

Electronic supplementary material
“Press Freedom and Government Spending Efficiency”

Appendix A Further robustness

Subsection A.1 Additional controls

In subsection 7.1.1 of the main manuscript, we progressively augment the baseline model with the following additional controls: GDP per capita, economic freedom, the strength of fiscal rules, a dummy variable for elections, civil society strength, the independence of the judiciary, and the quality of bureaucracy.¹ Per capita income is included to account for the level of economic development, given the heterogeneity of our sample, which includes both advanced and developing countries. We expect a positive effect, reflecting the association between institutional quality and per capita income. Economic freedom captures the extent to which a country’s institutions and policies support personal choice, voluntary exchange, market competition, and the protection of private property (Gwartney et al. 2021). Controlling for this variable is therefore important to account for reforms that may be correlated with both media freedom and spending efficiency, particularly given evidence that greater economic freedom is associated with subsequent improvements in press freedom (Bjørnskov 2018). Fiscal rules are included as studies show that they promote fiscal sustainability and public expenditure efficiency (Heinemann et al. 2018; Apeti et al. 2025). The effect of elections on efficiency is less straightforward. According to Rogoff (1987)’s equilibrium budget cycle model, decision-makers may favor visible current spending, such as wages and subsidies, during election years rather than investment spending, which is more likely to improve long-term economic outcomes. Empirically, Schuknecht (2000) finds that investment spending tends to increase during election years, whereas Vergne (2009) reports that an increase in

1. We follow previous studies (for instance, see Gootjes et al. 2021 and Apeti et al. 2025) and compute the fiscal rules index as an aggregation of five aspects of fiscal rules (coverage; legal basis; supporting procedures; enforcement; and flexibility), based on the IMF Fiscal Rules Dataset. The index can range from 0 to 5, where higher values indicate a strengthening of fiscal rules. Table C4 reports the sources and the definition of our additional controls.

current expenditures often characterizes political budget cycles. Regarding civil society strength, a positive effect on efficiency is expected, as a strong and autonomous civil society can pressure the government and demand greater accountability in public resource management. Similarly, an independent judiciary is a key pillar of democratic governance, ensuring that rulers are held accountable to the governed. Finally, a high-quality bureaucracy reflects institutional strength and can serve as a shock absorber during government changes, minimizing policy revisions and interruptions in public services.

The additional controls are introduced in Columns [2] to [9] of Table 1 of the main manuscript. The results confirm our main findings regarding the positive and statistically significant effect of press freedom on efficiency. Regarding the additional controls, we find that fiscal rules, elections, and judicial independence are all positively and significantly associated with efficiency.

Subsection A.2 Alternative subsamples

We then re-estimate our baseline model using various subsamples to assess the sensitivity of our results to sample dependence and outliers. In Columns [2] and [3] of Table A1 (Panel A), we exclude country-year observations in which the dependent variable and the variable of interest fall above the 95th percentile and below the first quartile, respectively, to limit the influence of extreme values. Column [4] restricts the analysis to the period from 2002 onward, which marks the beginning of the decline in press freedom in our sample (see Figure 1 in the main manuscript). Our sample also includes seven countries classified by the IMF as institutionally and socially fragile, as well as twelve countries experiencing persistent or recurring conflict. Given that these countries differ systematically from the rest of the sample, their inclusion in the baseline specification may affect the stability of the estimated coefficients. Accordingly, Column [5] excludes fragile and conflict-affected countries from the analysis. Overall, the results remain robust across all specifications.

Subsection A.3 Alternative measures

This section assesses the robustness of our results to alternative measurements of the two main variables, starting with the dependent variable. In the baseline efficiency indicator, among Musgravian functions, the outcome indicators associated with the government’s performance function include: GDP per capita, average growth over ten years, and the 10-year average unemployment rate. As a robustness check, Apeti et al. (2024) incorporate a subjective measure of economic performance by replacing GDP per capita with a happiness indicator. The authors also re-estimate the efficiency index using the Greene (2005) approach, rather than the Kumbhakar et al. (2015) method employed in the baseline specification. The latter proceeds in three steps: first, residuals are obtained from the panel model; second, time-varying inefficiency is estimated; and third, country-specific persistent inefficiency is identified. These components are then combined to compute overall efficiency. By contrast, the Greene (2005) approach provides a more direct estimation while disentangling individual heterogeneity from stochastic noise. The results based on these two alternative measures, reported in the first two columns of Panel B of Table A1, remain robust.

