Investigating the Effect of Environment, Technology, Fiscal and Monetary Policy on Government Effectiveness Using Bootstrapped Simultaneous Quantile Regression

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ABSTRACT
There is a growing interest in the explanatory factors of governance quality due to the direct relationship between government effectiveness and the well-being of the population. Government effectiveness can be influenced by a wide range of factors, including the environment policy, technology policy, fiscal policy, and monetary policy. The aim of this study is therefore the identification of the determinants of government effectiveness in relation to a wide range of factors, including the environment policy, technology policy, fiscal policy, and monetary policy. A sample of 99 countries observed between 1990 and 2022 was used across three regions: East Asia & Pacific, Europe & Central Asia and Latin America & Caribbean. The government effectiveness is measured by the World Bank governance indicator. Bootstrapped Simultaneous Quantile Regression (BSQR) is used as it allows researchers to predict a particular quantile of the dependent variable as a function of one or more independent variables. Quantile regression is a statistical modelling method that can accommodate asymmetric or extreme value problems in data distribution. The combination of different quantile values will provide a complete description of distributions that are asymmetric, dense in the tails of the distribution or truncated. Compared to estimates based on linear models, quantile regression has the attractive feature of being able to estimate the effects of explanatory variables, such as environment, technology and economic instability, with different coefficients at different quantiles of the conditional distribution of the response variable. This approach provides a more nuanced understanding of the relationships, especially if they are not constant across the distribution. In the context of government policy related to government effectiveness, BSQR can be used to predict how different government policies and other economic factors may affect different quantiles of the distribution of government effectiveness. In general, the results show that the effects vary (and are sometimes reversed sign) both across different variables and across regions. Actionable policies for the improvement of government effectiveness can be customized to the pattern of relationships at a given level of effectiveness.

Keywords: *econometrics, environment, technology, finance, quantile, bootstrap, simultaneous*

1. INTRODUCTION

Government effectiveness refers to the ability and capacity of a government to carry out its functions and deliver services to its citizens efficiently and successfully. It is a multidimensional concept that encompasses various aspects of governance, including the economic, social, environment and technology factors. Good governance leads to higher economics growth. [1] argue that institutions and government policies affect the economic environment where an efficient government can enhance market efficiency to drive economic growth. It can accelerate capital accumulation, directing resources to appropriate sectors, and assisting the absorption as well as learning of new technologies. A study by [2] found that governments in regions prone to natural disasters often struggle with lower government effectiveness due to the challenges posed by disaster response and recovery. [3] also have highlighted the importance of government policies in addressing climate change, natural disasters and its impact on institutional integrity, emphasizing the need for proactive and adaptive policies.

On the other hand, technological advancements have transformative effects on government effectiveness as investigated by [4] and [5] that argue the adoption of e-governance and information technology can improve government services, enhance transparency, and increase citizen participation, ultimately contributing to government effectiveness.

Fiscal policy also plays a crucial role in shaping government effectiveness as studied by [6] who conclude that governments with better fiscal policies tend to achieve higher levels of government effectiveness, as they can allocate

Y. A. Yusran et al. (eds.), *Proceedings of the 2023 Brawijaya International Conference (BIC 2023)*, Advances in Economics, Business and Management Research 294,
https://doi.org/10.2991/978-94-6463-525-6_33

resources more efficiently. Furthermore, monetary policy can impact government effectiveness by affecting macroeconomic stability. High inflation rates can erode public trust in government. [7] further emphasized the importance of monetary policy in controlling inflation and maintaining price stability, which can indirectly strengthen government effectiveness.

Government effectiveness is often measured and assessed through various indicators and indices, such as the Worldwide Governance Indicators (WGI), the World Bank's Governance Indicators, and the World Economic Forum's Global Competitiveness Report. These indices consider factors like voice and accountability, political stability, government effectiveness, regulatory quality, and the rule of law. This study will use the measurement from the World Bank's Governance Indicators.

