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Shadow Economy, Corruption and Economic Growth: An Analysis of BRICS Countries

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Abstract

The paper examines the impact of shadow economy and corruption, along with public expenditure, trade openness, foreign direct investment (FDI), inflation, and tax revenue on the economic growth of the BRICS countries. Data were collected from the World Bank, Transparency International, and Heritage Foundation over the 1991–2017 period. The Bayesian linear regression method is used to examine whether shadow economy, corruption and other indicators affect the economic growth of countries studied. This paper applies the normal prior suggested by Lemoine (2019) while the posterior distribution is simulated using Monte Carlo Markov Chain (MCMC) technique through the Gibbs sampling algorithm. The results indicate that public expenditure and trade openness can enhance the BRICS countries' economic growth, with the positive impact probability of 75.69% and 67.11%, respectively. Also, FDI, inflation, and tax revenue positively affect this growth, though the probability of positive effect is ambiguous, ranging from 51.13% to 56.36%. Further, the research's major finding is that shadow economy and control of corruption have a positive effect on the economic growth of the BRICS countries. Nevertheless, the posterior probabilities of these two factors are 62.23% and 65.25%, respectively. This result suggests that their positive effect probability is not high.

Keywords: Bayesian Linear Regression, BRICS, Economic Growth, Gibbs Sampling, Shadow Economy

JEL Classification Code: C11, H26, O47

1. Introduction

Shadow economy is a fact of life that happens around the world. A study by Medina and Schneider (2018) shows that, on average, the size of the shadow economy of 157 countries examined for the period 1991–2017 is approximately 30.9% of gross domestic product (GDP). While the shadow economy is below 20% of GDP in the OECD countries, this figure in Latin America and Sub-Saharan Africa is much larger, averaging nearly 38% and 39% of GDP, respectively.

Although there are various studies on the impact of shadow economy on economic growth, the results are still mixed and inconclusive. Loayza (1996) introduces an endogenous growth model whose production technology hinges on congestible public services. Using a sample of Latin American countries in the early 1990's, the author finds that a rise in the size of shadow economy has a negative effect on growth through decreasing the availability of public services and raising activities "that use some of the existing public services less efficiently" (Loayza, 1996, p. 154). In contrast, other authors confirm a positive association between these two factors. For instance, Williams (2006) suggests that shadow economy can enhance economic growth through providing an environment with improved overall competitiveness and less stringent government regulations.

Moreover, there is disagreement over the definition of shadow economic activities. Smith (1994, p. 18) defines the shadow economy as "market-based production of goods and services, whether legal or illegal, that escapes detection in the official estimates of GDP." Dell'Anno (2007) refers the shadow economy as "non-observed economy," which includes

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three areas, namely, underground production, informal production, and illegal production. Meanwhile, Schneider (2010) suggests that the shadow economy comprises all production activities of goods and services based on the market and intentionally concealed from public authorities.

Another issue that gains growing attention among researchers is corruption. Different authors may have different definitions of corruption. However, “the most popular and simplest definition of corruption is that it is the abuse of public power for private benefit” (Tanzi, 1998, p. 8). The relationship between corruption and economic growth is still controversy. While many authors indicate that corruption is negatively affected economic growth (Hodge, Shankar, Rao, & Duhs, 2011; d’Agostino, Dunne, & Pieroni, 2016; Baklouti & Boujelbene, 2019; Gründler & Potrafke, 2019), other studies suggest that corruption can “grease the wheels” rather than “sand the wheels” in certain countries.

The research aims to shed light on the impact of shadow economy and corruption on the economic growth of the BRICS countries. The BRICS emerge as a multilateral group and comprise the five major emerging economies, namely, Brazil, Russia, India, China, and South Africa. These countries account for nearly 24% of the world’s real GDP in 2018 (Li, 2019). The BRICS countries along with other emerging economies have become an important driving force behind the global economic growth.

The reminder of the paper is organized as follows. Section 2 reviews the literature while section 3 describes the measurement method and sources of data as well as the methodology of the research. Section 4 presents the results from Bayesian linear regression and the discussion on the relevant topic. Finally, section 5 offers the conclusion.

2. Literature Review

2.1. Economic Growth and Shadow Economy

The relationship between the shadow economy and the economic growth remains controversial. Some studies report that the former has a significant negative impact on the latter (Loayza, 1996; Borlea, Achim & Miron, 2017; Baklouti & Boujelbene, 2019). For instance, Baklouti and Boujelbene (2019) show that an increase in the informal economy can lead to a reduction in the tax base, which negatively affects the investment in public infrastructure and the efficiency of public services. These factors may harm the economic growth of a country.

