear form and depends on a set of variables as discussed in the previous section with several cut-off points to draw up the boundaries of each rating category, and the final rating notation is given by:

[3] The 35 OECD countries considered are: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. We do not consider Mexico because the country is efficient by default, and data heterogeneity is quite important for the country sample analysis. When a country is efficient by default it means that it will not appear as peer of any other non-efficient country.

[4] We excluded Estonia because we were not able to gather sufficient information on its rating.

$$R_{it} = \begin{cases} AAA\ (Aaa) & if \quad R_{it}^* > c_{20} \\ AA+\ (Aa1) & if \quad c_{16} > R_{it}^* > c_{19} \\ AA\ (Aa2) & if \quad c_{15} > R_{it}^* > c_{18} \\ \vdots & \\ < C & if \quad c_1 > R_{it}^* \end{cases} . \tag{4}$$

The difference between the cut off points determines a non-linearity in the effect of variables (i.e. it might be easier to move from AA to AA+, then the subsequent upgrade to AAA). Similarly to Afonso et al. (2011), we group ratings into 21 categories by putting together the few observations below C, which are given the value one, while AAA observations receive the value 21 (Table 1).

[Table 1]

In addition to using each rating agency´s assessment separately, we also take three aggregate measures. The first, is the result of the simple average across the three agencies (Average Ratings, which we have plotted in Figure 1 for illustration purposes). The second uses a Principal Component Analysis (PCA) to extract the common factor (Ratings PCA). A likelihood ratio (LR) test was used ex-ante to examine the "sphericity" case, allowing for sampling variability in the correlations. This test comfortably rejected sphericity at the 1 percent level. Moreover, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was equal to 0.79 suggesting that the use of a factor analysis of the variables is a good idea.[5] The first factor explains 98 percent of the variance in the standardized data. Given that PCA is based on the classical covariance matrix, which is sensitive to outliers, we take a third measure by basing it on a robust estimation of the covariance (correlation) matrix. A well suited method is the Minimum Covariance Determinant (MCD) that considers all subsets containing h% of the observations and estimates the variance of the mean on the data of the subset associated with the smallest covariance matrix determinant – we implement Rousseeuw and Van Driessen's (1999) algorithm. After re-computing the same indices with the MCD version we obtained similar results, meaning that outliers were not driving our factor analysis.[6]

[Figure 1]

[5] This is an index for comparing the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients.
[6] The correlation coefficient between Ratings_PCA and the MCD-equivalent (hereafter MDCeq) was equal to 99, statistically significant at the 1 percent level.

3.2.2. Public Sector Efficiency

Our variables of interest are the public sector efficiency scores, which we computed using data envelopment analysis (DEA).[7] This approach compares each observation with an optimal outcome. This is a suitable approach for several reasons: first, it does not impose an underlying production function; second, it allows deviations from the efficient frontier and it examines the efficiency of a country relative to its peers. Formally, for each country i out of 35 advanced economies, we consider the following function:

$$Y_i = f(X_i),\ i = 1, \dots, 35 \qquad (2)$$

where Y is the composite output measure (Public Sector Performance, PSP) and X is the composite input measure (Public Expenditure, PE), namely government spending-to-GDP ratio.

As suggested by Afonso et al. (2005, 2019), we use a set of metrics to construct a composite of public sector performance (PSP). PSP is the simple average between opportunity and Musgravian indicators. The opportunity indicators evaluate the performance of the government in administration, education, health and infrastructure sectors, with equal weighting. The Musgravian indicators include three sub-indicators: distribution, stability and economic performance, also with equal weighting for the indicators. Accordingly, the opportunity and Musgravian indicators result from the average of the measures included in each sub-indicator. To ensure a convenient benchmark, each sub-indicator measure is first normalized by dividing the value of a specific country by the average of that measure for all the countries in the sample.

Our input measure, Public Expenditure (PE) is lagged one year and expressed as a percentage of GDP in several sectors. More specifically, we consider government consumption, expenditure on education, expenditure on health, public investment, transfers and subsidies and total expenditure. Each area of government expenditure is equally weighted to compute the public expenditure input. Tables A1 and A2 in Appendix A provide additional information on the sources and variable construction. Further explanation on the variables construction is provided in Afonso et al. (2020).

We adopt an output orientated approach, to measure the proportional increase in outputs while holding input constant and assume variable-returns to scale (VRS), to account for the fact

[7] DEA is a non-parametric frontier methodology, drawing from Farrell's (1957) seminal work and that was further developed by Charnes et al. (1978). Coelli et al. (2002) and Thanassoulis (2001) offer introductions to DEA.

that countries might not operate at the optimal scale. The efficiency scores are computed by solving the following linear programming problem: [8]

$$
\begin{aligned}
&\max_{\varphi,\lambda} \varphi \\
s.t.\ & -\varphi y_i + Y\lambda \geq 0 \\
& x_i - X\lambda \geq 0 \\
& I1'\lambda = 1 \\
& \lambda \geq 0
\end{aligned}
\qquad (3)
$$

where y_i is a column vector of outputs, x_i is a column vector of inputs, λ is a vector of constants, $I1'$ is a vector of ones, X is the input matrix and Y is the output matrix. φ is a scalar showing by how much the output of each country could increase. If φ>1, the country is inefficient, and if φ =1, the country is on the frontier (i.e., it is efficient) representing the best existing country (but not necessarily the best possible).

We performed DEA for three different models: baseline model (Model 0) includes only one input (PE as percentage of GDP) and one output (PSP); Model 1 uses one input, governments' normalized total spending (PE) and two outputs, the opportunity PSP and the "Musgravian" PSP scores; and Model 2 assumes two inputs, governments' normalized spending on opportunity and on "Musgravian" indicators and one output, total PSP scores. Detailed results are illustrated on Table B.1, B.2 and B.3 of Appendix B.

Table 2 provides a summary of the DEA results for the three models using an output-oriented assessment. The average output efficiency score is approximately 1.50 for Models 0 and 1 and 1.16 for Model 3 suggesting that outputs could be increased by approximately 50% or 16%. The output efficiency scores for Models 0 and 1 where somewhat higher and seemed to have peaked in the period 2011-2013, and then they decreased.

Overall, the countries located in the production possibility frontier, hence the more efficient ones in terms of government spending are: Switzerland and Korea in 2006, and Chile and Korea in 2017. Table C1 in Appendix C presents the summary statistics of the data used in our analysis.

[Table 2]

[8] This is the equivalent envelopment form (see Charnes et al., 1978), using the duality property of the multiplier form of the original model.

4. Empirical Methodology and Results

4.1. Methodology

To estimate the impact of public sector efficiency ($PSE_{i,t}$) on credit ratings $\left(R^*_{i,t}\right)$, we run the following panel regression:

$$R^*_{i,t} = \alpha_i + \delta_t + \beta \widehat{PSE}_{i,t-1} + \gamma \boldsymbol{X}'_{i,t-1} + \varepsilon_{i,t} \qquad (4)$$

where the unobserved latent variable R^*_{it} follows a linear quantitative transformation of the qualitative rating scales; α_i are country-fixed effects capturing unobserved heterogeneity across countries, and time-unvarying factors; δ_t are time effects to account for common time trends and control for global shocks (such as the global business cycle); $PSE_{i,t}$ is the time-varying output efficiency estimate (see sub-section 3.2.2 for details on the variables construction); $\boldsymbol{X_{it}}$ is a vector of credit ratings determinants, lagged one year to reduce reverse causality.[9] $\varepsilon_{i,t}$ is an error term satisfying the usual assumptions. Note that the output efficiency scores are higher or equal to 1. To easily interpret the results, we made the following transformation $\widehat{PSE}_{i,t-1} = \frac{1}{\varphi_{i,t-1}}$.

Following the literature (Cantor and Packer, 1996; Monfort and Mulder, 2000; Bissoondoyal-Bheenick, 2005), the vector $\boldsymbol{X_{it}}$ includes the following key determinants of sovereign credit ratings (with expected sign in parenthesis): inflation rate (+/-), debt-to-GDP ratio (-), foreign reserves (+), term of trade index(+/-).[10]

In the context of estimating equation (1) with the type of dependent variable we have – sovereign credit ratings –, two econometric approaches are typically employed. One uses linear regression methods to a linear numerical representation of the ratings (Afonso, 2003) since the OLS application is simple and allows for simple generalizations to panel data settings (Mora, 2006). The second, following Bissoondoyal-Bheenick (2005), uses ordered response models given the fact that ratings are a qualitative ordinal measure and traditional linear estimation techniques are not adequate. To treat ordered variables as continuous could cause errors in the inference as they are biased even in large samples (Trevino and Thomas, 2001; Bessis, 2002; Hu et al., 2002; Bissoondoyal-Bheenick, 2005; Mora, 2006; Depken et al., 2007; Afonso et al., 2011). We use two

[9] Similar results obtained using contemporaneous regressors (not reported).
[10] Summary statistics of these variables are provided in Table C1 in the appendix.

types of estimators: Ordinary Least Squares (OLS) with robust standard errors clustered at the country level and two ordered models (probit and logit) estimated using maximum likelihood using a robust variance-covariance matrix to account for serial correlation.