Government effectiveness can vary significantly across countries and regions, leading to inequality in the quality of governance and public services due to several factors such as political stability, economic development, institutional quality, etc. This inequality has been persistent and indeed high over decades. Accordingly, several empirical studies have been identified to address it. The standard approach to determining the linear regression model and estimating its parameters is the Ordinary Least Square (OLS) method. Parameter estimation in the OLS method is obtained by minimizing the sum of squared errors. The estimator of the OLS method is the mean of the conditional distribution function of the response variable. Although the mean is an important measure of the centralization of a distribution, this statistic cannot explain the behaviour of the distribution conditional on the tails of a distribution. Quantile regression, introduced by [8], is an extension of the regression model to the conditional quantiles of the response variable. This approach allows estimating the quantile function of the conditional distribution of the response at various quantile values of interest. Each quantile characterizes a particular point (centre or tail) of the conditional distribution.

The combination of various quantile values will result in a complete description of the conditional distribution. This analysis is particularly useful for conditional distributions that are asymmetric, dense in the tails of the distribution, or truncated. The main advantage of quantile regression over OLS regression is the flexibility in modelling data with heterogeneous conditional distributions. This method can be used to measure the effect of explanatory variables not only at the centre of the data distribution, but also at the top or bottom of the tails of the distribution. This is very useful in applications, especially when extreme values are an important issue [9].

Bootstrapped Simultaneous Quantile Regression (BSQR) is a statistical method used to estimate quantile regression simultaneously on multiple quantiles of the data distribution. This method utilizes the bootstrap technique to obtain confidence intervals that can be used to test the significance of the regression coefficients. In BSQR, data are randomly drawn with repetition, and the same quantile regression model is estimated on each bootstrap data set. This makes it possible to obtain sampling distributions for the quantile regression coefficients at each quantile point, so that more accurate confidence intervals and hypothesis tests can be constructed. The concept of Bootstrapped Simultaneous Quantile Regression was introduced by [10]. They developed a method to estimate multiple quantiles simultaneously while addressing the issue of asymptotic bias in quantile regression.

This method is commonly used in the analysis of data that has an asymmetric distribution or with significant extreme values, and when there is an assumption of linearity in the quantile regression model that is not met. BSQR also provides more complete information on how the independent variable affects the dependent variable at certain quantile points of the data distribution. Research in economics and finance has employed BSQR to analyse income inequality, asset pricing models, and financial market volatility. For instance, BSQR has been applied in various field such as [11] used BSQR to study criminal specialization. [12] identify the determinants of capital structure for Indian firms using a panel framework of BSQR. [13] found a noteworthy heterogeneous environmental effect of industrialization when using BSQR to investigate how industrialization affects the environment.

Government Effectiveness is also strongly affected by several government qualities (GDP, FDI, etc) besides the government policy in economics (fiscal, monetary, etc), technology and environment. Quantile regression modelling can be important in the context of government effectiveness because government quality and policy can have different impacts on different groups of government effectiveness. The following is the problem formulation in this study: 1) How to analyse the impact of government policy in technology, environment, fiscal, monetary as well as government quality (as independent variables) on different groups based on the distribution of government effectiveness (as dependent) by using BSQR; 2) How to identify the effects of the independent variables on different levels of dependent variable. Thus, the use of quantile regression can assist the government in planning the corresponding policies that are more effective and favourable to different levels of effectiveness.

2. Bootstrapped Simultaneous Quantile Regression

Quantile Regression (QR) is a statistical method used to model the relationship between the independent variable and the dependent variable at various quantiles of the dependent variable distribution. QR is useful in overcoming situations where the relationship between the independent variable and the dependent variable is not homogeneous across the range of the dependent variable. In QR, the regression parameters are calculated at various quantiles of the dependent variable distribution, not just at the middle quantile (as in ordinary linear regression). By using QR, we can identify how the effect of the independent variable on the dependent variable changes at various quantiles of the dependent variable distribution [8].

[14] used QR to examine the effects of changes in factors such as education and work experience on wage distribution in Portugal. This study also introduces the concept of counterfactual decomposition, which allows us to identify the contribution of certain factors to changes in the wage distribution. [15] shows how QR can be used to estimate the effect of fiscal policy on household consumption across different quartiles of the consumption expenditure distribution. The study uses data from the European Household Panel (1994-2001) and shows that fiscal policy (as measured by changes in taxes and government spending) has different effects on household consumption across different quartiles of the consumption expenditure distribution. The study finds that government spending has a positive effect on household consumption in the lower quartile of the consumption expenditure distribution, while taxes have a negative effect in the upper quartile of the consumption expenditure distribution. The results of this study demonstrate the importance of considering heterogeneity in the effect of fiscal policy on household consumption, and show that QR is a useful method to estimate the effect of fiscal policy on different segments of the population. This study can assist policymakers in making better decisions in terms of fiscal policies directed at specific groups of the population.