In contrast, other authors suggest the shadow economy is positively associated with the economic growth. Notably, Asea (1996) claims that such a sector may contribute “to the creation of markets, increase financial resources, enhance entrepreneurship, and transform the legal social, and economic institutions necessary for accumulation”

(Asea, 1996, p. 166). Schneider and Enste (2000) argue that in some countries, most of the income earned in the shadow economy is used in the formal economy, which can foster the growth of the formal sector. Also, Bhattacharyya (1999) reports such positive spillovers in the United Kingdom.

Afterward, Schneider (2011) adds that the effect of the shadow economy differs across countries. Specifically, a rise in the shadow economy’s size may be beneficial for the growth in the developed and transition economies. However, in developing countries, a larger size of the shadow economy can prevent the economic growth. Meanwhile, Goel, Saunoris, and Schneider (2017) investigate the impact of the shadow economy on economic growth in the United States over more than a century. The authors conclude that prior to World War II, the shadow economy is negatively related to the economic growth; whereas, the shadow economy in post-World War II enhances such growth.

2.2. Economic Growth and Corruption

The impact of corruption on economic growth is an ongoing topic that has caused debates among researchers. Many studies indicate that corruption can have adverse effects on the growth of economy (Hodge, Shankar, Rao, & Duhs, 2011; Dridi, 2013; d’Agostino, Dunne, & Pieroni, 2016; Cieřlik & Goczek, 2018; Baklouti & Boujelbene, 2019). Notably, Hodge, Shankar, Rao, and Duhs (2011) claim that corruption adversely affects investment, human capital, and political instability, which in turn hinders economic growth. Gründler and Potrafke (2019) analyze data from 175 countries during the period 2012–2018 to find the relationship between corruption and economic growth. The authors conclude that one standard deviation increase in the reversed Transparency International’s Perception of Corruption Index leads to an approximately 17% decrease in the real per capita GDP. They add that corruption negatively influences growth by reducing FDI and raising inflation.

Nevertheless, some other authors argue that this relationship can be positive in certain countries (Paul, 2010; Jiang & Nie, 2014; Nguyen & Luong, 2020). Particularly, Nguyen and Luong (2020) claim that “corruption does not sand; but greases the wheels of economic growth” (Nguyen & Luong, 2020, p. 92). Also, Huang (2016) argues that in South Korea, corruption and economic growth may be positively associated.

Meanwhile, Acemoglu and Verdier (1998) suggest that there may exist an optimum threshold of corruption. In this regard, Dzhumashev (2014) examines the impact of governance, public expenditure, and economic development on the relationship between corruption and economic growth. The author indicates that “corruption improves economic efficiency only when the actual government size is above the optimal level. It implies that a growth-maximizing level of corruption is possible” (Dzhumashev, 2014, p. 202).

2.3. Economic Growth and Public Expenditure

Public expenditure is a vital determinant of economic growth for any nation. Studies by different authors in different countries suggest that public expenditure can enhance the growth of an economy. For instance, Jiranyakul and Brahmasrene (2007) investigate the relationship between government expenditures and economic growth in Thailand. They show that government spending has a strong positive effect on economic growth. Danladi, Akomolafe, Olarinde, and Anyadiegwu (2015) analyze the impact of government expenditure on Nigeria's economic growth over the period 1980–2013. The authors conclude that government expenditure significantly and positively influences the growth of the country.

Likewise, Sasmal and Sasmal (2016) explore the effect of public expenditure on economic growth and poverty alleviation of the major states in India. The authors indicate that states which invest more in infrastructure, including roads, irrigation, electricity, transport, and communication are prone to have higher per capita income. Therefore, the study concludes that public expenditure on infrastructure development is essential for economic growth.

Meanwhile, Pula and Elshani (2018) apply a Johansen Co-Integrated test and a Granger Causality test to discover the causal nexus between public expenditure and economic growth in Kosovo for the period 2004–2016. The authors posit that there exists a unidirectional causality between these two factors. Notably, public expenditure can promote economic growth in the country. Based on this finding, the authors propose that public expenditure should be used to enhance the environment for economic reform and infrastructure, which in turn can facilitate the private sector (Pula & Elshani, 2018).