4.2. Results

We start our empirical analysis by assessing the standalone (unconditional) link between the output level of government spending efficiency (for the baseline Model 0)[11] and sovereign ratings. The results reported in Table 3 show that better spending efficiency is positively related to higher sovereign ratings. This baseline result holds for all the three rating agencies (Moodys, Standard & Poors and Fitch), for the average rating, and also for the PCA rating proxy and using alternative output efficiency scores (for the Models 1 and 2), reported in Appendix C, Table C.2.

[Table 3]

As a next step, we estimate the initial specification augmented with a set of control variables, notably: inflation, terms of trade, the debt-to-GDP ratio, and external reserves. Table 4 reports this new set of results again for alternative dependent variables: the three rating agencies, the average rating of the three ratings, and the PCA rating proxy.

[Table 4]

As expected, the control variables for the determinants of sovereign credit ratings are in line with previous literature. Indeed, a higher level of government indebtedness and terms of trade translate into downgrades of sovereign rating notations across the three rating agencies. In addition, no statistically significant result is available for the inflation rate, while the results for foreign reserves appear less obvious.

Related to our research title question, we continue to find that better public spending efficiency contributes to sovereign rating upgrades, notably for the all alternative dependent

[11] Recall that Model 0 uses one input, governments' normalized spending, and one output, total PSP scores. Table C.2 in Appendix C, presents our baseline results using alternative output efficiency measures, namely Model 1 (one input and two outputs) and Model 2 (two inputs and one output) and as discussed earlier. We continue to find a positive effect of public sectir efficiency on rating in all the models and consideing the alternative dependent variables.

variables and considering alternative efficiency scores (for Model 1 and 2) reported in Appendix C , Table C.3.

Considering that an ordered response model (probit or logit) is also a good alternative fit model for the latent variable R_{it}^{*}, we report in Table 5 such results. In Table 5, we can see that the statistical significance of the several determinants of rating is kept, and now an increase in foreign reserves improves sovereign ratings. In addition, the effect of the output spending efficiency score continues to be positive and statistically significant. This main result is also captured for alternative efficiency scores (see Table C.4 and Table C.5 in Appendix C).

[Table 5]

Another valid conclusion is that the estimated magnitude of the efficiency score is lower in the ordered estimations than it was in the linear panel estimation. Overall, these results hint to the possibility that movements up and down the ratings scale can indeed be non-linear. As an aside comment, and since the thresholds are mostly all statistically significant that suggests that the cutting points are truly different and therefore there is no need to combine the levels of the (ordinal rating) dependent variable.

At this point, it is also important to address an important issue, the endogeneity of the efficiency score variable. We estimated specification (1) using OLS and order logit and order probit, however, there is a potential bi-directional relationship between the efficiency and rating scores. Public sector efficiency may influence the rating scores, but the rating scores may also have an impact on public sector performance. For example, the rating scores will affect the sovereign yields, which in the end affect government's fiscal policy and its efficient use of public resources. To account for this issue, in our previous analyses, we used the lag efficiency score to explain the current rating score.

Furthermore, we employ an instrumental variable (IV) approach. To instrument for the efficiency score variable, we select instruments capturing institutional and political characteristics of the countries likely to be correlated to our measure of public sector efficiency but presumably not directly related to credit ratings. The main instruments used are those proposed by Acemoglu et al. (2019) and Fatas and Mihov (2001, 2013). The first (*constraints*) captures potential veto points on the decisions of the executive (comes from Henisz, 2000).[12] The second (*polconv*) captures not only institutional characteristics in the country but also political outcomes as its value is adjusted when, for example, the president and the legislature is member of the same party (comes from the Database of Political Institutions). Indeed, as documented by Fatas and Mihov (2013), constraints on the executive are likely to reduce spending volatility and positively influence fiscal stabilization which is rewarded by credit rating agencies. Table 6 reports the IV estimation results of specification (1).

As previously shown, public sector efficiency is positively related to the average sovereign ratings, except for Standard & Poors rating. This main result is also captured for alternative efficiency scores (see Table C.6 in Appendix C). For an instrument to be valid the following conditions have to be satisfied. First, the instruments need to be correlated with the endogenous variables. In Appendix C, Table C.7., we see that this condition is satisfied. Second, the lagged values of the instruments should not be strongly correlated with the average rating score, otherwise the estimated coefficient would still be biased. To test the relevancy of the instrument, we report the Kleibergen-Paap (2016) Wald F statistics. The results are reported on the bottom of Tables 6. The rejection of the Kleibergen-Paap rk LM statistics indicates the validity of the instruments used and which has a straightforward interpretation: countries with more constraints on the executive do not allow the ruling government to change policy for reasons unrelated to the state of the economy. Therefore, in these countries, overall policy volatility is lower which benefits its external perception on government bond issuance, lowering its risk (price) and providing rating agencies a basis for a positive assessment.

5. Conclusion

In this paper we evaluate the link between government spending efficiency and performance and sovereign debt assessments made by financial markets´ participants. More specifically we study how sovereign ratings by the three main rating agencies (Standard & Poors, Moody´s and Fitch) react to public spending efficiency developments. To compute the public efficiency scores, we use data envelopment analysis. Lastly, we rely on linear regression, ordered

[12] The role of veto players in policymaking has been studied extensively in the political economy literature. See, for example, Tsebelis (2002) for an insightful discussion of the policy effects of veto players.

response and instrumental variable models to estimate the reaction of sovereign ratings to improvements in efficiency scores.

For a sample of 34 OECD countries over the period 2007-2018, we find that increased public spending efficiency is indeed rewarded by financial markets though higher sovereign credit rating notations. In addition, higher inflation and government indebtedness reduce the quality of the sovereign credit rating, while higher foreign reserves contribute to rating upgrades. Moreover, our results are robust to several sensitivity and robustness checks.

Therefore, a relevant policy implication from our work is the fact that we do have a positive answer to the title question of the paper. In other words, and in the context of fewer public resources, and a strong demand for public services, financial markets will reward better more efficient governments. This is paramount since higher sovereign credit ratings will naturally imply lower funding costs in capital markets.

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Table 1. Qualitative Credit Ratings Linear Transformation to Ordinal Scale, by agency

	Ordinal scale	S&P	Moody's	Fitch
Highest quality	21	AAA	Aaa	AAA
High quality	20	AA+	Aa1	AA+
	19	AA	Aa2	AA
	18	AA-	Aa3	AA-
Strong payment capacity	17	A+	A1	A+
	16	A	A2	A
	15	A-	A3	A-
Adequate payment capacity	14	BBB+	Baa1	BBB+
	13	BBB	Baa2	BBB
	12	BBB-	Baa3	BBB-
Likely to fulfil obligations, ongoing uncertainty	11	BB+	Ba1	BB+
	10	BB	Ba2	BB
	9	BB-	Ba3	BB-
High credit risk	8	B+	B1	B+
	7	B	B2	B
	6	B-	B3	B-
Very high credit risk	5	CCC+	Caa1	CCC+
	4	CCC	Caa2	CCC
	3	CCC-	Caa4	CCC-
Near default with possibility of recovery	2	CC	Ca	CC
	1	C	C	C
Default	0	SD/D		DDD/DD/D

Table 2. Summary of DEA results (output efficiency scores)

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Model 0	Efficient	2	3	3	3	3	3	2	3	3	3	2	2
	Name	CHE; KOR	CHE; CHL; KOR	CHE; CHL; KOR	AUS; CHL; KOR	AUS; CHL; KOR	AUS; CHL; KOR	AUS; KOR	AUS; CHL; KOR	CHE; CHL; KOR	CHL; IRL; KOR	CHL; KOR	CHL; KOR
	Average	1.19	1.22	1.43	1.34	1.49	1.59	2.39	2.05	1.34	1.44	1.30	1.37
	Median	1.17	1.18	1.33	1.34	1.41	1.51	2.20	1.95	1.33	1.42	1.26	1.35
	Min	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Max	1.52	1.62	3.40	1.63	2.56	3.69	6.12	5.18	2.13	2.25	1.91	1.92
	Stdev	0.13	0.16	0.51	0.17	0.35	0.47	1.16	0.83	0.25	0.27	0.21	0.19
Model 1	Efficient	3	3	3	3	3	3	4	3	4	3	2	2
	Name	CHE; CHL; KOR	CHE; CHL; KOR	CHE; CHL; KOR	AUS; CHL; KOR	AUS; CHL; KOR	AUS; CHL; KOR	AUS; CHL; KOR; TUR	AUS; CHL; KOR	CHE; CHL; KOR; USA	CHL; IRL; KOR	CHL; KOR	CHL; KOR
	Average	1.18	1.21	1.43	1.33	1.49	1.58	2.37	2.04	1.33	1.43	1.30	1.37
	Median	1.17	1.18	1.31	1.33	1.39	1.51	2.20	1.95	1.33	1.41	1.26	1.35
	Min	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Max	1.52	1.62	3.33	1.63	2.56	3.69	6.12	5.18	2.13	2.25	1.91	1.92
	Stdev	0.13	0.15	0.50	0.17	0.35	0.47	1.18	0.83	0.26	0.28	0.21	0.19
Model 2	Efficient	3	4	5	4	4	4	4	4	3	4	4	4
	Name	CHE; ESP; KOR	CHE; CHL; ESP; KOR	CHE; CHL; KOR; NLD; SVK	AUS; CHE; CHL; KOR	AUS; CHE; CHL; KOR	AUS; CHE; CHL; KOR	AUS; CHE; CHL; KOR	AUS; CHE; CHL; KOR	CHE; CHL; KOR	CHE; CHL; IRL; KOR	CHE; CHL; IRL; KOR	CHE; CHL; IRL; KOR
	Average	1.14	1.15	1.16	1.17	1.16	1.16	1.16	1.16	1.16	1.17	1.18	1.17
	Median	1.10	1.12	1.11	1.11	1.13	1.12	1.11	1.11	1.12	1.12	1.12	1.14
	Min	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Max	1.47	1.49	1.48	1.43	1.41	1.43	1.42	1.46	1.45	1.42	1.46	1.44
	Stdev	0.13	0.14	0.15	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.13