[16] examine the distributional effects of fiscal policy on household consumption using QR. The study uses data from the Household Budget Survey in Italy from 2008 and shows that fiscal policies (such as taxes, social transfers, and subsidies) have different distributional effects on household consumption across different income quartiles. The study finds that beneficiary-oriented fiscal policies (such as social transfers and subsidies) have a larger positive effect on household consumption in the lower quartile of income, while beneficiary-oriented fiscal policies (such as tax cuts) have a larger positive effect on household consumption in the upper quartile of income. The results of this study show the importance of considering the distributional effects of fiscal policies on household consumption, especially when making fiscal policies that aim to reduce social and economic inequality. This study can assist policymakers in making better decisions in terms of fiscal policies directed at specific groups of the population.

[17] show how QR can be used to analyse the relationship between monetary policy and food inflation in South Africa across different quartiles of the inflation distribution. The study uses data from the South African Reserve Bank and Statistics South Africa from 2008-2018 and shows that monetary policies (such as interest rates and currency reserves) have different effects on food inflation across different quartiles of the inflation distribution. The study found that monetary policies aimed at stabilizing overall prices (such as the use of interest rates) have similar effects on all quartiles of the inflation distribution, whereas monetary policies that are more specific to food inflation (such as currency reserves) have more significant effects on the upper quartiles of the inflation distribution.

[18] analyzed the relationship between external debt and economic growth in South Asia. The study used data from five countries in South Asia (Pakistan, India, Bangladesh, Sri Lanka, and Nepal) from 1990-2018 and showed that the relationship between external debt and economic growth varies across different quartiles of the economic growth distribution. The study shows that the relationship between external debt and economic growth is non-linear and depends on the level of economic growth obtained. The results show that external debt has a significant positive effect on economic growth in the lower and middle quartiles of the economic growth distribution, while the effect is less significant in the upper quartile of the economic growth distribution. Overall, QR is a useful method for modelling the relationship between independent and dependent variables at various quantiles of the dependent variable distribution. QR can provide better insight into how the effects of independent variables on dependent variables change across different segments of the population and can help in making better policy decisions.

Introduced by [8], QR approach estimates various quantile functions of a distribution Y as a function of X. QR is very useful if the data distribution is not heterogeneous and not in a standard form such as not symmetrical, there are tails in the distribution, or *truncated distribution*.

Suppose Y is a random variable with distribution function F_Y and θ is a constant where $0 < \theta < 1$. The quantile θ of F_Y, denoted as $q_Y(\theta)$ is the solution to $F_Y(q) = \theta$, i.e:

$$q_Y(\theta) = F_y^{-1}(\theta) = inf\{y: F_Y(y) \geq \theta\} \quad (1)$$

So that $100\theta\%(100(1-\theta)\%)$ of the chance mass Y is below (above) $q_Y(\theta)$.

As with the OLS method, which minimizes the sum of squares of the residuals to find the estimated value for β, then in quantile regression, the quantile from θ of F_Y can be obtained by minimizing the following function with respect to q:

$$\theta \int_{y>q} |y-q| dF_Y(y) + (1-\theta) \int_{y<q} |y-q| dF_Y(y) \quad (2)$$

By minimizing the above function, the following equation is obtained:

$$0 = -\theta \int_{y>q} dF_Y(y) + (1-\theta) \int_{y<q} dF_Y(y)$$

$$0 = -\theta[1 - F_Y(q)] + (1-\theta)F_Y(q)$$

$$= -\theta + F_Y(q) \quad (3)$$

So that the quantile θ is the solution of F_Y

If Yas a function of X which is known, has probability $F_{Y|X}(y)$, the zero quantile θ of the function can be written as $Q_{Y|X}(\theta) = F_{Y|X}^{-1}(\theta)$. $Q_{Y|X}(\theta)$ is a function of X and solved by the following equation:

$$min_q\, \theta \int_{y>q} |y-q| dF_Y(y) + (1-\theta) \int_{y<q} |y-q| dF_Y(y) \quad (4)$$

$Q_{Y|X}(0.5)$ is the median Y (as a function of X) which denotes the symmetry point of $F_{Y|X}$; for θ close to 0 (or 1), $Q_{Y|X}(\theta)$ denotes the left (or right) tail of $F_{Y|X}$.