We then turn to our right-hand side variable. For robustness, we use the political pressures and control of media content indicator from the Quality of Government Standard Dataset. This variable captures the degree of political influence over news media, covering editorial independence of public and private outlets, access to information and sources, official censorship and self-censorship, media vibrancy, and journalists’ freedom to report without harassment, intimidation, arbitrary detention, violence, or other threats. The original scale ranges from 0 to 40, where 0 denotes maximum freedom. To align this index with our media freedom measure, we rescale it to 0-100 and invert it so that higher values indicate greater press freedom. Media freedom exhibits a strong positive correlation with this alternative measure, as indicated by a correlation coefficient of roughly 0.97. Results based on this alternative indicator, reported in the last column of Table A1 (Panel B), are very close to those obtained using the Freedom House measure.

Subsection A.4 Structural breaks

The 2008-2009 global financial crisis represented a major structural break, sharply weakening economic performance, straining public finances, and reshaping governance dynamics, with direct implications for public expenditure management. Similarly, the Arab Spring had significant economic and institutional consequences, potentially affecting our results. To account for these structural breaks, we restrict the analysis to the post-2000 period, when press freedom begins its structural decline in our sample. This allows us to leverage a period of greater variability, increasing the likelihood of capturing major disruptions in the relationship between press freedom and government efficiency. We further include two interaction terms to explicitly model these breaks. The first interacts press freedom with a post-crisis dummy, equal to 1 after 2009. The second captures the structural break specific to the Arab Spring by interacting press freedom with a dummy equal to 1 for Tunisia, Egypt, Libya, Syria, Yemen, and Bahrain from 2011 onward, reflecting the prolonged political and institutional instability triggered by these uprisings. The results for the two interaction terms are reported in Columns [1] and [2] of Panel C (Table A1), respectively. We observe that the positive effect of press freedom on government spending efficiency remains robust both before and after the global financial crisis and the Arab Spring, and is even amplified in the post-crisis and post-Arab Spring periods. This suggests that the role of the media in enhancing transparency, public sector accountability, and civic engagement is particularly crucial during periods of crisis, when these functions are most needed. The results regarding the Arab Spring align with Khondker (2011), who emphasizes that new media played a crucial role during this period, particularly in contexts lacking free media and an active civil society, by facilitating social mobilization and enabling interaction with traditional media such as television, radio, and mobile phones.

Table A1: Press Freedom and Public Expenditure Efficiency: Additional robustness

Panel A: Alternative subsamples	[1]	[2]	[3]	[4]	[5]
	Baseline model				
Media freedom	0.122*** (0.040)	0.051** (0.025)	0.175*** (0.052)	0.161*** (0.049)	0.156*** (0.041)
Observations	2747	1961	1937	1912	2381
R-squared	0.2569	0.2339	0.273	0.1585	0.2585
Baseline controls/Country FE/Year FE	Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes
Panel B: Alternative measures			[1]	[2]	[3]
Media freedom			0.124** (0.050)	0.100** (0.039)	
Political control of media					0.079** (0.033)
Observations			2829	2747	2042
R-squared			0.1474	0.2393	0.1595
Baseline controls/Country FE/Year FE			Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes
Panel C: Structural breaks				[1]	[2]
Media freedom				0.139*** (0.041)	0.238*** (0.047)
Media freedom * Post 2008-2009 GFC				0.101*** (0.036)	
Media freedom * Post Arab Spring					0.141** (0.065)
Observations				2042	
R-squared				0.1836	0.0723
Baseline controls/Country FE/Year FE				Yes/Yes/Yes	Yes/Yes/Yes