2.4. Economic Growth and Trade Openness

Some studies show that trade openness positively impacts economic growth (Shahbaz, 2012; Tahir & Azid, 2015; Leyaro, 2015; Hye, Wizarat, & Lau, 2016; Keho, 2017). For instance, Tahir and Azid (2015) analyze data from 50 developing countries from 1990–2009. They find a positive correlation between trade openness and economic growth. Therefore, they suggest that the developing countries should speed up trade liberalization to boost economic growth. Also, Hye, Wizarat, and Lau (2016) discover the relationship between trade openness and economic growth in China for the period 1975–2009. The authors claim that trade openness is crucial for sustainable economic growth in this country. A study by Keho (2017) using data from Cote d'Ivoire over the period 1965–2014 reports similar results.

In contrast, other findings show that there is a negative relation between trade openness and economic growth.

Yanikkaya (2003) argues that trade restrictions can positively affect economic growth, especially for developing countries. Vlastou (2010) analyzes a sample of 34 African countries during the period 1960–2003. The author claims that trade openness may deteriorate economic growth in these countries. Abbas (2014) indicates that one unit increase in trade liberalization can reduce the economic growth of developing and least developing countries by US\$280.86 million and US\$3555.09, respectively.

2.5. Other Factors Affecting Economic Growth

In this study, based on the availability of research data and the review of previous literature, we also examine other factors that can affect economic growth, namely FDI, inflation, tax revenue. Some studies indicate that FDI benefits economic growth (Mustafa & Santhirasegaram, 2013; Neto & Veiga, 2013; Pegkas, 2015; Erum, Hussain, & Yousaf, 2016). For instance, Neto and Veiga (2013) analyze data from 139 countries between 1970–2009. The authors find that FDI can enhance economic growth through the diffusion of technology and innovation. Similarly, Erum, Hussain, and Yousaf (2016) examine the impact of FDI using the sample of South Asian Association of Regional Cooperation countries over the period 1990–2014. The authors conclude that FDI positively affects economic growth of these countries.

Another factor that will be investigated in the study is tax revenue. Several studies show a positive relationship between tax revenue and economic growth (Okafor, 2012; Akwe, 2014; Ojong, Anthony, & Arikpo, 2016; Egbunike, Emudainohwo, & Gunardi, 2018; Nguyen, 2019). For instance, Akwe (2014) examines the effect of non-oil tax revenue on economic growth in Nigeria between 1993–2012. The author states that such tax revenue has a positive impact on economic growth in Nigeria. Also, Egbunike, Emudainohwo, and Gunardi (2018) report a positive relationship between tax revenue and Nigeria's and Ghana's GDP. Nguyen (2019) discovers the effect of tax on Vietnam's economic growth over the 2003–2017 period. The author suggests that indirect tax positively affects the growth in the country.

Other authors investigate the connection between inflation and economic growth. Umaru and Zubairu (2012) explore the effect of inflation on economic growth and development in Nigeria for the 1970–2010 period. The authors show that inflation is statistically significant and positively affects the country's economic growth by improving productivity and output level. In contrast, Vinayagathan (2013) analyzes the impact of inflation using a sample of 32 Asian countries between 1980–2009. The author finds that a rate above a threshold of 5.43% can deteriorate the growth, whereas a rate below this threshold does not affect the growth. Meanwhile, Bick (2010) investigates data from 40 developing countries

between 1960–2004. The author claims that at a low inflation rate, specifically less than 12%, inflation has a significant positive effect on growth. Baharumshah, Slesman, and Wohar (2016) examine 94 emerging and developing countries and conclude that high inflation rates hinder growth while low inflation rates can enhance growth.

3. Data and Methodology

3.1. Data

The research uses the BRICS countries' sample to examine the impact of shadow economy and corruption on economic growth over the 1991–2017 period. The dependent variable, namely, economic growth, is measured as via GDP per capita (constant 2010 US\$) and collected from World Development Indicators. The main independent variables, namely, shadow economy and control of corruption, are collected from Medina and Schneider (2018) and Heritage Foundation. Moreover, public expenditure, trade openness, foreign direct investment, tax revenue, and inflation are also added in the empirical model as control variables in the empirical analysis. The research model is constructed as follows:

$$GE = \beta_0 + \beta_1 SE + \beta_2 CO + \beta_3 PE + \beta_4 TO + \beta_5 FDI + \beta_6 TR + \beta_7 INF + \varepsilon$$

where GE is economic growth, SE is shadow economy, CO is control of corruption, PE is government expenditure, TO is trade openness, FDI is foreign direct investment, TR is tax revenue, INF is inflation, and ε is a random error.

