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RESEARCH PAPER

The impact of corruption on economic growth: a nonlinear evidence

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Abstract
On the basis of the lubricating corruption effect hypothesis (grease-the-wheels hypothesis), the impact of corruption on growth seems ambiguous. Therefore, the question that arises is how corruption affects economic growth, to what extent corruption can be tolerated and at what threshold it has a detrimental effect on an economy. This paper examines the impact of corruption on economic growth by testing the hypothesis that the relationship between these two variables is nonlinear. Moreover, the paper assesses whether the belief that corruption has detrimental effects on the economy is always true. This paper uses a panel data of 65 countries observed over the 1987 to 2021 period. The findings indicate that corruption can have a positive effect on growth. It has been found that beyond an optimal threshold, both high and low corruption levels can decrease economic growth. Under this threshold, a moderate level of corruption is defined by the point of reversal of the curve of the marginal corruption effect on growth. Such a threshold could have advantages for economic growth.

Keywords Corruption · Economic growth · Panel data: PCSE estimator

JEL Classification B23 · C51 · D73 · O47

Introduction

The corruption and economic growth nexus has been examined for a long time. According to Jain (2001), there are certain channels through which corruption affects economic growth. These transmission channels include equally allocated investments and bureaucratic efficiency. The relevant literature has consistently reported a negative correlation between economic growth and corruption. These studies have shown that developed countries are known for low corruption levels and a relatively high growth rate (Cooper et al.

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2006), and by contrast, most developing countries are known for high poverty and corruption levels (Chetwynd et al. 2003; Umbreen and Saadat 2015).

Empirical evidence tends to suggest that corruption decreases economic growth, especially in countries with low investment rates and low-quality governance (Mauro 1995; Mo, 2001; Aidt et al. 2008; Méon and Sekkat 2005; Huang 2016; Chang and Hao 2018).

The contribution of this study is that it estimates a nonlinear growth model that allows for threshold effects. To this end, it will use the method proposed by Beck and Katz (1995) who suggested estimating linear models of time-series-cross-section (TSCS) data by ordinary least squares (OLS). To this end, they proposed the panel-corrected standard errors model (PCSE).

The paper is structured as follows: The section on "Review of previous studies: the relationship between corruption and Growth" reviews both the theoretical and empirical literature; the section "Theoretical background:" presents the theoretical background; the section "Research methodology" describes the research methodology and the main results followed by a discussion of the findings. The final section concludes the paper.

Review of previous studies: the relationship between corruption and growth

The effects of corruption on economic growth and development have long been an issue of debate in economics and other social sciences. This literature can be summarized in two opposing theories. The first assumes that corruption "lubricates the economic cycle" or "greases the economic wheel" and produces the most efficient economies (Acemoglu and Verdier 2000; Barreto 2000; Egger and Winner 2005; Méon and Weill 2010; Heckelman and Powell 2010 and Johnson et al. 2014). In contrast, the second theory blames corruption and considers it as a factor that slows down economic growth (Mo, 2001; Mironov 2005; Méon and Sekkat 2005 and Mushfiq 2011).

Mauro (1995) studied the impact of corruption on economic growth in 68 countries over the 1980–1983 period. The author detected a low statistical significance between corruption and economic growth. The author found that a one standard deviation decrease in corruption causes a significant increase in the annual GDP per capita growth rate by 0.8%. However, this significance disappears once the investment rate is introduced in the model.

Mo (2001), examining a panel dataset of 54 countries observed over the 1970–1985 period, found that corruption negatively affects economic growth (a 1% increase in corruption level reduces the growth rate by about 0.72%). However, the additional introduction of variables like investment-to-GDP ratio, political stability and human capital weakens the significance of this negative impact.

Pellegrini and Gerlagh (2004) found that a one standard deviation decrease in corruption leads to an increase in growth of 1% per year, for a given initial income level.

Méon and Sekkat (2005) examined a panel dataset of 63–71 countries over the 1970–1998 period and found that corruption harms growth. These effects are different depending on governance quality.

Mendez and Sepúlveda (2006) studied a panel dataset of 40–85 countries over the 1960–2000 period. They found that corruption has beneficial effects on economic growth at low levels of political freedom and harmful effects at high levels.