Source: authors' calculations. Model 0 - one input and one output; Model 1 - one input and two outputs; Model 2 - two inputs and one output.

Table 3. Unconditional regression on alternative rating variables

Specification Dependent Variable	(1) Moodys	(2) SP	(3) Fitch	(4) Average Rating	(5) Rating PCA
PSE_0 (t-1)	8.238***	6.831***	6.578***	7.215***	1.430***
	(1.252)	(0.936)	(0.912)	(1.000)	(0.198)
Constant	15.082***	15.372***	16.325***	15.593***	0.123
	(1.123)	(0.839)	(0.826)	(0.894)	(0.177)
Country effects	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes
Observations	406	406	406	406	406
R-squared	0.850	0.893	0.886	0.884	0.885

Note: standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. Country and time fixed effects included but omitted for reasons of parsimony.

Table 4. Conditional regression on alternative rating variables

Specification Dependent Variable	(1) Moodys	(2) SP	(3) Fitch	(4) Average Rating	(5) Rating PCA
PSE_0 (t-1)	4.045***	3.989***	3.526***	3.853***	0.764***
	(0.880)	(0.713)	(0.603)	(0.679)	(0.134)
Inflation (t-1)	-0.050	-0.077	-0.047	-0.058	-0.011
	(0.055)	(0.057)	(0.046)	(0.047)	(0.009)
Terms of trade index (t-1)	-0.017	-0.018	-0.027**	-0.021*	-0.004*
	(0.016)	(0.012)	(0.011)	(0.012)	(0.002)
Debt ratio (t-1)	-0.092***	-0.064***	-0.070***	-0.075***	-0.015***
	(0.009)	(0.006)	(0.007)	(0.007)	(0.001)
Ln(Reserves) (t-1)	-0.421***	-0.569***	-0.379***	-0.456***	-0.091***
	(0.157)	(0.121)	(0.120)	(0.126)	(0.025)
Constant	38.309***	39.131***	36.788***	38.076***	4.583***
	(4.566)	(3.392)	(3.504)	(3.621)	(0.717)
Country effects	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes
Observations	406	406	406	406	406
R-squared	0.909	0.931	0.930	0.932	0.932

Note: standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. Country and time fixed effects included but omitted for reasons of parsimony.

Table 5. Conditional robustness regression on alternative dependent rating variables

	Moodys			Standard & Poors		Fitch	
	(1) Ordered probit	(2) Ordered logit		(3) Ordered probit	(4) Ordered logit	(5) Ordered probit	(6) Ordered logit
PSE_0 (t-1)	2.175 ***	3.715 ***	PSE_0 (t-1)	2.384 ***	3.989 ***	2.099 ***	3.521 ***
	(0.397)	(0.682)		(0.395)	(0.683)	(0.396)	(0.676)
Inflation (t-1)	-0.171 ***	-0.265 ***	Inflation (t-1)	-0.183 ***	-0.307 ***	-0.170 ***	-0.279 ***
	(0.026)	(0.047)		(0.026)	(0.047)	(0.026)	(0.047)
Terms of trade index (t-1)	0.007	0.010	Terms of trade index (t-1)	0.006	0.007	0.003	0.004
	(0.009)	(0.016)		(0.009)	(0.016)	(0.009)	(0.016)
Debt ratio (t-1)	-0.010 ***	-0.015 ***	Debt ratio (t-1)	-0.010 ***	-0.015 ***	-0.010 ***	-0.015 ***
	(0.001)	(0.002)		(0.001)	(0.002)	(0.001)	(0.002)
Ln(Reserves) (t-1)	0.185 ***	0.308 ***	Ln(Reserves) (t-1)	0.147 ***	0.245 ***	0.158 ***	0.257 ***
	(0.035)	(0.063)		(0.035)	(0.061)	(0.035)	(0.061)
Cut off 2	1.622	2.478	Cut off 6	0.976	0.700	1.273	1.670
	(1.219)	(2.160)		(1.172)	(2.099)	(1.146)	(1.938)
Cut off 3	2.050 *	3.242	Cut off 8	1.613	2.165	1.429	1.985
	(1.179)	(2.047)		(1.138)	(1.920)	(1.141)	(1.918)
Cut off 4	2.473 **	4.009 **	Cut off 9	1.738	2.415	1.559	2.236
	(1.160)	(1.990)		(1.135)	(1.909)	(1.139)	(1.907)
Cut off 6	2.606 **	4.255 **	Cut off 10	1.925 *	2.789	1.674	2.447
	(1.157)	(1.979)		(1.133)	(1.897)	(1.137)	(1.901)
Cut off 9	2.718 **	4.458 **	Cut off 11	2.454 **	3.807	1.771	2.625
	(1.156)	(1.972)		(1.127)	(1.874)	(1.135)	(1.896)
Cut off 10	3.114 ***	5.161 ***	Cut off 12	2.807 **	4.461	2.345	3.671 *
	(1.150)	(1.957)		(1.124)	(1.867)	(1.130)	(1.880)
Cut off 11	3.275 ***	5.448 ***	Cut off 13	3.251 ***	5.253 **	2.718	4.347 **
	(1.148)	(1.953)		(1.123)	(1.865)	(1.128)	(1.876)
Cut off 12	3.751 ***	6.299 ***	Cut off 14	3.491 ***	5.663 **	3.008 **	4.863 ***
	(1.146)	(1.949)		(1.124)	(1.865)	(1.127)	(1.872)

Cut off 13	4.312 ***	7.268 ***	Cut off 15	3.704 ***	6.022 ***	3.484 **	5.681 ***
	(1.149)	(1.956)		(1.125)	(1.867)	(1.129)	(1.874)
Cut off 14	4.505 ***	7.594 ***	Cut off 16	3.919 ***	6.381 ***	3.820 ***	6.244 ***
	(1.151)	(1.960)		(1.127)	(1.870)	(1.133)	(1.881)
Cut off 15	4.722 ***	7.953 ***	Cut off 17	4.137 ***	6.741 ***	3.997 ***	6.535 ***
	(1.153)	(1.964)		(1.129)	(1.873)	(1.135)	(1.884)
Cut off 16	4.900 ***	8.246 ***	Cut off 18	4.466 ***	7.279 ***	4.340 ***	7.094 ***
	(1.156)	(1.968)		(1.133)	(1.880)	(1.138)	(1.890)
Cut off 17	5.165 ***	8.678 ***	Cut off 19	4.639 ***	7.559 ***	4.603 ***	7.519 ***
	(1.160)	(1.975)		(1.134)	(1.883)	(1.139)	(1.893)
Cut off 18	5.533 ***	9.275 ***	Cut off 20	4.973 ***	8.104 ***	4.774 ***	7.799 ***
	(1.164)	(1.982)		(1.136)	(1.888)	(1.139)	(1.894)
Cut off 19	5.729 ***	9.590 ***	Cut off 21	5.238 ***	8.541 ***	4.909 ***	8.021 ***
	(1.164)	(1.984)		(1.137)	(1.891)	(1.140)	(1.896)
Cut off 20	5.884 ***	9.842 ***					
	(1.165)	(1.985)					
Cut off 21	6.035 ***	10.090 ***					
	(1.165)	(1.987)					
N	357	357		357	357	357	357