In matrix notation, if $Q_{Y|X}(\theta)$ is a linear function $X'\beta$, then equation (2) becomes:

$$min_q\, \theta \int_{y>X'\beta} |y - X'\beta| dF_Y(y) + (1-\theta) \int_{y<X'\beta} \left|y - X'\beta\right| dF_Y(y) \quad (5)$$

The solution of equation (5) is denoted as $\beta_\theta$and quantile Y (as a function of X) to θ is $Q_{Y|X}(\theta) = X'\beta_\theta$

For example, given data $(y_t, x_t)'$ for $t = 1, 2, \ldots T$ then the linear model of the quantile regression equation can be written as:

$$y_t = x_t'\beta + e_t \quad (6)$$

with $Q_\theta(y_t|x_t) = x_t'\beta$ is the quantile θ of y with a certain value x_t value. Estimates for β of the regression of the quantile θ is obtained by minimizing the sum of the absolute values of the errors with weights θ for positive errors and weights $(1-\theta)$ for negative errors i.e:

$$\hat{\beta} = min_\beta \left\{\theta \sum_{t:y_{t\geq x_t}} |y - X'\beta| + (1-\theta) \sum_{t:y_{t<x_t}} |y - X'\beta|\right\} \quad (7)$$

or

$$\hat{\beta} = min_\beta \frac{1}{T} \sum_{i=1}^{T} \rho_\theta u_t \quad (8)$$

where

$$\rho_\theta(u_t) = \{\theta u_t, \qquad if\ \ u_t \geq 0\ \ (\theta-1)u_t,\ \ if\ \ u_t < 0$$

$\rho_\theta(u_t)$ is also called the *check function* and the expected *error of* y is $\hat{e}_t = y_t - x_t'\beta$

Estimates of quantile regression can be obtained from linear programming solutions. Several algorithms for obtaining solutions are described in the literature. In this study, a method developed by [19] will be used which is a development of the simplex algorithm of [20].

The quantile regression analysis introduced by [8] is an extension of the least squares method. [21] and [22] applied this method to income distribution data and obtained significant results. [23] conducted a study to apply panel data

quantile regression to income distribution in the UK and USA and concluded that this method succeeded in providing more informative results about the income distribution model in both countries.

Simultaneous Quantile Regression extends quantile regression to estimate multiple quantiles simultaneously. Instead of estimating each quantile separately, this approach provides a joint estimation of multiple quantiles, which can be useful when you want to compare and contrast the effects at different points in the distribution. Bootstrapping is a resampling technique used to estimate the sampling distribution of a statistic by repeatedly drawing samples from the data with replacement. In BSQR, bootstrapping is applied to the simultaneous quantile regression procedure. This involves repeatedly resampling the data with replacement, estimating multiple quantiles simultaneously for each bootstrap sample, and then aggregating the results to obtain robust parameter estimates and standard errors.

3. DATA AND METHODS

This study uses a sample of 99 countries observed between 1990 and 2022 across three regions: East Asia & Pacific, Europe & Central Asia and Latin America & Caribbean. The government effectiveness is measured by the World Bank governance indicator. The World Bank defines government effectiveness (as dependent variable) as the perceived quality of public services, the quality of the civil service and its degree of independence from political pressures, the quality of policy formulation and implementation, and the credible commitment of the government to such policies. The estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution. This means that the range is from about -2.5 to 2.5.