Column [1] of Panel A reports the results of the baseline model estimated using the OLS method. Both spending efficiency and press freedom are measured on a 0–100 scale, with higher values indicating better performance. Columns [2] and [3] exclude country-year observations above the 95th percentile and below the first quartile of spending efficiency and press freedom, respectively, to reduce the influence of extreme values. Column [4] restricts the sample to 2002 onward, capturing the onset of declining press freedom, while Column [5] excludes fragile and conflict-affected countries. In the first column of Panel B, we use an alternative efficiency measure from Apeti et al. (2024), in which the authors adopt a subjective approach to computing economic performance outcomes by replacing GDP per capita with a happiness measure. Similarly, in the second column, efficiency is re-estimated using the Greene (2005) method instead of the Kumbhakar et al. (2015) approach employed in the main model. In the last column, we use an alternative measure of our press freedom index for robustness, namely, the political pressures and control of the media content variable from the Quality of Government Standard Dataset. The index has been rescaled to 0–100 and inverted so that higher values represent greater press freedom, making it comparable with our main index. In Panel C, interaction terms capture the post-crisis period and the period following the Arab Spring in selected MENA countries, and the sample is restricted to the post-2000 period to exploit greater variability and capture potential structural breaks. All regressions include the constant, not reported in the table. Robust standard errors clustered at the country level are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix B Average treatment effects

Subsection B.1 The method

Our results so far are based on a continuous press freedom index, which allows us to capture greater variability in press freedom and provides a measure of its strength. However, the Freedom House database offers an alternative classification, indicating whether the media environment is “free,” “partially free,” or “not free.” This classification enables the use of different estimation methods, such as impact evaluation techniques, which can serve as an additional approach to address potential endogeneity in press freedom, alongside the instrumental variable method employed in the main manuscript—although binary or categorical variables entail a loss of information compared to a continuous index. In what follows, for robustness, we consider two binary variables: one equal to 1 for country-year observations where the media are classified as free (and 0 otherwise), and another for partially free media. This approach allows us to account for gradations in media capture, particularly in hybrid or partially free regimes. We adopt a program evaluation methodology to estimate the average treatment effect on the treated (ATT), defined as the difference in efficiency between treated and untreated units. The ATT is defined as follows:

$$ATT = E[(Y_{i1}|T_i=1)] - E[(Y_{i0}|T_i=1)] \quad (A1)$$

T_i is a binary variable indicating treatment. In our main model, the variable takes the value of 1 if the media in country i are classified as free in year t , and 0 otherwise. Y_{i0} represents the outcome for untreated units, i.e., country-year observations where the media are not free ($T_i=0$), and Y_{i1} represents the outcome for treated units ($T_i=1$). The treatment effect thus corresponds to the difference in expenditure efficiency between the situation where media are classified as free and the situation where they are not. This approach, however, faces the so-called counterfactual problem. Indeed, in a free media environment, it is impossible to observe how public spending efficiency would have evolved if the media were not free. One way to address this issue is to adopt a counterfactual framework based on untreated observations, which serve as a potential

control group for the treated units. However, this approach assumes that treatment assignment is purely exogenous, which might not hold in our context. For example, the very fact that a media environment is free may be driven by unobservable factors, such as political ideology, cultural characteristics, foreign diplomatic influences, or other determinants that are difficult to capture in an econometric model, potentially generating selection bias. The matching approach addresses the counterfactual problem by creating a context that approximates random treatment assignment. Treated units are then paired with untreated units that have similar pre-treatment characteristics. The ATT obtained from this method can be formally expressed as follows:

$$ATT(\chi) = E[Y_{i1}|T_i = 1, X = \chi] - E[Y_{i0}|T_i = 0, X = \chi] \quad (\text{A2})$$

χ represents a set of pre-treatment covariates described in Subsection B.2, which are correlated with the treatment and potentially with the outcome variable. $E[Y_{i1} | T_i=1, X=\chi]$ denotes the expected outcome for the treated units, while $E[Y_{i0} | T_i=0, X=\chi]$ represents the expected outcome for the best counterfactuals of the treated units. Our matching strategy relies on entropy balancing (Hainmueller 2012), a two-step estimation technique. In the first step, weights are assigned to untreated units so that the averages of the pre-treatment covariates in the control group closely match those of the treated group. This procedure creates a synthetic control group comparable to the treated units. In the second step, these weights are incorporated into a linear regression where the treatment indicator serves as the explanatory variable. This approach offers several advantages over traditional matching methods. Its non-parametric nature reduces the risk of model misspecification, while the weighting procedure orthogonalizes covariates relative to the treatment, mitigating multicollinearity and ensuring balanced pre-treatment characteristics across groups, even with small samples or few untreated units. Moreover, incorporating fixed effects in the second-stage regression controls for unobserved heterogeneity, thereby enabling a more efficient use of the panel structure of our sample (see Neuenkirch et al. 2016; Apeti et al. 2023; or Bambe et al. 2024 for further discussion).