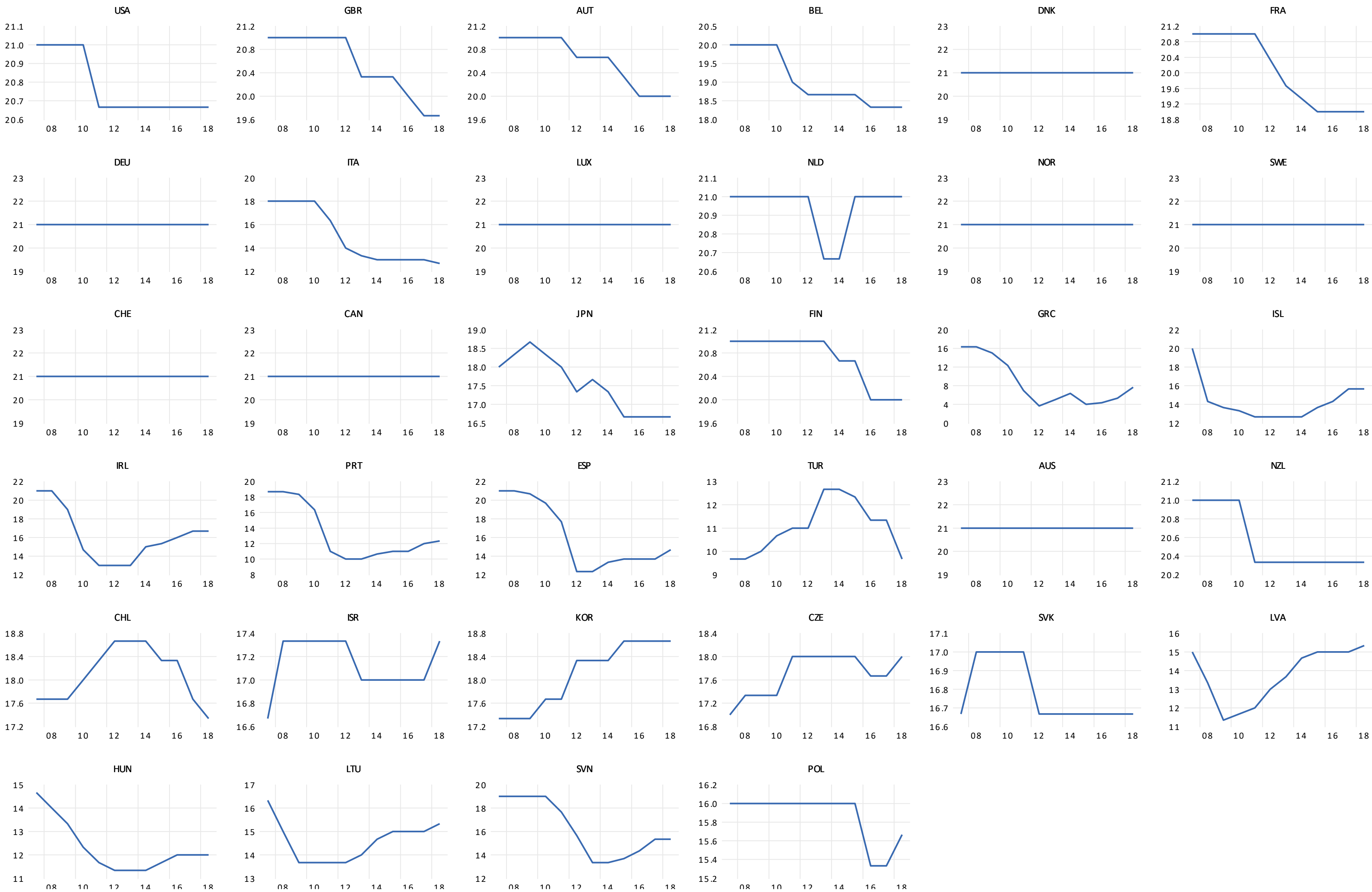
Note: standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively.

Table 6. Endogeneity robust conditional regression on alternative rating variables

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	Moodys	Moodys	SP	SP	Fitch	Fitch	Average Rating	Average Rating	Rating PCA	Rating PCA
	IV1	IV2	IV1	IV2	IV1	IV2	IV1	IV2	IV1	IV2
PSE_0 (t-1)	6.075	6.410*	4.158	2.974	4.748*	5.871**	4.993*	5.085**	0.989*	1.006**
	(4.051)	(3.484)	(2.678)	(2.301)	(2.813)	(2.448)	(2.978)	(2.559)	(0.589)	(0.506)
Inflation (t-1)	0.027	0.025	0.115*	0.123**	0.076	0.068	0.073	0.072	0.015	0.014
	(0.094)	(0.093)	(0.062)	(0.061)	(0.065)	(0.065)	(0.069)	(0.068)	(0.014)	(0.014)
Terms of trade index (t-1)	-0.037*	-0.037*	-0.026*	-0.023*	-0.032**	-0.035**	-0.032**	-0.032**	-0.006**	-0.006**
	(0.021)	(0.020)	(0.014)	(0.013)	(0.014)	(0.014)	(0.015)	(0.015)	(0.003)	(0.003)
Debt ratio (t-1)	-0.078***	-0.077***	-0.062***	-0.066***	-0.068***	-0.065***	-0.070***	-0.069***	-0.014***	-0.014***
	(0.017)	(0.015)	(0.011)	(0.010)	(0.012)	(0.011)	(0.012)	(0.011)	(0.002)	(0.002)
Ln(Reserves) (t-1)	-0.979**	-0.976**	-0.664**	-0.674**	-0.381	-0.371	-0.674*	-0.674*	-0.133*	-0.133*
	(0.480)	(0.480)	(0.317)	(0.317)	(0.333)	(0.337)	(0.353)	(0.353)	(0.070)	(0.070)
Constant	51.021***	50.654***	41.565***	42.859***	35.716***	34.487***	42.767***	42.667***	5.497***	5.478***
	(12.595)	(12.405)	(8.325)	(8.191)	(8.747)	(8.714)	(9.258)	(9.112)	(1.831)	(1.802)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	163	163	163	163	163	163	163	163	163	163
R-squared	0.918	0.918	0.957	0.957	0.951	0.950	0.949	0.949	0.949	0.949
Kleibergen-Paap F-statistics	6.728	4.659	6.728	4.659	6.728	4.659	6.728	4.659	6.728	4.659

Note: standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. Country and time fixed effects included but omitted for reasons of parsimony.

Figure 1 – Simple average of sovereign ratings (Moody's, S&P, Fitch)
(2007-2018, ordinal scale, 0-21)



Appendix A

Table A1: DEA Output Components

Sub Index	Variable	Source	Series
Opportunity Indicators			
Administration	Corruption	Transparency International's Corruption Perceptions Index (CPI) (2006- 2017)	Corruption on a scale from 10 (Perceived to have low levels of corruption) to 0 (highly corrupt), 2006-2011; Corruption on a scale from 100 (Perceived to have low levels of corruption) to 0 (highly corrupt), 2012-2017.
	Red Tape	World Economic Forum: The Global competitiveness Report (2006-2017)	Burden of government regulation on a scale from 7 (not burdensome at all) to 1 (extremely burdensome).
	Judicial Independence	World Economic Forum: The Global competitiveness Report (2006-2017)	Judicial independence on a scale from 7 (entirely independent) to 1 (heavily influenced).
	Property Rights	World Economic Forum: The Global competitiveness Report (2006-2017)	Property rights on a scale from 7 (very strong) to 1 (very weak).
	Shadow Economy	Schneider (2016) (2006-2016)[13]	Shadow economy measured as percentage of official GDP. Reciprocal value 1/x.
Education	Secondary School Enrolment	World Bank, World Development Indicators (2006-2017)	Ratio of total enrolment in secondary education.
	Quality of Educational System	World Economic Forum: The Global competitiveness Report (2006-2017)	Quality of educational system on a scale from 7 (very well) to 1 (not well at all).
	PISA scores	PISA Report (2003, 2006, 2009, 2012, 2015)	Simple average of mathematics, reading and science scores for the years 2015, 2012, 2009; Simple average of mathematics and reading for the year 2003. For the missing years, we assumed that the scores were the same as in the previous years.
Health	Infant Survival Rate	World Bank, World Development Indicators (2006-2017)	Infant survival rate = (1000-IMR)/1000. IMR is the infant mortality rate measured per 1000 lives birth in a given year.
	Life Expectancy	World Bank, World Development Indicators (2006-2017)	Life expectancy at birth, measured in years.
	CVD, cancer, diabetes or CRD Survival Rate	World Health Organization, Global Health Observatory Data Repository (2000, 2005, 2010, 2015, 2016)	CVD, cancer and diabetes survival rate =100-M. M is the mortality rate between the ages 30 and 70. For the missing years, we assumed that the scores were the same as in the previous years.
Public Infrastructure	Infrastructure Quality	World Economic Forum: The Global competitiveness Report (2006-2017)	Infrastructure quality on a scale from 7 (extensive and efficient) to 1 (extremely underdeveloped)
Standard Musgravian Indicators			
Distribution	Gini Index	Eurostat, OECD (2006-2016)[14]	Gini index on a scale from 1(perfect inequality) to 0 (perfect equality). Transformed to 1-Gini.
Stabilization	Coefficient of Variation of Growth	IMF World Economic Outlook (WEO database) (2006-2017)	Coefficient of variation=standard deviation/mean of GDP growth based on 5 year data. GDP constant prices (percent change). Reciprocal value 1/x.
	Standard Deviation of Inflation	IMF World Economic Outlook (WEO database) (2006-2017)	Standard deviation of inflation based on 5-year consumer prices (percent change) data. Reciprocal value 1/x.
Economic Performance	GDP per Capita	IMF World Economic Outlook (WEO database) (2006-2017)	GDP per capita based on PPP, current international dollar.
	GDP Growth	IMF World Economic Outlook (WEO database) (2006-2017)	GDP constant prices (percent change).
	Unemployment	IMF World Economic Outlook (WEO database) (2006-2017)	Unemployment rate, as a percentage of total labor force. Reciprocal value 1/x.