Aidt et al. (2008) examined a panel dataset of 120 countries over the 1970–2000 period and show that the impact of corruption on economic growth depends on

institutional quality. Moreover, they showed that when political institutions are of low quality, corruption has little impact on growth. However, Mendez and Sepúlveda (2006) found that with high quality political institutions, corruption has harmful effects on growth. Like Mendez and Sepúlveda (2006), Heckelman and Powell (2010) found that at lowest democracy levels, corruption is harmful to growth but becomes less harmful and eventually beneficial as democracy level increases.

Méon and Weill (2010) highlighted the lubricating corruption effect hypothesis. Studying the interaction between institutional quality, corruption and production efficiency, the authors validated the hypothesis that corruption may have a positive effect on economic activities. Similarly, Kato and Sato (2015) provided evidence supporting the "greasing the wheels" hypothesis and argued that corruption enhances economic growth. Moreover, Aghion et al. (2016) showed that corruption affects the marginal taxation effect on growth.

Huang (2016) examined the causal relationship between corruption and economic development in 13 Asia–Pacific countries during the 1997–2013 period and found that South Korea and China were experiencing economic development despite high-corruption levels.

Pulok and Ahmed (2017) found a negative effect of corruption on economic growth in Bangladesh. More recently, Sharma and Mitra (2019) found an inverse effect of corruption on economic growth across the world.

All these studies indicate that corruption may have either positive or negative effects on economic growth, making the issue ambiguous and confirming the nonlinearity of the relationship between the two variables. However, one must ask to what extent can corruption be tolerated and at which threshold would it become destructive to the economy. The question is motivated by the fact that previous studies have not tested whether there is a growth-enhancing or growth-reducing level of corruption. To our knowledge, no study has comprehensively determined the corruption level that would allow for an optimal growth.

Theoretical background

Most studies have used a linear specification and reached inconclusive results. For instance, some studies have found evidence of a nonlinear relationship between corruption and growth. Bearing on this, our study subscribes to the line of research proposed by Durlauf & Johnson (1995), Mushfiq (2011), Allan & Roland (2013) and Trabelsi & Trabelsi (2021) who essentially tested the corruption-growth relationship using a nonlinear model.

Durlauf and Johnson (1995) explored a nonlinear specification of the relationship between corruption and growth in a cross-country analysis and identified multiple corruption thresholds. Similarly, Mushfiq (2011) tested the corruption-growth relationship in a nonlinear model. The author found that corruption increases growth even at a higher corruption threshold. Likewise, Allan and Roland (2013) used linear and nonlinear panel methods over the 1998 to 2009 period to determine a causal relationship between economic growth and corruption in 42 developing countries. In the same line of thought, Trabelsi and Trabelsi (2021) examined a panel data of 88 countries observed over the 1984–2011 period and found that beyond an optimal threshold, both high and low corruption can decrease economic growth.

Research methodology

Description of data

Corruption is not the only factor that affects economic growth (Barro 1991; Brunetti 1997; Lambsdorff, 1999). Other control variables are also relevant (Fernando et al. 2016). According to theory and on the basis of arguments cited in the literature, we propose that economic growth depends mainly on investment, inflation and trade openness.

The study examines a panel dataset of 65 countries over the 1987–2021 period taken from the World Development Indicators (growth rate, foreign direct investment, inflation & trade). The ICRG index has been obtained from the Quality of Government Institute, Transparency International and International Country Risk Guide (ICRG) published by Political Risk Services group. The ICRG index is suitable for our study because it is consistent across years and countries. It measures the risk involved in corruption rather than the perceived level of the corruption.

The descriptive statistics for the full set of 65 countries is reported in Table 1. It shows that average economic growth is 3.63% with an average corruption index of 3.35.

Empirical model

Empirical studies generally opt for the nonlinear approach to study the impact of corruption on economic growth (Méon and Sekkat 2005; Mendez and Sepúlveda, 2006; Aidt et al. 2008; Mushfiq 2011; Allan and Roland 2013; Eatzaz et al. 2012; Saha and Gounder 2013 and Kolstad and Wiig 2013). This is a quadratic function assuming the hypothesis that the impact of corruption on growth is not always negative and that a moderate corruption level could have advantages for economic growth.