Subsection B.2 Data

We consider two groups of variables. The first group, consisting of covariates, includes factors that are likely to influence a country’s media freedom status. Building on Barro (1999), we include the following potential determinants of press freedom: the level of democracy, GDP per capita, GDP per capita growth, human capital, Internet access, natural resources, and the urbanization rate.² The link between democracy and press freedom is direct, as both are closely intertwined and historical demands for democratization have often been accompanied by calls for media freedom (De Smaele 2006). A nation’s wealth, measured by GDP per capita or its growth, can influence the quality of institutions, including press freedom, as wealthier populations are better able to finance independent and transparent media. Similarly, better-educated citizens are more likely to assert their rights, participate in civic and political life, and critically evaluate information. Education may also enhance income prospects, providing an additional means to support a free and independent press. The role of Internet access is more nuanced. While it facilitates the dissemination of information and promotes transparency, it can also enable the spread of misinformation, potentially weakening media credibility and biasing perceptions. A strong endowment of natural resources may undermine institutional quality through the well-known “resource curse”, by fostering rent-seeking behavior and heightening the risk of instability (Mehlum et al. 2006). Lastly, although the link between urbanization and institutional quality is less clear, some studies suggest that rural areas tend to have weaker institutions, as lower organizational capacity makes populations more vulnerable to authoritarian control (Barro 1999). While these covariates are included in the first step of entropy balancing, our second category of variables, considered as determinants of public expenditure efficiency, is incorporated in the second step. These correspond to the same baseline controls used in the main specification of the manuscript.

2. We lag the level of democracy, GDP per capita, GDP per capita growth, human capital, and Internet access by one year to mitigate potential reverse causality with the press freedom variable. All variables are sourced from the World Development Indicators (WDI), except for the level of democracy, which is obtained from the ICRG database, and human capital, which comes from the Penn World Table.

Subsection B.3 Covariates balance

Our baseline model relies on a dummy variable equal to 1 for country-year observations with a free media environment and 0 otherwise. Panel A of Table B1 presents a comparison of pre-weighting sample means for the matching covariates between control units (Column [1]) and treated units (Column [2]). The results reveal statistically significant differences across all covariates, as all p-values reported in Column [5] fall below conventional significance thresholds. More specifically, treated units (those with free media) exhibit higher levels of democracy, GDP per capita, human capital, Internet access, and urbanization, along with a lower share of natural resources in GDP. These patterns are consistent with our earlier discussion of the determinants of media freedom. In Panel B, control units are reweighted so that their pre-treatment covariates match those of the treated group on average. This procedure effectively removes all statistically significant pre-treatment differences between the two groups, as evidenced by the p-values in Column [5]. In other words, the synthetic control group closely replicates the characteristics of the treated units, suggesting that any remaining difference in government efficiency can be attributed to press freedom.

Subsection B.4 Main findings

Using the weights computed in the first stage, the second stage of entropy balancing estimates the average treatment effect, reported in Table B2. Panel A reports our baseline results. In the first column, we perform a bivariate regression between the treatment and the outcome variable, without including the baseline controls, while the second column reports the main specification, which incorporates these controls. The results indicate a positive and statistically significant effect of free media on government efficiency. Specifically, a free media environment increases efficiency by approximately 4 units relative to a non-free media environment. Panel B considers a hybrid or semi-free media environment and shows that it reduces public expenditure efficiency by about 2 units compared to a fully free media environment. Overall, these findings strongly corroborate our main results obtained using the continuous press freedom index.