The independent variables include:

1. GDP growth (annual %) - *GDPg*
   Annual percentage growth rate of GDP at market prices based on constant local currency.
2. Central government debt, total (% of GDP) - *Debt*
   The entire stock of direct government fixed-term contractual obligations to others outstanding on a particular date.
3. Real interest rate (%) - *Intrate*
   The lending interest rate adjusted for inflation as measured by the GDP deflator
4. Inflation, consumer prices (annual %) - *Inflation*
   The consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.
5. General government final consumption expenditure (% of GDP) - *GovExp*
   Includes all government current expenditures for purchases of goods and services (including compensation of employees).
6. Foreign direct investment, net inflows (% of GDP) - *FDI*
   The net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor
7. Terrestrial and marine protected areas (% of total territorial area) - *Area*
   The total or partially protected areas of at least 1,000 hectares that are designated by national authorities as scientific reserves with limited public access, national parks, natural monuments, nature reserves or wildlife sanctuaries, protected landscapes, and areas managed mainly for sustainable use.
8. CO2 emissions (kg per PPP $ of GDP) – CO_2
   Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement.
9. Market capitalization of listed domestic companies (% of GDP) - *Cap*
   The share price times the number of shares outstanding for listed domestic companies. Research and development expenditure (% of GDP)
10. Gross domestic expenditures on research and development (R&D), expressed as a percent of GDP - *RnDExp*
11. High-technology exports (% of manufactured exports) - *Tech*
    High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery

This study will use 9 (nine) quantile levels (0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9) to obtain a comprehensive picture of the relationship pattern in the context of government policy and government effectiveness. This study investigates the relationship modelling between fiscal policy and economic variables at multiple distribution quantiles with BSQR and interprets the BSQR results with respect to each selected quantile. These results can provide information on how a particular policy can affect different aspects of the government effectiveness at different levels.

4. RESULTS AND DISCUSSION

The box plots on Figure 1 show that there are various patterns in the distribution of Government Effectiveness across the regions. Within the range around -2.5 to 2.5, it is interesting to note that the North America region has the most pronounced distribution pattern, with the Government Effectiveness Index consistently quite high above 1. As for the other regions, the distribution is relatively evenly scattered, with the highest average in Europe and Central Asia and the lowest in Sub-Saharan Africa. There are some outliers with a very low index in Latin America and the Caribbean, the Middle East and North Africa and South Asia. Furthermore, the analysis is carried out for only three regions, namely East Asia and the Pacific, Europe and Central Asia and Latin America and the Caribbean, due to the data availability (with the longest period).

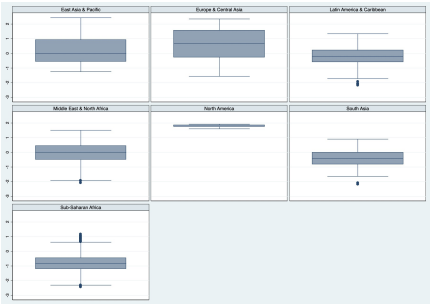

Figure 1 The boxplot of Government Effectiveness across region.

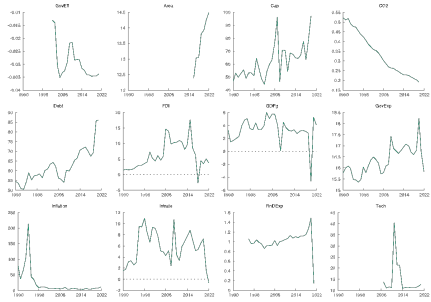

Figure 2 The time series plot of the variables

Figure 2 provides an overview of the time series patterns of the variables used in this study. It can be seen that each variable has a pattern of movement that varies over time. Overall, government efficiency is very unstable and shows no systematic pattern.

In general, terrestrial and marine protected areas, market capitalisation, debt, FDI, government expenditure and research and development expenditure show a positive trend, i.e. their values tend to increase over time, with some fluctuations. Meanwhile, CO2 emissions tend to decrease over time. The inflation, GDP growth, interest rate and technology variables do not show any particular pattern. They tend to be dynamic, with no structured movement over time.

This finding reinforces the more appropriate estimation method to obtain a model that can comprehensively represent the causal relationship by considering the scatter points as a whole, rather than inferring from the mean approach only.