In order to check this hypothesis, a cross-sectional approach is used in which growth rate and the ICRG index are observed only once for each country. The scatter plot

Table 1 Descriptive statistics. *Source*: World Development Indicators and author's own analyses

Variable	Obs	Mean	Std. Dev	Min	Max
Growth	2275	3.631514	3.694122	− 17.14604	21.82889
Fdi	2275	2.792351	4.098536	− 12.20843	33.56602
Inf	2275	5.787994	7.268143	− 11.68611	59.46156
Trade	2275	81.67821	51.23418	10.74832	439.6567
Icrg	2275	3.351098	1.462316	0	6

Where:

Growth: GDP per capita annual growth rate

Fdi: Percent of foreign direct investment per GDP

Inf: Consumer price index inflation (annual %)

Trad: Exports plus imports as share of GDP

Icrg: International country risk guide index of corruption, scaled 0–6. Higher values indicate lower corruption (good governance)

These results do not specify the dependency relationship between growth and corruption. To further probe this dependency, an econometric study of the relationship between growth and corruption is deemed necessary

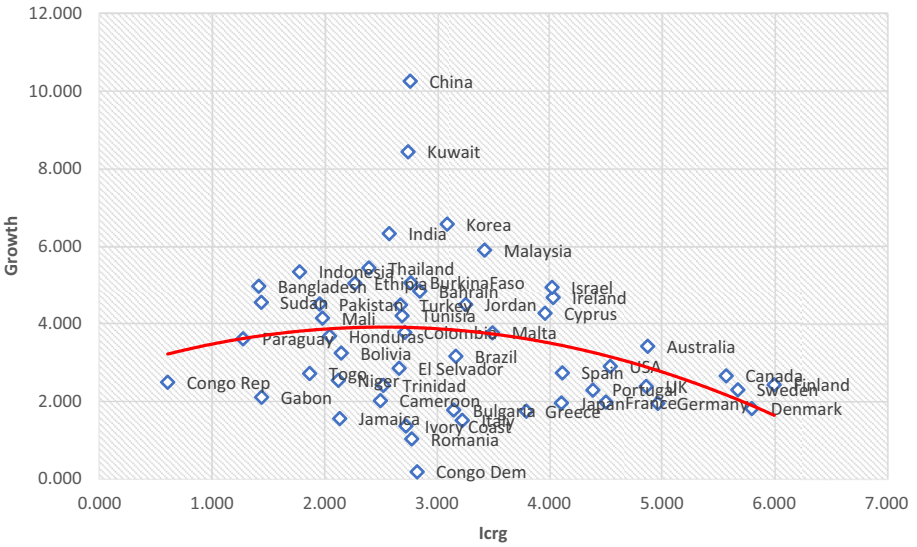

Figure 1 Growth an Corruption: Countries distribution. *Source*: World Development Indicators and author's own analyses

(Figure 1), using the fitted Kernel curve, illustrates and confirms the hypothesis that the relationship between corruption and economic growth (fitted values) is nonlinear.

The curve clearly increases in the middle range of corruption and decreases where corruption is the lowest.

Therefore, we propose the following quadratic model. Subscripts i (i = 1,…..,65) and t (t = 1987,….,2021) denote index country and time, respectively.

$$\text{Growth}_{it} = \alpha_i + \beta \text{Inf}_{it} + \gamma \text{Trad}_{it} + \mu \text{Fdi}_{it} + \delta \text{Icrg}_{it} + \lambda \text{Icrg}_{it}^2 + \varepsilon_{it} \quad (1)$$

Previous studies have used a panel of 5-year averages and the GMM system estimator because such an approach reduces, in general, short run fluctuations and resolves endogeneity due to time invariant effects. However, this method will not address endogeneity because of the possible interactions between higher growth rates and greater resources to fight corruption, or other time varying effects. Levin and Satarov (2000) and Paldam (2002) have presented evidence for the presence of both types of endogeneities.

Recently, empirical studies have indicated that repeated observations over time on some countries can be resolved by other models. In this study, we will follow the Beck and Katz's (1995) methodology who suggested estimating linear models of time-series cross-section (TSCS) data by ordinary least squares (OLS) and proposed the panel-corrected standard errors (PCSE) estimator.

The results for GDP growth using the PCSE estimator are reported in Table 2.