Table B1: Covariate balancing

	[1]	[2]	[3] = [1] - [2]	[4]	[5]
Panel A : Descriptive statistics	Non-Treated units	Treated units	Difference	t-Test	p-Val.
Level of democracy	3.6	5.48	-1.88	40.03	0.00
Log. GDP per capita	8.89	10.37	-1.48	36.90	0.00
GDP per capita growth	2.49	2.26	0.23	-1.38	0.00
Human capital	2.14	2.98	-0.84	35.48	0.00
Internet access	13.76	40.38	-26.62	21.57	0.00
Log.Natural resources	1.78	0.61	1.17	- 31.67	0.00
Urbanization rate	51.55	72.99	-21.44	26.66	0.00
Observations	1853	990			
	[1]	[2]	[3] = [1] - [2]	[4]	[5]
Panel B : Covariate balancing	Non-Treated units	Treated units	Difference	t-Test	p-Val.
Level of democracy	5.45	5.48	-0.03	-0.65	0.514
Log. GDP per capita	10.33	10.37	-0.04	-0.68	0.497
GDP per capita growth	2.28	2.26	0.02	0.05	0.957
Human capital	2.96	2.98	-0.02	-0.38	0.706
Internet access	39.79	40.38	-0.59	-0.23	0.820
Log.Natural resources	0.63	0.61	0.02	0.28	0.777
Urbanization rate	72.49	72.99	-0.5	-0.32	0.750
Observations	1328	825			
Total of weights	825	825			

Notes: The level of democracy, GDP per capita, GDP per capita growth, human capital, and Internet access are lagged by one year to mitigate potential reverse causality with the press freedom variable. The reduction in the total number of observations compared to our OLS model is due to missing values in some of the covariates.

Table B2: Press Freedom and Public Expenditure Efficiency: Treatment effects

Panel A: Free media	[1]	[2]
ATT	4.937*** (0.832)	4.270*** (0.855)
Observations	2094	2044
R-squared	0.5908	0.6149
Baseline controls	Yes	Yes
Country FE	Yes	Yes
Year FE	Yes	Yes
Panel B: Partially free media	[1]	[2]
ATT	-2.953*** (0.894)	-2.451*** (0.893)
Observations	2094	2044
R-squared	0.5752	0.6026
Baseline controls	Yes	Yes
Country FE	Yes	Yes
Year FE	Yes	Yes

We report estimates of the impact of press freedom on public spending efficiency, measured on a 0–100 scale, with higher values indicating better performance. The Average Treatment Effects on the Treated (ATT) are estimated using entropy balancing. In the first stage, we balance on a set of covariates, including the level of democracy, GDP per capita, GDP per capita growth, human capital, Internet access, natural resources, and urbanization. In the second stage, we additionally control for the determinants of efficiency identified in the main manuscript. In Panel A, the treatment variable is a dummy equal to 1 for country-year observations with a free press and 0 otherwise. Panel B extends the analysis to partially free media environments. The smaller sample size relative to the OLS specifications reflects missing values in some of the covariates. All regressions include the constant, not reported in the table. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix C Descriptive statistics, sample and data

Table C1: Summary statistics of the baseline model variables and unit root tests

Panel A: Summary statistics	Variables	Obs.	Mean.	Sd	Min	Max
	Government efficiency	2952	66.624	7.656	24.664	87.796
	Press freedom	3081	54.581	23.183	0	95
	Financial globalization	3082	57.174	17.685	11.639	98.257
	Trade globalization	3082	54.009	17.598	13.184	96.77
	Δ Population density	2920	2.975	15.129	-197.035	311.122
	Tax revenues	2985	17.338	9.472	0.607	112.805
Panel B: Unit root tests	Variables	Inverse Normal (Z)	Integration Order			
	Expenditure efficiency	-3.75 (0.000)	I(0)			
	Media freedom	-7.85 (0.000)	I(0)			
	Financial globalization	-5.19 (0.000)	I(0)			
	Trade globalization	-2.55 0.005	I(0)			
	Population density	-6.04 (0.000)	I(1)			
	Tax revenues	-4.34 (0.000)	I(0)			

Notes: In Panel B, we perform Fisher-type unit root tests, which are based on Phillips-Perron procedures, to assess the stationarity properties of our panel variables. Panel-specific AR parameters are included, with one Newey-West lag used. I(0) indicates stationarity in levels; I(1) indicates stationarity after first differencing.