Table 1. The estimation results

Region	Quantile	Area		Cap		CO2		Debt		FDI		GDPg		GovExp		Inflation		Intrate		RnDExp		Tech	
East Asia & Pacific	**0.1**	0.103	** *	-0.007	**	2.401	n.s	0.009	n.s	0.043	** *	-0.007	n.s	-0.280	** *	-0.393	*	-0.080	**	0.489	n.s	-0.002	n.s

	0.2	0.103	**	-0.007	**	2.401	n.s	0.009	n.s	0.043	**	-0.007	n.s	-0.280	**	-0.393	*	-0.080	**	0.489	n.s	-0.002	n.s
	0.3	0.103	**	-0.007	**	2.401	n.s	0.009	n.s	0.043	**	-0.007	n.s	-0.280	**	-0.393	*	-0.080	**	0.489	n.s	-0.002	n.s
	0.4	0.100	**	-0.006	*	1.647	n.s	0.010	*	0.047	**	-0.005	n.s	-0.234	**	-0.313	n.s	-0.061	*	0.344	n.s	0.003	n.s
	0.5	0.101	**	-0.006	*	1.292	n.s	0.012	**	0.043	**	-0.002	n.s	-0.219	**	-0.283	n.s	-0.051	n.s	0.276	n.s	0.005	n.s
	0.6	0.081	**	-0.011	**	2.028	n.s	0.011	**	0.063	**	0.020	n.s	-0.179	**	-0.290	n.s	-0.038	n.s	0.443	n.s	0.005	n.s
	0.7	0.081	**	-0.011	**	2.028	n.s	0.011	**	0.063	**	0.020	n.s	-0.179	**	-0.290	n.s	-0.038	n.s	0.443	n.s	0.005	n.s
	0.8	0.094	**	-0.005	n.s	0.512	n.s	0.017	**	0.035	**	0.024	n.s	-0.163	*	-0.192	n.s	-0.018	n.s	0.155	n.s	0.007	n.s
	0.9	0.094	**	-0.005	n.s	0.512	n.s	0.017	**	0.035	**	0.024	n.s	-0.163	*	-0.192	n.s	-0.018	n.s	0.155	n.s	0.007	n.s
Europe & Central Asia	**0.1**	-0.014	*	-0.001	n.s	-1.265	**	0.000	n.s	0.000	n.s	0.008	n.s	-0.017	n.s	-0.029	**	-0.010	n.s	0.720	***	-0.008	n.s
	0.2	-0.014	*	-0.001	n.s	-1.265	**	0.000	n.s	0.000	n.s	0.008	n.s	-0.017	n.s	-0.029	**	-0.010	n.s	0.720	***	-0.008	n.s
	0.3	-0.014	*	-0.001	n.s	-1.284	**	0.000	n.s	0.001	n.s	0.008	n.s	-0.017	n.s	-0.029	**	-0.010	n.s	0.733	***	-0.008	n.s
	0.4	-0.008	n.s	0.002	n.s	-0.050	n.s	0.001	n.s	0.001	n.s	0.014	**	-0.028	n.s	-0.018	*	0.001	n.s	0.460	***	0.033	n.s
	0.5	-0.015	*	0.002	n.s	-0.027	n.s	-0.003	n.s	0.002	n.s	0.016	**	-0.026	n.s	-0.015	n.s	0.000	n.s	0.419	**	0.062	***
	0.6	-0.007	n.s	0.003	n.s	1.022	**	-0.005	*	0.002	n.s	0.014	**	-0.014	n.s	-0.018	*	-0.004	n.s	0.388	**	0.072	***
	0.7	-0.008	n.s	0.002	n.s	0.938	**	-0.005	*	0.001	n.s	0.014	**	-0.014	n.s	-0.019	*	-0.005	n.s	0.463	***	0.070	***
	0.8	-0.008	n.s	0.002	n.s	0.938	**	-0.005	*	0.001	n.s	0.014	**	-0.014	n.s	-0.019	*	-0.005	n.s	0.463	***	0.070	***
	0.9	-0.008	n.s	0.002	n.s	0.938	**	-0.005	*	0.001	n.s	0.014	**	-0.014	n.s	-0.019	*	-0.005	n.s	0.463	***	0.070	***
Latin America & Caribbean	**0.1**	0.015	n.s	0.008	**	-0.908	n.s	0.022	**	-0.034	**	-0.059	*	0.352	*	0.068	**	0.039	**	0.185	n.s	-0.066	***
	0.2	0.015	n.s	0.008	**	-0.908	n.s	0.022	**	-0.034	**	-0.059	*	0.352	*	0.068	**	0.039	**	0.185	n.s	-0.066	***
	0.3	0.016	n.s	0.006	**	0.503	n.s	0.023	**	-0.020	n.s	-0.062	*	0.356	*	0.062	**	0.035	**	0.346	n.s	-0.076	***
	0.4	0.014	n.s	0.003	**	1.208	n.s	0.023	**	-0.010	n.s	-0.065	*	0.366	*	0.054	**	0.032	**	0.606	***	-0.084	***
	0.5	-0.030	*	0.002	n.s	0.837	n.s	0.017	**	0.015	n.s	-0.037	*	0.236	*	-0.028	n.s	0.021	**	0.753	***	-0.044	**
	0.6	-0.096	**	0.009	**	-1.716	n.s	0.008	**	0.017	n.s	0.011	n.s	-0.028	n.s	-0.115	*	0.017	**	0.254	n.s	0.040	**
	0.7	-0.096	**	0.009	**	-1.716	n.s	0.008	**	0.017	n.s	0.011	n.s	-0.028	n.s	-0.115	*	0.017	**	0.254	n.s	0.040	**
	0.8	-0.096	**	0.009	**	-1.716	n.s	0.008	**	0.017	n.s	0.011	n.s	-0.028	n.s	-0.115	*	0.017	**	0.254	n.s	0.040	**
	0.9	-0.096	**	0.009	**	-1.716	n.s	0.008	**	0.017	n.s	0.011	n.s	-0.028	n.s	-0.115	*	0.017	**	0.254	n.s	0.040	**