It can be seen that the corruption coefficient (− 1.0853466) points to a negative effect on economic growth, unlike the square coefficient (0.1982614), which indicates a positive effect on economic growth. The significance of the Icrg^2 coefficient confirms

Table 2 Panels corrected standard errors (PCSE). *Source*: World Development Indicators and author's own analyses

Growth	Coef	Std. err	t	P>| t |	[95% Conf. Interval]	
Fdi	0.0618651	0.0238888	2.59*	0.008	0.0150430	0.1086871
Inf	− 0.0392218	0.0128872	− 3.04*	0.003	− 0.0644807	− 0.0139629
Trade	0.0112539	0.0022877	4.92*	0.000	0.0067700	0.0157378
Icrg	− 1.0853466	0.3167777	− 3.43*	0.001	− 1.7062309	− 0.4644623
Icrg2	0.1982614	0.0464706	4.27*	0.000	0.1071790	0.2893438
Cons	2.153168	0.5132159	4.19*	0.000	1.1472648	3.1590712

*: test-statistic is significant at the 1% level

the nonlinearity of this model and shows the presence of a threshold above which there will be a change of trend.

Determining the threshold

We will determine the governance level that allows for achieving maximum growth. The resulting model is:

$$\text{Growth} = 2.153—0.0391\text{Inf} + 0.011\text{Trad}—1.08\text{Icrg} + 0.198\text{Icrg}^2 + 0.062\text{Fdi} \quad (2)$$

In deriving growth through governance, we get:

$$\frac{\partial Grow}{\partial Icrg} = -1.08 + 0.396\text{Icrg} = 0 \quad (3)$$

Relationship (3) shows that an optimum level is noticed for Icrg = 1.08/0.396 = 2.73. This indicates that up to a corruption index of 2.73, the trend of the bell-shaped curve (Figures 1 & 2) increases, showing a positive relationship between corruption and economic growth. After this optimum, the relationship becomes negative.

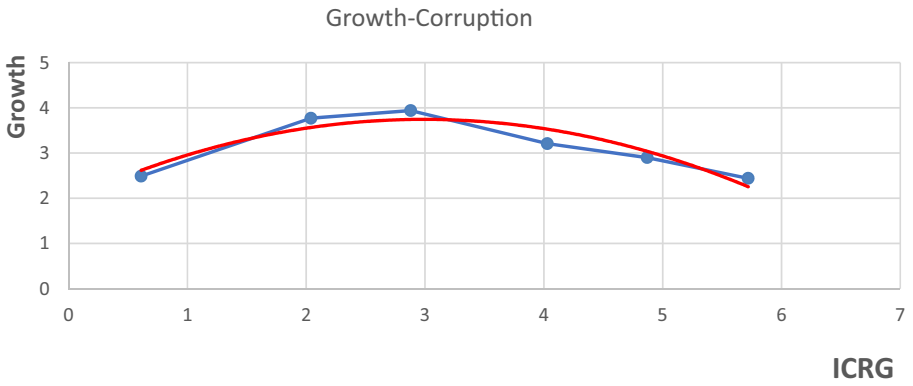

Figure 2 Means of ICRG and Growth. *Source*: World Development Indicators and author's own analyses

Table 3 Means of Icrg and Growth. *Source*: World Development Indicators and author's own analyses

ICRG	Mean-Icrg	Mean-growth (%)
Icrg ≤ 1	0.61	2.49
1 ≤ Icrg ≤ 2.5	2.04	3.77
2.5 ≤ Icrg ≤ 3.5	2.88	3.94
3.5 ≤ Icrg ≤ 4.5	4.03	3.21
4.5 ≤ Icrg ≤ 5.5	4.87	2.9
Icrg ≥ 5.5	5.72	2.44

Table 4 Analysis of variance. *Source*: World Development Indicators and author's own analyses

Source	SS	df	MS	Number of obs = 2275
Model	1757.3525	5	351.4705	F(5, 2269) = 27.16
Residual	13,366.3981	2269	5.8909	Prob > F = 0.0000
Total	15,123.7506	2274	6.6507	Root MSE = 2.4271

This finding leads us to examine the means of economic growth of the studied 65 countries under different corruption indices. Table 3 confirms our finding, namely that optimal growth is achieved under moderate corruption [2.5; 3.5], which is in average 3.94%. A low corruption level beyond 3.5 leads to a decline in growth and a level beyond 4.5 promotes growth. The same is true if the index is less than 1 (high corruption).