Table C2: Average Public Spending Efficiency and Press Freedom scores (1994-2016)

Country	PSE	Press freedom	Country	PSE	Press freedom	Country	PSE	Press freedom	Country	PSE	Press freedom
Angola	59.07	30.78	Spain	70.06	78	Sri Lanka	70.49	38.22	Russia	67.13	30.57
Albania	63.4	46.09	Estonia	67.07	81.48	Lesotho	63.28	50.96	Rwanda	65.66	21.5
Argentina	67.35	57.57	Ethiopia	57.73	27.96	Lithuania	69.32	78.78	Saudi Arabia	65.04	18.61
Australia	75.97	83.61	Finland	68.99	88.17	Luxembourg	67.12	88.48	Sudan	63.33	17.78
Austria	72.39	81.13	Fiji	64.53	52	Latvia	67.5	76.48	Senegal	66.59	55.7
Azerbaijan	63.24	23.35	France	70.49	76.83	Morocco	65.82	40.04	Singapore	71.58	33.74
Burundi	59.42	21.48	United Kingdom	77.9	79.35	Moldova	65.82	41.96	Solomon Islands	64.81	75.39
Belgium	71.05	89.74	Georgia	66.83	44.13	Madagascar	62.37	52.17	Sierra Leone	65.4	37.26
Benin	62.21	67.87	Ghana	64.84	60.78	Maldives	64.94	38.39	El Salvador	66.6	58.09
Burkina Faso	64.9	59.96	Guinea Bissau	63.76	44.09	Mexico	67.03	46.22	Suriname	66.26	72.52
Bangladesh	63.36	41.09	Equatorial Guinea	60.38	14.91	Mali	63.56	70	Slovak Republic	69.63	71.39
Bulgaria	67.67	63.43	Greece	67.07	67.65	Malta	71.38	80.3	Slovenia	71.13	75.09
Bahrain	66.84	26.83	Grenada	68.29	78.35	Myanmar	60.55	9.22	Sweden	66.4	89.87
Bahamas, The	63.62	85	Guatemala	64.02	41.74	Mongolia	64.26	64.09	Eswatini	64.89	23.96
Belarus	69.67	14.78	Honduras	62.8	46.17	Mozambique	65.8	54.43	Togo	55.83	28.83
Belize	67.37	76.91	Croatia	65.95	54.22	Mauritius	69.58	74	Thailand	66.56	49.48
Brazil	68.54	61.43	Hungary	67.92	70.61	Malawi	63.15	50.43	Tajikistan	65.43	16.78
Barbados	68.16	82.61	Indonesia	66.51	43.74	Malaysia	65.71	34.65	Tunisia	68.33	30.17
Bhutan	63.47	36.13	India	64.47	60.61	Namibia	62.83	68.61	Turkey	68.52	40.52
Botswana	66.75	65.65	Ireland	71.62	83.22	Niger	64.58	42.13	Tanzania	56.6	49.09
Central African Republic	62.88	35.3	Iran	61.57	16.74	Nigeria	55.98	41.13	Uganda	61.2	49.91
Canada	72.79	82.96	Iceland	72.21	88.39	Nicaragua	61.71	54.04	Ukraine	66.6	45.39
Switzerland	69.86	89.13	Israel	74.77	70.57	Netherlands	73.34	87	Uruguay	70.41	73
Chile	66.62	71.7	Italy	73.04	69.61	Norway	73.47	91.52	United States	81.79	83.61
Cameroon	63.38	30.65	Jamaica	66.29	84.26	Nepal	65.72	41.57	Uzbekistan	67.22	12.43
Congo, Republic of	59.52	41.57	Jordan	64.86	39.39	New Zealand	74.5	87.87	Venezuela, RB	64.86	39.13
Cape Verde	69.35	69.96	Japan	74.65	78.65	Oman	64.99	29.22	Vietnam	65.21	21.22
Costa Rica	72.74	82.39	Kazakhstan	71.13	25.65	Pakistan	62.37	38.83	Vanuatu	65.84	69.13
Cyprus	69.39	78.7	Kenya	60.91	40.09	Panama	67.09	61.13	Yemen, Rep	54.98	25.91
Czech Republic	70.14	79.91	Kyrgyz Republic	65.36	34.52	Peru	70.92	51.83	South Africa	65.88	69.78
Denmark	72.54	89.52	Cambodia	64.29	37.17	Philippines	65.41	59	Zambia	61.36	38.35
Dominican Republic	68.06	63.26	Kuwait	65.66	45.09	Poland	70.81	75.74	Zimbabwe	62.64	25.39
Ecuador	66.65	53.35	Lebanon	69.27	43.52	Portugal	70.85	83.61			
Egypt, Arab Rep	69.52	31.04	Liberia	62.51	33.83	Paraguay	66.79	44.43			