Table 1 presents a short description of the indicators in the study. Accordingly, the average economic growth of the BRICS countries between 1991–2017 is about US\$5,874.25 with the minimum value at US\$575.50 and the maximum value at US\$11,993.48. Meanwhile, shadow economy measured by % GDP has the mean value of 28.14%. Control of corruption is measured by Corruption Perception Index (CPI) on a scale from 0 (high corruption) to 100 (no corruption). This indicator's mean value stands at 35.32 which is lower than the average value of 50 in a range of 0–100. This number suggests a pretty high level of corruption in the countries examined. Further information can be found in Table 1.

3.2. Methodology

We use Bayesian linear regression to examine the effect of shadow economy, control of corruption, public expenditure, trade openness, FDI, inflation, and tax revenue on the BRICS countries' economic growth over the 1991–2017 period. For the observed data, the Bayes analysis depends on the posterior distribution of the model's parameters. According to Bayes' law, the posterior distribution combines the prior distribution information with evidence from observational data. The incorporation of prior information into the model makes the inference results more robust. In this paper, we use a normal prior suggested by Lemoine (2019). Meanwhile, the posterior distribution will be simulated using the Monte Carlo Markov Chain (MCMC) technique through Gibbs sampling algorithm due to the efficiency of this sampling algorithm (Thach, 2021).

Table 1: Summary Statistics and Data Sources

Variables	Obs	Mean	Std. Dev.	Min	Max	Measurement	Source
GE	135	5,874.25	3,638.29	575.50	11,993.48	GDP per capita (constant 2010 US\$)	World Bank
SE	135	28.14	9.89	11.00	46.30	Shadow economy (% of GDP)	Medina and Schneider (2018)
CO	114	35.32	8.27	21.00	56.80	Control of corruption is measured by Corruption Perception Index (CPI)	Transparency International
PE	115	73.47	11.83	48.60	95.90	Government expenditure (% of GDP)	Heritage Foundation
TO	135	42.15	16.00	15.64	110.58	Trade (% of GDP)	World Bank
FDI	134	2.12	1.52	0.00	6.19	Foreign direct investment, net inflows (% of GDP)	World Bank
TR	94	14.69	5.98	8.08	27.21	Tax revenue (% of GDP)	World Bank
INF	133	59.09	269.33	-1.40	2,075.89	Inflation, Consumer prices (annual %)	World Bank

4. Results and Discussion

4.1. Posterior Simulations

Table 2 describes the results from Bayesian linear regression. Accordingly, shadow economy (SE), control of corruption (CO), government expenditure (PE), and trade openness (TO) positively affect the economic growth (GE) of the BRICS countries. The mean parameters of SE, CO, PE, and TO are 0.31038, 0.38956, 0.69897, and 0.45289, respectively. However, the effects of these indicators on economic growth vary across the BRICS countries. The probability that mean parameters of SE, CO, TO variables are positive is quite low (the positive range varies from 62.23% to 67.11%). Meanwhile, the positive effect of PE on economic growth is strong with an impact probability of 75.69%.

The regression results also indicate a positive relationship between variables such as foreign direct investment (FDI), tax revenue (TR), and inflation (INF) and economic

growth. Particularly, the mean parameters of FDI, TR, and INF are 0.02735, 0.16900, and 0.07629, respectively. Nevertheless, the effect is ambiguous because the probability of positive effect for these factors ranges from 51.13% to 56.36%.

In the Bayes analysis, the acceptance rate and the efficiency are used to evaluate the MCMC estimator's efficiency as these will affect the MCMC convergence. Table 2 also summarizes the estimates of indicators such as the efficiency, the acceptance rate and the Gelman-Rubin (Rc) value. Notably, it is shown that all efficiencies are greater than 0.01. Also, the effective sample size (ESS) confirms that the posterior estimates are based on at least 27,000 independent observations for each coefficient. Moreover, the average acceptance rate is 1.0000 with the Gibbs sampling algorithm, so the regression results have reached the acceptance rate (Geman & Geman, 1984). Meanwhile, the Max Gelman-Rubin (Rc) value of the model is 1.00015, which is less than 1.1. Thus, the MCMC converges to the desired distribution (Gelman & Rubin, 1992).