[13] For Chile, Iceland, Israel, South Korea and Mexico, we use the data available in Medina and Schneider (2017).

[14] For Switzerland, we were only able to collect data for the period between 2009 and 2016.

Table A2: Input Components

Sub Index	Variable	Source	Series
Opportunity Indicators			
Administration	Government Consumption	IMF World Economic Outlook (WEO database) (2005-2016)	General government final consumption expenditure (% of GDP) at current prices
Education	Education Expenditure	UNESCO Institute for Statistics (2005-2016)[15]	Expenditure on education (% of GDP)
Health	Health Expenditure	OECD database (2005-2016)	Expenditure on health (% of GDP)
Public Infrastructure	**Public Investment**	European Commission, AMECO (2005-2016)[16]	General government gross fixed capital formation (% of GDP) at current prices
Standard Musgravian Indicators			
Distribution	Social Protection Expenditure	OECD database (2005-2016)[17]	Aggregation of the social transfers (% of GDP)
Stabilization/ Economic Performance	Government Total Expenditure	OECD database (2005-2016)[18]	Total expenditure (% of GDP)

[15] From IMF World Economic Outlook (WEO database), we retrieved data for Greece for the period between 2006 and 2012 and for the USA for the period 2005 and 2007.

[16] We were not able to collect data on the following countries: Australia, Canada, Mexico, New Zealand, Chile, Israel and South Korea.

[17] From IMF World Economic Outlook (WEO database), we retrieved data for New Zealand for the period 2005 and 2012. For Turkey, we retrieve data from European Commission, AMECO database. For Chile and Iceland, we were only able to collect data for the period between 2013 and 2016. For Turkey, we were only able to get data for the period between 2009 and 2015. We were not able to collect data for Canada.

[18] From IMF World Economic Outlook (WEO database), we retrieved data for Canada for the period between 2005 and 2012 and for New Zealand for the period 2009 and 2012. For Turkey, we retrieve data from European Commission, AMECO database. We were not able to collect data for Mexico. For Chile and Iceland, we were only able to collect data for the period between 2013 and 2016. For New Zealand, we were only able to collect data for the period between 2009 and 2016. For Japan, we were only able to collect data for the period between 2005 and 2016.

Appendix B

Table B.1: Output-oriented DEA VRS Efficiency Scores Model 0

	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
AUS	1.05	1.10	1.06	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	1.05	1.18	1.10	1.07
AUT	1.08	1.14	1.11	1.24	1.32	1.39	2.03	1.99	1.29	1.44	1.26	1.36
BEL	1.22	1.23	1.33	1.38	1.41	1.51	2.20	2.03	1.38	1.50	1.31	1.41
CAN	1.07	1.14	1.03	1.29	1.32	1.40	1.82	1.65	1.07	1.33	1.14	1.25
CHE	**1.00**	**1.00**	**1.00**	1.11	1.16	1.23	1.68	1.44	**1.00**	1.11	1.01	1.15
CHL	1.15	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
CZE	1.32	1.32	1.24	1.44	1.57	1.70	2.86	2.51	1.46	1.50	1.41	1.41
DEU	1.21	1.26	1.24	1.31	1.34	1.42	2.06	1.89	1.22	1.37	1.21	1.30
DNK	1.11	1.15	1.37	1.25	1.39	1.52	2.26	2.01	1.26	1.36	1.23	1.18
ESP	1.02	1.07	1.31	1.52	1.75	2.01	5.26	5.18	1.70	1.72	1.51	1.62
EST	1.17	1.24	3.40	1.43	1.82	1.68	2.13	2.25	1.42	1.60	1.38	1.45
FIN	1.15	1.15	1.29	1.26	1.38	1.47	2.59	2.19	1.41	1.58	1.33	1.39
FRA	1.06	1.17	1.34	1.37	1.44	1.51	2.25	1.99	1.33	1.48	1.31	1.36
GBR	1.09	1.15	1.52	1.33	1.45	1.60	2.12	1.89	1.20	1.34	1.20	1.35
GRC	1.27	1.29	1.64	1.56	2.37	3.69			2.13	2.25	1.91	1.92
HUN	1.19	1.62	1.65	1.63	1.92	2.04	3.61	2.54	1.55	1.73	1.60	1.50
IRL	1.16	1.21	2.09	1.48	1.67	1.68	2.69	2.07	1.20	**1.00**	1.21	1.15
ISL	1.15	1.10	1.18	1.29	1.72	1.63	2.39	1.91	1.34	1.29	1.09	1.25
ISR	1.44	1.39	1.23	1.34	1.20	1.19	1.45	1.25	1.29	1.46	1.21	1.30
ITA	1.32	1.38	1.84	1.61	1.77	2.00	4.95	3.50	1.81	1.97	1.77	1.71
JPN	1.18	1.03	1.52	1.36	1.39	1.63	2.08	1.76	1.34	1.39	1.24	1.35
KOR	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	1.03	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
LTU	1.25	1.27	1.39	1.50	1.94	1.81	2.27	2.23	1.37	1.52	1.36	1.53
LUX	1.06	1.06	1.37	1.21	1.22	1.37	2.20	1.59	1.12	1.32	1.19	1.27
LVA	1.20	1.27	3.04	1.56	2.56	1.97	2.49	2.54	1.69	1.62	1.39	1.58
NLD	1.23	1.13	1.00	1.10	1.24	1.35	2.30	2.14	1.34	1.42	1.29	1.32
NOR	1.17	1.17	1.27	1.19	1.32	1.40	1.66	1.62	1.15	1.22	1.21	1.25
NZL	1.18	1.20	1.47	1.24	1.27	1.36	1.61	1.25	1.11	1.29	1.03	1.26
POL	1.52	1.50	1.21	1.30	1.20	1.11	1.33	1.48	1.48	1.61	1.43	1.50
PRT	1.45	1.43	1.39	1.58	1.66	2.08	6.12	3.66	1.70	1.79	1.57	1.51
SVK	1.35	1.38	1.09	1.46	1.51	1.71	2.27	2.31	1.54	1.57	1.43	1.53
SVN	1.29	1.31	1.14	1.37	1.63	1.83	3.98	2.89	1.50	1.71	1.49	1.51
SWE	1.16	1.18	1.47	1.28	1.23	1.40	2.25	1.82	1.27	1.23	1.13	1.33
TUR	1.43	1.57	1.68	1.58	1.44	1.33	1.45	1.32	1.18	1.32	1.38	1.53
USA	1.13	1.16	1.33	1.40	1.47	1.61	1.94	1.77	1.05	1.22	1.12	1.24
Count	2	3	3	3	3	3	2	3	3	3	2	2
Average	1.19	1.22	1.43	1.34	1.49	1.59	2.39	2.05	1.34	1.44	1.30	1.37
Median	1.17	1.18	1.33	1.34	1.41	1.51	2.20	1.95	1.33	1.42	1.26	1.35
Min	1	1	1	1	1	1	1	1	1	1	1	1
Max	1.52	1.62	3.40	1.63	2.56	3.69	6.12	5.18	2.13	2.25	1.91	1.92
Stdev	0.13	0.16	0.51	0.17	0.35	0.47	1.16	0.83	0.25	0.27	0.21	0.19