The choice of intervals for the ICRG variable was made following the results of Eq. (3), which gave an optimum Icrg = 2.73.

Table 3 is schematized in Figure 2:

The blue curve is the original curve, and the red curve is the trend. The values used to represent this curve are the averages of Icrg and growth per interval.

Analysis of Table 4, reporting the regression of Eq. (1) and whose results are represented in Table 2, shows the Root MSE is 2.4271. This coefficient indicates the average distance between the predicted values from the model and the actual values in the dataset. The obtained relatively low coefficient shows a perfect fit to the data.

Results and discussion

The threshold model highlights two points. First, the model provides insights into the importance of measuring a corruption threshold and analyzing the effect of corruption at different corruption regimes.

This bell-shaped curve in dotted blue and the trend curve in red (Figure 2) leaves room to assume that corruption, through tax evasion, has two types of effects on an economy. First, it offers households a tax that can be consumed or invested, and therefore, it could improve growth up to a certain threshold. This optimal threshold represents the reversal point of the curve; otherwise, the country's economy can dwindle like several countries where corruption is high. Corruption, if significant, will reduce state resources because of unproductive public spending, which will lead to a loss in economic growth. Sooner or later, such a condition will lead to an uprising, calling for establishing democratic principles and good governance.

The above findings may surprise those who advocate the negative effects of corruption, but it can be explained by the fact that administrative red tape resulting from absence of "bribes" paid in a corrupt economy may dampen economic growth and reduce economic development. This finding is confirmed by the recent study of Saha and Sen (2021). In fact, these authors have examined the role of political regimes in mediating the corruption-growth relationship, using panel data of 100 countries observed during the 1984–2016 period. They found that a marginal effect analysis shows that in strongly autocratic countries, higher corruption may lead to significantly higher growth while this is not the case in democracies. Alternatively, democracy is not good for growth, if there is a high level of perceived corruption.

Conclusion

The aim of this paper is to examine the impact of corruption on economic growth. The empirical literature that reported a linear relationship between corruption and economic development failed to differentiate between growth-enhancing and growth-reducing levels of corruption.

In our study, we presented evidence that indicates the presence of a hump-shaped relationship between corruption and growth, which indicates a nonlinear relationship between these two variables. This nonlinear relationship shows that growth increases at middle-corruption levels and decreases as nations show higher level of corruption (low governance). The results also indicate that lower levels of corruption (good governance) negatively affect growth. This observation is plausible because corruption is a phenomenon that is found both in developed and developing countries, but at different levels. Indeed, if good governance principles and structures (transparency, integrity, rule of law, sound policy, participation, accountability, responsiveness, etc.) are not in place, this provides greater opportunity for corruption. Corruption, in turn, can prevent good governance principles and structures from being put in place, or enforced. Violations of the principles of transparency, accountability and rule of law appear to be most closely associated with corruption.

Our findings confirm some theories that assume that corruption "lubricates the economic cycle" and produces the most efficient economies. In other words, when economic actors pay bribes to avoid bureaucracy, corruption may boost economic growth. However, this lubricating effect has a threshold beyond which it slows down economic growth, and so putting in place good governance principles and structures is necessary for developing countries to curb corruption and create a level playing field for businesses and individuals because corruption tends to be bad for government revenues, it can harm society by eroding trust in institutions and creating unfair advantages for corrupt individuals.

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Declarations

Conflict of interest On behalf of myself as the sole author of this manuscript, I declare that there is no conflict of interests and that no funds, grants, or any other support in any form were received during the preparation of this manuscript. Data are available from the author upon reasonable request.

References

Acemoglu D, Verdier T (2000) The choice between market failures and corruption. Am Econ Rev 90(1):194–211

Aghion P, Akcigit J, Kerr WR (2016) Taxation, corruption, and growth. In: National Bureau of Economic Research. NBER Working Papers, 21928, Cambridge, Massachusetts

Aidt T, Dutta J, Sena V (2008) Governance regimes, corruption and growth: theory and evidence. J Comp Econ 36:195–220

Allan SW, Roland C (2013) Economic growth and corruption in developing economies: evidence from linear and non-linear panel causality tests. J Bus, Financ Econ Emerg Econ 8(2):21–43