Table 2: The Results from Bayesian Linear Regression

Variables	Mean	Posterior Probability > 0	ESS	Efficiency
SE	0.31038 (-1.64684; 2.26351)	0.6223	30000.00	1.0000
CO	0.38956 (-1.59491; 2.31701)	0.6525	29648.67	0.9883
PE	0.69897 (-1.24662; 2.66503)	0.7569	28946.15	0.9649
TO	0.45289 (-1.50143; 2.41172)	0.6711	29689.65	0.9897
FDI	0.02735 (-1.91072; 1.96325)	0.5113	30000.00	1.0000
TR	0.16900 (-1.7837; 2.14671)	0.5636	30000.00	1.0000
INF	0.07629 (-1.87464; 2.05238)	0.5279	29863.87	0.9955
_cons	0.00668 (-1.9566; 1.96201)	0.5028	30000.00	1.0000
var	5.58×10^7 (4.15×10^7 ; 7.51×10^7)		27065.84	0.9022
Average acceptance rate: 1.0000				
Max Gelman-Rubin (Rc): 1.00015				

Note: 95% Credible Intervals in Parentheses.

To ensure the robustness of the regression model, we also consider the convergence of the MCMC through results from the graphics in the analysis. First, the trace plots do not depict the trend and pass the parameter range quite well; so the trace graph is homogenous. Second, the autocorrelation plots only fluctuate in the range from -0.02 to 0.02 . In other words, the autocorrelation is very small. Finally, the density plots indicate that the overall density, the density for the first half and the density for the second half are similar. The above tests reveal that the MCMC is converging, and therefore the Bayes' inference is robust.

4.2. Discussion

The findings reveal a positive relationship between the shadow economy and the economic growth of the BRICS countries. The positive effect probability of shadow economy on economic growth is 62.23%. Comparing our results with previous research, we find that this positive effect is consistent with findings by studies such as Asea (1996), Schneider and Enste (2000), Williams (2006), and Goel, Saunoris, and Schneider (2017). Indeed, the shadow economy may provide an economic environment for small-scale manufacturing and urban services. In this sense, it can foster dynamic entrepreneurship in the economy. It can also result in “more competition, higher efficiency and strong boundaries and limits for government activities” (Schneider & Enste, 2000, p. 27). Meanwhile, Bhattacharyya (1999) and Schneider and Enste (2000) emphasize the positive spillovers of the shadow economy on the economic growth.

Moreover, we find that the positive effect probability of control of corruption on the BRICS countries' economic growth is 65.25%. Other studies that also confirm a positive relationship between these two factors are Hodge, Shankar, Rao, and Duhs (2011), d'Agostino, Dunne, and Pieroni (2016), Cieřlik and Goczek (2018), and Baklouti and Boujelbene (2019). In other words, we believe that for the BRICS countries, corruption may sand the wheels rather than grease the wheels of economic growth.

The study shows that public expenditure has a strong positive effect on the BRICS countries' economic growth. The finding is consistent with those by Jiranyakul and Brahmasrene (2007), Danladi, Akomolafe, Olarinde, and Anyadiegwu (2015) and Sasmal and Sasmal (2016). Trade openness is also positively associated with economic growth, which is supported by studies such as Tahir and Azid (2015), and Hye, Wizarat, and Lau (2016). Finally, inflation, foreign direct investment and tax revenue can help enhance the BRICS countries' economic growth. However, the positive effects of these factors are not clear.

5. Conclusion

The paper investigates factors that affect the BRICS countries' economic growth over the period 1991–2017. It is shown that public expenditure has a strong positive effect on such countries' economic growth with an impact probability of 75.69%. Meanwhile, the positive effect probability of trade openness on the BRICS countries' economic growth is lower (67.11%). Moreover, although FDI, tax revenue and inflation are positively associated with economic growth, these factors' effects are not clear since their positive impact probability ranges from 51.13% to 56.36%.

The study also indicates that while shadow economy can promote the countries' growth, corruption hinders such growth. The posterior probabilities of shadow economy and control of corruption are 62.23% and 65.25%, respectively. These findings suggest that the governments should pay more attention to the shadow economic sector in order to spread its positive effects. This in turn can help boost the economic growth of a nation. Furthermore, the control of corruption may be essential to facilitate the economic growth of the BRICS countries.

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