Table B.2: Output-oriented DEA VRS Efficiency Scores Model 1

	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
AUS	1.02	1.07	1.03	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	1.02	1.12	1.10	1.07
AUT	1.08	1.14	1.11	1.24	1.32	1.39	2.03	1.99	1.29	1.44	1.26	1.36
BEL	1.22	1.23	1.33	1.38	1.41	1.51	2.20	2.03	1.38	1.50	1.31	1.41
CAN	1.07	1.14	1.03	1.29	1.32	1.40	1.82	1.65	1.07	1.33	1.14	1.25
CHE	**1.00**	**1.00**	**1.00**	1.10	1.14	1.18	1.64	1.44	**1.00**	1.07	1.01	1.15
CHL	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
CZE	1.32	1.32	1.24	1.44	1.57	1.70	2.86	2.51	1.46	1.50	1.41	1.41
DEU	1.21	1.26	1.24	1.31	1.34	1.42	2.06	1.89	1.22	1.37	1.21	1.30
DNK	1.11	1.15	1.37	1.25	1.39	1.52	2.26	2.01	1.26	1.36	1.23	1.18
ESP	1.02	1.07	1.31	1.52	1.75	2.01	5.26	5.18	1.64	1.72	1.51	1.62
EST	1.14	1.19	3.33	1.43	1.82	1.68	2.13	2.25	1.42	1.55	1.38	1.45
FIN	1.15	1.15	1.29	1.26	1.38	1.47	2.59	2.19	1.41	1.58	1.33	1.39
FRA	1.06	1.17	1.34	1.37	1.44	1.51	2.25	1.99	1.33	1.48	1.31	1.36
GBR	1.03	1.15	1.52	1.33	1.45	1.60	2.12	1.89	1.20	1.34	1.20	1.35
GRC	1.27	1.29	1.64	1.56	2.37	3.69			2.13	2.25	1.91	1.92
HUN	1.19	1.62	1.65	1.63	1.92	2.04	3.61	2.54	1.55	1.73	1.60	1.50
IRL	1.15	1.21	2.09	1.48	1.67	1.68	2.69	2.07	1.18	**1.00**	1.21	1.15
ISL	1.15	1.10	1.18	1.29	1.72	1.63	2.39	1.91	1.34	1.26	1.09	1.25
ISR	1.44	1.39	1.23	1.34	1.19	1.17	1.41	1.25	1.28	1.41	1.21	1.30
ITA	1.32	1.38	1.84	1.61	1.77	2.00	4.95	3.50	1.81	1.97	1.77	1.71
JPN	1.17	1.03	1.52	1.33	1.39	1.62	2.08	1.76	1.34	1.39	1.24	1.35
KOR	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
LTU	1.24	1.25	1.39	1.50	1.94	1.81	2.27	2.18	1.35	1.51	1.36	1.53
LUX	1.06	1.06	1.37	1.21	1.22	1.37	2.20	1.59	1.10	1.32	1.19	1.27
LVA	1.19	1.24	2.94	1.53	2.56	1.96	2.49	2.54	1.69	1.57	1.39	1.58
NLD	1.23	1.13	1.00	1.10	1.24	1.35	2.30	2.14	1.34	1.42	1.29	1.32
NOR	1.17	1.17	1.27	1.19	1.32	1.40	1.66	1.62	1.15	1.22	1.21	1.25
NZL	1.17	1.20	1.47	1.24	1.27	1.36	1.61	1.25	1.11	1.23	1.03	1.26
POL	1.52	1.50	1.21	1.30	1.20	1.11	1.33	1.48	1.48	1.61	1.43	1.50
PRT	1.45	1.43	1.39	1.58	1.66	2.08	6.12	3.66	1.70	1.79	1.57	1.51
SVK	1.31	1.37	1.08	1.40	1.51	1.67	2.23	2.25	1.49	1.57	1.43	1.53
SVN	1.29	1.31	1.14	1.37	1.63	1.83	3.98	2.89	1.50	1.71	1.49	1.51
SWE	1.16	1.18	1.47	1.28	1.23	1.40	2.25	1.82	1.27	1.23	1.13	1.33
TUR	1.31	1.44	1.60	1.44	1.37	1.23	**1.00**	1.22	1.12	1.26	1.38	1.53
USA	1.04	1.07	1.28	1.35	1.47	1.61	1.94	1.77	**1.00**	1.09	1.12	1.24
Count	3	3	3	3	3	3	4	3	4	3	2	2
Average	1.18	1.21	1.43	1.33	1.49	1.58	2.37	2.04	1.33	1.43	1.30	1.37
Median	1.17	1.18	1.31	1.33	1.39	1.51	2.20	1.95	1.33	1.41	1.26	1.35
Min	1	1	1	1	1	1	1	1	1	1	1	1
Max	1.52	1.62	3.33	1.63	2.56	3.69	6.12	5.18	2.13	2.25	1.91	1.92
Stdev	0.13	0.15	0.50	0.17	0.35	0.47	1.18	0.83	0.26	0.28	0.21	0.19

Table B.3: Output-oriented DEA VRS Efficiency Scores Model 2

	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
AUS	1.01	1.05	1.05	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	1.02	1.08	1.09	1.01
AUT	1.05	1.06	1.05	1.05	1.06	1.07	1.08	1.08	1.09	1.11	1.12	1.14
BEL	1.13	1.13	1.13	1.14	1.15	1.14	1.14	1.14	1.14	1.16	1.14	1.17
CAN	1.07	1.08	1.03	1.08	1.07	1.08	1.08	1.09	1.06	1.11	1.12	1.11
CHE	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
CHL	1.01	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
CZE	1.28	1.31	1.21	1.30	1.29	1.28	1.28	1.31	1.31	1.30	1.31	1.27
DEU	1.08	1.08	1.08	1.09	1.10	1.10	1.09	1.09	1.10	1.10	1.12	1.12
DNK	1.03	1.03	1.05	1.06	1.06	1.05	1.09	1.11	1.09	1.09	1.10	1.06
ESP	**1.00**	**1.00**	1.24	1.25	1.23	1.22	1.20	1.19	1.21	1.23	1.24	1.25
EST	1.16	1.23	1.25	1.23	1.21	1.20	1.21	1.21	1.20	1.22	1.21	1.21
FIN	1.02	1.02	1.02	1.04	1.04	1.03	1.02	1.02	1.03	1.05	1.04	1.04
FRA	1.06	1.09	1.10	1.11	1.10	1.10	1.11	1.11	1.13	1.14	1.16	1.17
GBR	1.09	1.12	1.16	1.17	1.15	1.12	1.11	1.11	1.12	1.12	1.12	1.14
GRC	1.26	1.25	1.38	1.39	1.40	1.41	1.42	1.39	1.38	1.41	1.43	1.44
HUN	1.18	1.38	1.44	1.42	1.37	1.37	1.37	1.36	1.35	1.40	1.46	1.36
IRL	1.13	1.19	1.21	1.19	1.19	1.16	1.11	1.11	1.11	**1.00**	**1.00**	**1.00**
ISL	1.02	1.05	1.06	1.05	1.05	1.06	1.07	1.09	1.10	1.10	1.08	1.11
ISR	1.20	1.22	1.23	1.27	1.19	1.16	1.17	1.15	1.29	1.28	1.19	1.17
ITA	1.31	1.35	1.46	1.43	1.41	1.41	1.41	1.34	1.36	1.41	1.40	1.40
JPN	1.06	1.00	1.09	1.10	1.10	1.09	1.10	1.08	1.07	1.07	1.09	1.10
KOR	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
LTU	1.24	1.21	1.38	1.36	1.36	1.35	1.33	1.31	1.27	1.24	1.25	1.24
LUX	1.05	1.03	1.11	1.08	1.07	1.08	1.08	1.07	1.07	1.09	1.11	1.11
LVA	1.18	1.18	1.43	1.39	1.38	1.39	1.37	1.34	1.32	1.32	1.36	1.35
NLD	1.06	1.06	**1.00**	1.03	1.07	1.06	1.04	1.04	1.04	1.03	1.05	1.05
NOR	1.11	1.12	1.15	1.10	1.14	1.15	1.11	1.12	1.12	1.11	1.14	1.11
NZL	1.10	1.13	1.15	1.10	1.10	1.09	1.06	1.02	1.07	1.08	1.02	1.10
POL	1.47	1.49	1.10	1.25	1.13	1.03	1.27	1.30	1.38	1.38	1.39	1.34
PRT	1.23	1.23	1.25	1.23	1.23	1.22	1.20	1.19	1.18	1.20	1.23	1.21
SVK	1.34	1.36	**1.00**	1.36	1.38	1.43	1.42	1.46	1.45	1.42	1.41	1.38
SVN	1.29	1.29	1.11	1.23	1.25	1.28	1.27	1.29	1.30	1.32	1.33	1.32
SWE	1.11	1.09	1.09	1.07	1.06	1.07	1.10	1.10	1.13	1.12	1.11	1.11
TUR	1.42	1.43	1.48	1.41	1.30	1.23	1.20	1.19	1.17	1.22	1.23	1.24
USA	1.04	1.08	1.09	1.10	1.11	1.12	1.12	1.11	1.02	1.09	1.09	1.07
Count	3	4	5	4	4	4	4	4	3	4	4	4
Average	1.14	1.15	1.16	1.17	1.16	1.16	1.16	1.16	1.16	1.17	1.18	1.17
Median	1.10	1.12	1.11	1.11	1.13	1.12	1.11	1.11	1.12	1.12	1.12	1.14
Min	1	1	1	1	1	1	1	1	1	1	1	1
Max	1.47	1.49	1.48	1.43	1.41	1.43	1.42	1.46	1.45	1.42	1.46	1.44
Stdev	0.13	0.14	0.15	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.13

Appendix C

Table C.1– Summary Statistics

Variable	Obs	Mean	Std. Dev.
Dependent Variables			
Moodys	408	17.59	3.98
SP	408	17.81	3.63
Fitch	408	17.87	3.5
Average Rating	408	17.76	3.66
Rating PCA	408	0.55	0.73
Independent Variables			
PSE_0 (t-1)	406	0.72	0.17
PSE_1 (t-1)	406	0.73	0.17
PSE_2 (t-1)	408	0.87	0.09
Inflation rate (t-1)	408	2.17	2.24
Terms of trade index (t-1)	408	99.6	7.27
Debt-to-GDP ratio (t-1)	408	64.80	42.32
Ln(Foreign reserves) (t-1)	408	23.83	1.77
Ln(GDP per capita (t-1)	408	4.57	2

Notes: The rating variables are grouped in in 21 categories. The output efficiency scores (PSE) were transformed by computing PSE=1/φ and are available for three models (Model 0, 1 and 2). For Model 0 and 1, Greece's PSP score is negative in 2012 and 2013, therefore we cannot compute its efficiency score for Model 0 and 1.