Table C3: Sources of variables for the calculation of the efficiency scores

Variables		Nature	Sources
1. Public expenditure (inputs)			
Education expenditure (%GDP)		Continuous	Public Expenditures for Economic Development (SPEED)
Infrastructure expenditure (%GDP)		Continuous	SPEED
Health expenditure (%GDP)		Continuous	SPEED
Government final consumption (%GDP)		Continuous	World Economic Outlook (WEO)
2. Sectoral performance indices (outcomes)			
Education			
— Primary enrollment		Continuous	World Development Indicators (WDI)
— Secondary enrollment		Continuous	WDI
— Expected years of schooling		Continuous	WDI
Health			
— Life expectancy at birth		Continuous	World Development Indicators (WDI)
— Infant mortality rate (per 1000 live births)		Continuous	WDI
Infrastructure :			
— Total length of roads in kilometers		Continuous	World Telecommunication/ICT Indicators Database
— Number of paved roads (% total roads)		Continuous	World Telecommunication/ICT Indicators Database
— Fixed telephone subscriptions (per 100 people)		Continuous	World Telecommunication/ICT Indicators Database
— Fixed broadband subscriptions (per 100 people)		Continuous	World Telecommunication/ICT Indicators Database
— Faults for 100 fixed telephone lines per year		Continuous	World Telecommunication/ICT Indicators Database
— Proportion of households with electricity		Continuous	World Telecommunication/ICT Indicators Database
— Electric power consumption (in kWh per capita)		Continuous	World Telecommunication/ICT Indicators Database
— Electric power transmission and distribution losses (%production)		Continuous	World Telecommunication/ICT Indicators Database
Administration			
— Independence of the judiciary		Continuous	Teorell et al. (2021)
— Quality of property rights		Continuous	Teorell et al. (2021)
— Quality of government		Continuous	Teorell et al. (2021)
— Level of the shadow economy		Continuous	Teorell et al. (2021)
Stability			
— Standard deviation of the three-year moving average of GDP growth		Continuous	Authors, from WDI
— Standard deviation of the three-year moving of inflation		Continuous	Authors, from WDI
Distribution			
— Gini index		Continuous	Standardized World Income Inequality Database (SWIID)
Economic performance			
— GDP per capita		Continuous	WDI
— GDP growth (10-year average)		Continuous	WDI
— Unemployment rate (10-year average)		Continuous	WDI

Source: Apeti et al. (2024).

Table C4: Press Freedom and Public Expenditure Efficiency: Sources of variables

Variables		Nature	Sources
1. Main model variables			
Public Expenditure Efficiency		Scores ranging from 0 to 100	Apeti et al. (2024)
Press Freedom		Scores ranging from 0 to 100	Freedom House database
Trade globalization		Index ranging from 13 to 97	KOF index (Dreher 2006; Gygli et al. 2019)
Financial globalization		Index ranging from 12 to 98	KOF index (Dreher 2006; Gygli et al. 2019)
Population density		Continuous	World Development Indicators
Taxes revenues (excl. social contributions)		Continuous	UNU-WIDER Government Revenue Dataset (GRD)
2. Additional controls			
GDP per capita		Continuous	World Development Indicators
Economic freedom		Index ranging approximately from 0 to 100	Heritage Foundation
Fiscal rules index		Index ranging approximately from 0 to 5	Authors, from IMF Fiscal Rules Dataset
Elections		Dummy	Database of Political Institutions
Core civil society index		Index ranging approximately from 0 to 1	V-Dem
Independence of the judiciary		Index ranging approximately from 0 to 2	QoG dataset
Quality of bureaucracy		Index ranging approximately from 0 to 4	ICRG
3. Transmission channels			
Corruption control		Index ranging from 0 to 100	WGI
Public sector corruption		Index ranging from 0 to 1	V-Dem
Accountability and transparency		Index ranging from 8 to 83	QoG

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