note: *p-value<0.05, **p-value<0.01, ***p-value<0.001, ns=not significant, two-tailed test

Table 1 presents parameter estimation results showing the effect of independent variables on dependent variable from quantile 0.1 to 0.9. It shows how the effect of the independent variables, including aspects of government quality (GDP, foreign direct investment, etc.), environment, technology, fiscal and monetary policy, varies at different levels of government efficiency. In general, we can see that the effects vary (and are sometimes reversed sign) both between different variables and between regions.

As one of the proxies for environmental variables, the effect of the area variable (terrestrial and marine protected areas) on government effectiveness is strongest in the East Asia & Pacific region. In Europe and Central Asia, the effect of terrestrial and marine protected areas is stronger for countries with low levels of government effectiveness, but with a negative sign. In contrast, in Latin America and the Caribbean this effect is stronger in the upper quantile, i.e. in countries with high levels of government effectiveness.

There is no significant effect of the market capitalisation on government effectiveness in the Europe and Central Asia region, but this effect is quite strong in the Latin America and Caribbean region, in almost all quantile distributions, both in countries with low and high levels of government effectiveness. Another proxy for environmental variables, the effect of CO2 emissions, is significant on government effectiveness only in Europe and Central Asia. The effect is negative at low levels of government effectiveness and positive at high levels.

Central government debt has a positive and significant effect on government effectiveness in the East Asia and Pacific region, but only in countries with high levels of effectiveness. This influence tends to be smaller and insignificant

in the Europe and Central Asia region, and increases in the Latin America and Caribbean region at all levels of government effectiveness. In the East Asia and Pacific region, the effect of FDI on government effectiveness is very significant, especially in countries with low levels of effectiveness, and tends to be insignificant in countries in other regions.

GDP growth also shows a peculiar pattern, where the effect is stronger only for high effectiveness countries in the Europe and Central Asia region, while the effect is negative for low effectiveness countries in the Latin America and Caribbean region. Government expenditure, on the other hand, has a negative impact on government effectiveness in East Asia and Pacific and Latin America and the Caribbean, but is insignificant in Europe and Central Asia.

Inflation has an interesting pattern of influence, being negative in countries with low government effectiveness (both East Asia and Pacific and Europe and Central Asia), but positive in countries with high effectiveness in Latin America and the Caribbean. The interest rate also has a negative significant effect on government effectiveness in East Asia and the Pacific, an insignificant effect in Europe and Central Asia, but a positive significant effect in Latin America and the Caribbean.