Table C.2 Unconditional regression on alternative rating variables and alternative efficiency scores

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	Moodys	SP	Fitch	Average Rating	Rating PCA	Moodys	SP	Fitch	Average Rating	Rating PCA
PSE_1 (t-1)	7.782***	6.550***	6.183***	6.838***	1.355***					
	(1.183)	(0.875)	(0.871)	(0.943)	(0.187)					
PSE_2 (t-1)						9.894***	7.047***	7.224***	8.055***	1.594***
						(3.116)	(2.556)	(2.599)	(2.707)	(0.536)
Constant	15.215***	15.393***	16.459***	15.689***	0.142	13.070***	14.792***	15.352***	14.405***	-0.111
	(1.124)	(0.823)	(0.835)	(0.892)	(0.177)	(2.909)	(2.378)	(2.438)	(2.526)	(0.501)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	406	406	406	406	406	408	408	408	408	408
R-squared	0.849	0.892	0.884	0.883	0.884	0.834	0.875	0.871	0.867	0.868

Note: standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. Country and time fixed effects included but omitted for reasons of parsimony.

Table C.3 Conditional regression on alternative rating variables and alternative efficiency scores

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	Moodys	SP	Fitch	Average Rating	Rating PCA	Moodys	SP	Fitch	Average Rating	Rating PCA
PSE_1 (t-1)	3.704***	3.787***	3.194***	3.562***	0.707***					
	(0.821)	(0.674)	(0.576)	(0.639)	(0.127)					
PSE_2 (t-1)						4.916***	3.934**	3.575**	4.142***	0.820***
						(1.705)	(1.587)	(1.507)	(1.513)	(0.300)
Inflation (t-1)	-0.047	-0.074	-0.045	-0.056	-0.011	-0.055	-0.078	-0.051	-0.061	-0.012
	(0.055)	(0.058)	(0.047)	(0.048)	(0.009)	(0.060)	(0.067)	(0.052)	(0.054)	(0.011)
Terms of trade index (t-1)	-0.015	-0.017	-0.026**	-0.019+	-0.004+	-0.010	-0.011	-0.021*	-0.014	-0.003
	(0.016)	(0.012)	(0.011)	(0.012)	(0.002)	(0.016)	(0.012)	(0.012)	(0.012)	(0.002)
Debt ratio (t-1)	-0.093***	-0.064***	-0.070***	-0.076***	-0.015***	-0.100***	-0.073***	-0.077***	-0.083***	-0.017***
	(0.009)	(0.006)	(0.007)	(0.007)	(0.001)	(0.009)	(0.006)	(0.007)	(0.007)	(0.001)
Ln(Reserves) (t-1)	-0.422***	-0.570***	-0.380***	-0.457***	-0.091***	-0.443**	-0.582***	-0.393***	-0.473***	-0.094***
	(0.158)	(0.122)	(0.121)	(0.127)	(0.025)	(0.172)	(0.131)	(0.131)	(0.139)	(0.027)
Constant	38.386***	39.094***	36.884***	38.121***	4.592***	37.746***	39.268***	36.846***	37.954***	4.560***
	(4.583)	(3.425)	(3.515)	(3.641)	(0.721)	(4.823)	(3.489)	(3.783)	(3.843)	(0.761)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	406	406	406	406	406	408	408	408	408	408
R-squared	0.908	0.931	0.929	0.931	0.932	0.908	0.926	0.928	0.929	0.929

Note: standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. Country and time fixed effects included but omitted for reasons of parsimony.

Table C.4 Conditional robustness regression on alternative rating variables and alternative efficiency scores (Model 1)

	Moodys					Standard & Poors				Fitch			
	(1)		(2)			(3)		(4)		(5)		(6)	
	Ordered probit		Ordered logit			Ordered probit		Ordered logit		Ordered probit		Ordered logit	
PSE_1 (t-1)	1.995	***	3.427	***	PSE_1 (t-1)	2.199	***	3.665	***	1.920	***	3.235	***
	(0.391)		(0.672)			(0.389)		(0.670)		(0.390)		(0.666)	
Inflation (t-1)	-0.174	***	-0.267	***	Inflation (t-1)	-0.187	***	-0.311	***	-0.173	***	-0.282	***
	(0.026)		(0.047)			(0.026)		(0.047)		(0.026)		(0.048)	
Terms of trade index (t-1)	0.008		0.012		Terms of trade index (t-1)	0.007		0.009		0.004		0.005	
	(0.009)		(0.016)			(0.009)		(0.016)		(0.009)		(0.016)	
Debt ratio (t-1)	-0.010	***	-0.015	***	Debt ratio (t-1)	-0.010	***	-0.015	***	-0.010	***	-0.015	***
	(0.001)		(0.002)			(0.001)		(0.002)		(0.001)		(0.002)	
Ln(Reserves) (t-1)	0.186	***	0.310	***	Ln(Reserves) (t-1)	0.147	***	0.246	***	0.158	***	0.259	***
	(0.035)		(0.064)			(0.035)		(0.061)		(0.035)		(0.061)	
Cut off 2	1.650		2.518		Cut off 6	1.005		0.739		1.312		1.724	
	(1.219)		(2.158)			(1.172)		(2.099)		(1.146)		(1.936)	
Cut off 3	2.076	*	3.280		Cut off 8	1.640		2.203		1.467		2.038	
	(1.179)		(2.045)			(1.138)		(1.920)		(1.142)		(1.916)	
Cut off 4	2.498	**	4.046	*	Cut off 9	1.765		2.453		1.597		2.289	
	(1.161)		(1.988)			(1.136)		(1.909)		(1.139)		(1.905)	
Cut off 6	2.631	**	4.292	**	Cut off 10	1.952	*	2.826		1.712		2.500	
	(1.158)		(1.977)			(1.133)		(1.896)		(1.137)		(1.899)	
Cut off 9	2.743	**	4.495	**	Cut off 11	2.477	**	3.838		1.809		2.678	
	(1.156)		(1.970)			(1.128)		(1.874)		(1.136)		(1.894)	
Cut off 10	3.137	***	5.196	***	Cut off 12	2.827	**	4.485		2.379		3.720	*
	(1.150)		(1.954)			(1.125)		(1.866)		(1.130)		(1.878)	
Cut off 11	3.297	***	5.482	***	Cut off 13	3.267	***	5.273	**	2.750		4.392	**
	(1.148)		(1.951)			(1.124)		(1.864)		(1.129)		(1.874)	
Cut off 12	3.770	***	6.328	***	Cut off 14	3.504	***	5.678	**	3.036	**	4.904	***
	(1.146)		(1.947)			(1.124)		(1.865)		(1.128)		(1.870)	

Cut off 13	4.325***	7.289***	Cut off 15	3.715***	6.032***	3.506**	5.712***
	(1.150)	(1.954)		(1.125)	(1.866)	(1.129)	(1.872)
Cut off 14	4.516***	7.611***	Cut off 16	3.927***	6.386***	3.837***	6.268***
	(1.151)	(1.957)		(1.127)	(1.869)	(1.133)	(1.879)
Cut off 15	4.730***	7.966***	Cut off 17	4.142***	6.742***	4.012***	6.556***
	(1.154)	(1.962)		(1.130)	(1.873)	(1.135)	(1.882)
Cut off 16	4.906***	8.256***	Cut off 18	4.468***	7.274***	4.353***	7.111***
	(1.156)	(1.966)		(1.133)	(1.879)	(1.138)	(1.888)
Cut off 17	5.168***	8.684***	Cut off 19	4.639***	7.552***	4.614***	7.535***
	(1.160)	(1.973)		(1.135)	(1.882)	(1.140)	(1.891)
Cut off 18	5.533***	9.275***	Cut off 20	4.971***	8.094***	4.785***	7.813***
	(1.164)	(1.980)		(1.136)	(1.887)	(1.140)	(1.892)
Cut off 19	5.727***	9.588***	Cut off 21	5.235***	8.528***	4.920***	8.034***
	(1.165)	(1.982)		(1.137)	(1.890)	(1.140)	(1.894)
Cut off 20	5.882***	9.838***					
	(1.165)	(1.983)					
Cut off 21	6.033***	10.086***					
	(1.165)	(1.984)					
N	357	357		357	357	357	357

Note: standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. Country and time fixed effects included but omitted for reasons of parsimony.