Barreto RA (2000) Endogenous Corruption in a neoclassical growth model. Eur Econ Rev 44(1):35–60

Barro RJ (1991) Economic growth in a cross section of countries. Quart J Econ 106:407–443

Beck N, Katz J (1995) What to do (and not to do) with time-serie cross-section data. Am Polit Sci Rev 89(3):634–647

Brunetti A (1997) Political variables in cross-Country growth analysis. J Econ Surv 11:163–190

Chang CP, Hao Y (2018) Environmental performance, corruption and economic growth: global evidence using a new data set. Appl Econ 49:498–514

Chetwynd E., Chetwynd F. and Spector B. (2003). Corruption and Poverty: A Review of Recent Literature, *Management Systems International*, Final Report, Washington.

Cooper DA, Krieckhaus J, Lusztig M (2006) Corruption, democracy and economic growth. Int Polit Sci Rev 27(2):121–136

Durlauf SN, Johnson PA (1995) Multiple regimes and cross - country growth behaviour. J Appl Econom 10:365–384

Eatzaz A, Muhammad AU, Muhammad IA (2012) Does corruption affect economic growth? Latin Am J Econ 49(2):277–305

Egger P, Winner H (2005) Evidence on corruption as an incentive for foreign direct investment. Eur J Polit Econ 21(4):932–952

Fernando D, Carlos D, MarÃa Angeles CP (2016) Growth inequality and corruption: evidence from developing Countries. Economics Bulletin 36(3):1811–1820

Heckelman JC, Powell B (2010) Corruption and the institutional environment for growth. Comp Econ Stud 52:351–378

Huang CJ (2016) Is corruption bad for economic growth? Evidence from asia-pacific countries. North Am J Econ Finan 35:247–256

Jain AK (2001) Corruption: a review. J Econ Rev 15(1):71–121

Johnson ND, Ruger W, Sorens J, Yamarik S (2014) Corruption, regulation and growth: an empirical study of the United States. Econ Governance 15(1):51–69

Kato A, Sato T (2015) Greasing the wheels? The effect of corruption in regulated manufacturing sectors of India. Canadian J Dev Stud 36:459–483

Kolstad I, Wiig A (2013) Digging in the dirt? Extractive industry FDI and corruption. Econ Governance 14(4):369–383

Lambsdorfff JG (1999) Corruption in empirical research - a review. In: Transparency International Working Paper. Berlin

Levin M, Satarov GA (2000) Corruption and institutions in Russia. Eur J Polit Econ 16:113–132

Mauro P (1995) Corruption and growth. Quart J Econ 60(3):681–712

Méndez F, Sepúlveda F (2006) Corruption. growth and political regimes: cross country evidence. Eur J Polit Econ 22:82–98

Méon PG, Sekkat K (2005) Does corruption grease or sand the wheels of growth? Public Choice 122(1):69–97

Méon PG, Weill L (2010) Is corruption an efficient grease? World Dev 36(3):244–259

Mironov M (2005) Bad corruption, good corruption and growth. University of Chicago, Chicago

Mo PH (2001) Corruption and economic growth. J Compar Econ 29(1):66–79

Mushfiq S (2011) Economic growth with endogenous corruption: an empirical study. Public Choice 146:23–41

Paldam M (2002) The cross-country pattern of corruption: economics, culture and the seesaw dynamics. Eur J Polit Econ 18:215–240

Pellegrini L, Gerlagh L (2004) Corruption's effect on growth and its transmission channels. Kyklos 57(3):429–456

Pulok MH, Ahmed MU (2017) Does corruption matter for economic development? Long run evidence from Bangladesh. Int J Soc Econ 44(3):350–361

Saha S, Gounder R (2013) Corruption and economic development nexus: variations across income levels in a non-linear framework. Econ Model 31:70–79
Saha S, Sen K (2021) The corruption–growth relationship: does the political regime matter? J Inst Econ 17:243–266
Sharma C, Mitra A (2019) Corruption and economic growth: some new empirical evidence from a global sample. J Int Dev 31(8):691–719
Trabelsi MA, Trabelsi H (2021) At what level of corruption does economic growth decrease? J Financ Crime 28(4):1317–1324
Umbreen J, Saadat F (2015) Corruption pervades poverty in perspective of developing Countries. Res J South Asian Stud 30(1):175–187