There is also evidence that gross domestic expenditure on research and development has no significant effect on government effectiveness in East Asia and the Pacific, but not in Europe and Central Asia, where it is significant, particularly in countries with high government effectiveness. Finally, the variable used as a proxy for technology, high technology exports, has no significant contribution to government effectiveness in East Asia & Pacific countries, but has a significant effect in high government effectiveness countries in Europe & Central Asia. Interestingly, in Latin America & the Caribbean this effect is negative for low effectiveness countries and changes to a positive contribution for high effectiveness countries.

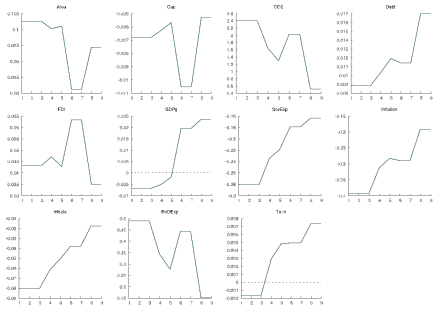

Figure 3 The coefficient across quantiles (East Asia and Pacific)

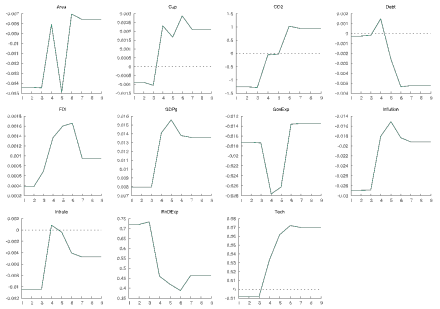

Figure 4 The coefficient across quantiles (Europe and Central Asia)

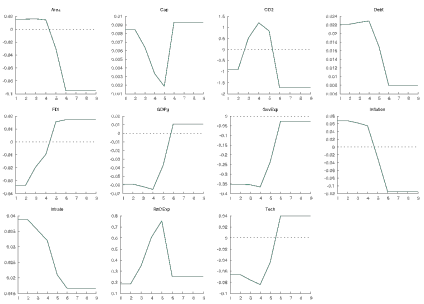

Figure 5 The coefficient across quantiles (Latin America and Caribbean)

Figures 3, 4 and 5 also show the pattern of movement of the effect of each independent variable on government effectiveness from the low quantile (0.1) to the high quantile (0.9). It can be seen that, in general, the movement patterns of these effects are different for countries with low to high levels of government effectiveness, as well as different patterns between regions. For example, for the variable CO2 emissions as a proxy for environmental variables, the effect tends to decrease in countries with high government effectiveness, except in the East Asia and Pacific region. A similar pattern is found for the influence of the variable high technology exports as a proxy for the technological aspect, where its influence tends to increase with the effectiveness of a country's government, especially in countries with high government effectiveness.

For the fiscal aspect, namely government expenditure, there is also a general pattern where the effect is more positive in countries that tend to be high in effectiveness. However, the central government debt variable tends to have a negative effect as government effectiveness increases, except in East Asia and the Pacific, where the effect tends to be stronger as government effectiveness increases.

The monetary policy aspects, which are interest rates and inflation, also show different patterns. Higher inflation tends to decrease as government effectiveness decreases in Latin America and the Caribbean, with the opposite pattern in other regions. Meanwhile, the pattern of influence of rising interest rates tends to increase government effectiveness in the East Asia and Pacific region, to remain constant in Europe and Central Asia, but to decrease in Latin America and the Caribbean.

CONCLUSION

This study provides evidence that the influence of variables, including aspects of institutional quality (GDP, FDI, etc.), fiscal (government expenditure, debt) and monetary (inflation, interest rate), has a varied impact depending on the level of government effectiveness. These patterns also vary between countries in different regions. For countries in the East Asia and Pacific region, improving government effectiveness requires attention to optimising aspects of government debt, GDP growth, government expenditure, controlling inflation and interest rates, and further improving aspects of technology development. Countries in the Europe and Central Asia region need to optimise environmental aspects, market capitalisation, GDP growth, FDI and also technology development to accelerate the improvement in government effectiveness. Countries in Latin America and the Caribbean need to optimise FDI, GDP growth, government expenditure and technology development.

ACKNOWLEDGMENTS

This work is supported by Universitas Brawijaya through the research grant organized by Faculty of Mathematics and Natural Sciences (Grants No.: 2824.8/UN10.F09/PN/2023)

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