Table C.5 Conditional robustness regression on alternative rating variables and alternative efficiency scores (Model 2)

	Moodys					Standard & Poors				Fitch			
	(1)		(2)			(3)		(4)		(5)		(6)	
	Ordered probit		Ordered logit			Ordered probit		Ordered logit		Ordered probit		Ordered logit	
PSE_2 (t-1)	8.372	***	15.488	***	PSE_2 (t-1)	9.108	***	16.307	***	8.735	***	15.909	***
	(0.725)		(1.409)			(0.739)		(1.405)		(0.729)		(1.414)	
Inflation (t-1)	-0.164	***	-0.279	***	Inflation (t-1)	-0.182	***	-0.307	***	-0.168	***	-0.284	***
	(0.027)		(0.049)			(0.027)		(0.047)		(0.027)		(0.048)	
Terms of trade index (t-1)	0.020		0.039		Terms of trade index (t-1)	0.020		0.033		0.014		0.029	
	(0.010)		(0.020)			(0.010)		(0.019)		(0.010)		(0.019)	
Debt ratio (t-1)	-0.012	***	-0.020	***	Debt ratio (t-1)	-0.012	***	-0.021	***	-0.012	***	-0.020	***
	(0.001)		(0.002)			(0.001)		(0.002)		(0.001)		(0.002)	
Ln(Reserves) (t-1)	0.155	***	0.254	***	Ln(Reserves) (t-1)	0.116	***	0.195	***	0.119	***	0.192	***
	(0.036)		(0.065)			(0.035)		(0.063)		(0.035)		(0.063)	
Cut off 2	7.158	***	13.286	***	Cut off 6	6.944	***	11.836	***	6.698	***	12.343	***
	(1.363)		(2.637)			(1.317)		(2.531)		(1.280)		(2.443)	
Cut off 3	7.588	***	14.089	***	Cut off 7	7.799	***	13.637	***	7.015	***	12.951	***
	(1.330)		(2.553)			(1.282)		(2.390)		(1.274)		(2.426)	
Cut off 4	8.203	***	15.193	***	Cut off 8	7.928	***	13.871	***	7.142	***	13.180	***
	(1.313)		(2.512)			(1.281)		(2.389)		(1.273)		(2.424)	
Cut off 5	8.336	***	15.426	***	Cut off 9	8.045	***	14.076	***	7.258	***	13.385	***
	(1.312)		(2.510)			(1.281)		(2.390)		(1.273)		(2.424)	
Cut off 6	8.455	***	15.630	***	Cut off 10	8.233	***	14.410	***	7.368	***	13.579	***
	(1.312)		(2.510)			(1.280)		(2.391)		(1.273)		(2.427)	
Cut off 9	8.565	***	15.818	***	Cut off 11	8.774	***	15.381	***	7.470	***	13.754	***
	(1.312)		(2.512)			(1.280)		(2.391)		(1.273)		(2.429)	
Cut off 10	8.978	***	16.519	***	Cut off 12	9.152	***	16.051	***	8.067	***	14.808	***
	(1.311)		(2.517)			(1.281)		(2.392)		(1.272)		(2.433)	
Cut off 11	9.153	***	16.815	***	Cut off 13	9.639	***	16.897	***	8.473	***	15.525	***
	(1.311)		(2.518)			(1.284)		(2.398)		(1.273)		(2.437)	

Cut off 12	9.653	***	17.682	***	Cut off 14	9.910	***	17.358	***	8.815	**	16.113	***
	(1.311)		(2.522)			(1.287)		(2.404)		(1.275)		(2.442)	
Cut off 13	10.225	***	18.655	***	Cut off 15	10.153	***	17.768	***	9.366	***	17.052	***
	(1.316)		(2.533)			(1.291)		(2.411)		(1.282)		(2.457)	
Cut off 14	10.430	***	19.000	***	Cut off 16	10.397	***	18.171	***	9.755	***	17.698	***
	(1.320)		(2.540)			(1.295)		(2.418)		(1.291)		(2.473)	
Cut off 15	10.668	***	19.400	***	Cut off 17	10.656	***	18.594	***	9.967	***	18.045	***
	(1.324)		(2.551)			(1.301)		(2.427)		(1.295)		(2.481)	
Cut off 16	10.868	***	19.734	***	Cut off 18	11.090	***	19.309	***	10.399	***	18.763	***
	(1.329)		(2.560)			(1.311)		(2.445)		(1.303)		(2.496)	
Cut off 17	11.187	***	20.269	***	Cut off 19	11.330	***	19.714	***	10.741	***	19.349	***
	(1.337)		(2.575)			(1.316)		(2.454)		(1.307)		(2.507)	
Cut off 18	11.673	***	21.091	***	Cut off 20	11.780	***	20.499	***	10.965	***	19.741	***
	(1.348)		(2.596)			(1.322)		(2.470)		(1.309)		(2.513)	
Cut off 19	11.927	***	21.529	***	Cut off 21	12.117	***	21.091	***	11.139	***	20.050	
	(1.352)		(2.604)			(1.325)		(2.481)		(1.310)		(2.518)	
Cut off 20	12.123	***	21.872	***									
	(1.354)		(2.614)										
Cut off 21	12.317	***	22.211	***									
	(1.354)		(2.614)										
N	357		357			357		357		357		357	

Note: standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. Country and time fixed effects included but omitted for reasons of parsimony.

Table C.6. Endogeneity robust conditional regression on alternative rating variables and alternative efficiency scores (Model 1)

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	Moodys	Moodys	SP	SP	Fitch	Fitch	Average Rating	Average Rating	Rating PCA	Rating PCA
	IV1	IV2	IV1	IV2	IV1	IV2	IV1	IV2	IV1	IV2
PSE_1 (t-1)	4.505	4.745*	3.286*	2.366	3.460*	4.291**	3.750*	3.800**	0.743*	0.752**
	(2.989)	(2.579)	(1.959)	(1.698)	(2.072)	(1.793)	(2.192)	(1.891)	(0.434)	(0.374)
Inflation (t-1)	0.043	0.042	0.125**	0.130**	0.088	0.084	0.085	0.085	0.017	0.017
	(0.092)	(0.092)	(0.060)	(0.060)	(0.064)	(0.064)	(0.068)	(0.067)	(0.013)	(0.013)
Terms of trade index (t-1)	-0.031	-0.031	-0.022*	-0.021*	-0.028**	-0.029**	-0.027*	-0.027*	-0.005*	-0.005*
	(0.019)	(0.019)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)	(0.003)	(0.003)
Debt ratio (t-1)	-0.083***	-0.082***	-0.065***	-0.068***	-0.072***	-0.069***	-0.073***	-0.073***	-0.015***	-0.014***
	(0.014)	(0.013)	(0.009)	(0.009)	(0.010)	(0.009)	(0.011)	(0.010)	(0.002)	(0.002)
Ln(Reserves) (t-1)	-0.994**	-0.992**	-0.673**	-0.680**	-0.393	-0.387	-0.687*	-0.686*	-0.136*	-0.136*
	(0.483)	(0.483)	(0.317)	(0.318)	(0.335)	(0.336)	(0.355)	(0.354)	(0.070)	(0.070)
Constant	52.328***	52.044***	42.220***	43.309***	36.809***	35.826***	43.786***	43.726***	5.699***	5.687***
	(12.405)	(12.276)	(8.129)	(8.083)	(8.598)	(8.538)	(9.099)	(9.004)	(1.800)	(1.781)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	163	163	163	163	163	163	163	163	163	163
R-squared	0.917	0.917	0.957	0.957	0.951	0.950	0.948	0.948	0.948	0.948
Kleibergen-Paap F-statistics	11.85	8.358	11.85	8.358	11.85	8.358	11.85	8.358	11.85	8.358

Note: standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. Country and time fixed effects included but omitted for reasons of parsimony.

Table C.7. First stage results of Table 6

Specification	(1)	(2)
Dependent variable	PSE_0 (t-1)	PSE_0 (t-1)
Regressors\estimation	IV1	IV2
constraints (t-1)	0.040**	0.045
	(0.020)	(0.032)
polconv (t-1)	-0.625***	-0.255
	(0.173)	(0.242)
constraints (t-2)		0.018
		(0.038)
polconv (t-2)		-0.537**
		(0.249)
Inflation (t-1)	0.009	0.010*
	(0.006)	(0.006)
Terms of trade index (t-1)	0.004***	0.004***
	(0.001)	(0.001)
Debt ratio (t-1)	-0.003***	-0.003***
	(0.001)	(0.001)
Ln(Reserves) (t-1)	-0.003	-0.004
	(0.032)	(0.032)
Constant	1.046	0.997
	(0.804)	(0.799)
Country effects	Yes	Yes
Time effects	Yes	Yes
Observations	163	163

Note: standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. Country and time fixed effects included but omitted for reasons of parsimony.

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