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Does Corruption Sand or Grease the Economic Wheels?

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Abstract: Common wisdom is that corruption hampers economic development by casting "sand in the wheels", but some economists still claim that corruption may slip "grease in the wheels" if governance is badly malfunctioning. This paper investigates the dilemma in a non-linear growth model with 99 countries worldwide over 2006–2014. The empirical results show that the quality of governance is generally negatively correlated with GDP per capita growth but that the role of corruption in this context remains mixed. The main finding is that if governance is labeled by deficiencies in *Government effectiveness, Regulatory quality* or *Rule of law*, corruption tends to mitigate their negative growth effects. Thus, the results indicate notable support for the grease in the wheels hypothesis.

1. Introduction

A common consent is that corruption must be defeated at any cost. International organizations like UN, IMF, World Bank and OECD place the battle against corruption at the top of their agenda. Governments all around the world announce tireless combat against corruption, and their political opponents court voters by accusing them of negligent offence. Public opinion condemns corruption unequivocally, anti-corruption activism is conspicuous, and fierce demonstrations against corrupt wheeling and dealing are frequent. Against this kind of hard consensus, the question about the economic consequences of corruption would seem signed and sealed.

Indeed, the economic literature on the harmfulness of corruption is extensive. The findings include that corruption hinders economic growth and development

(Shleifer and Vishny, 1993), depresses investments (Mauro, 1995; Keefer and Knack, 1995; Brunetti and Weder, 1998; Mo, 2001), and impedes countries' ability to attract foreign capital (Hines, 1995; Wei, 2000; Egger and Winner, 2005). Tanzi and Davoodi (1997) maintain that corruption deteriorates the quality of social infrastructures. The mainstream viewpoint that corruption endangers economic growth and development is described by the "sand in the wheels hypothesis" (SWH).

However, some antagonists have for long put forward the idea of efficient corruption and advocated the "grease in the wheels hypothesis" (GWH). For example, Leff (1964), Leys (1965) and Huntington (1968) claim that corruption can be beneficial in the presence of market distortions caused by unfit governance. Bardhan (1997) illustrates the intrinsic role of corruption in the historical development of entrepreneurship in USA and Europe, and Fisman and Gorden (2017) highlight the central role of "robber barons" in American industrialization. A covering conclusion is that, in a second-best world with exogenous distortions, corruption may have some intermediary benefits despite of its own distortive effects.

The core idea of GWH is that inefficient bureaucracy and excessive red tape constitute a bottleneck for starting firms and making investments, and that bribes and side payments can act as a bypass to more fluent business operations (Lakshmi, Saha and Bhattarai (2021)). In a strict sense, GWH would propose that corruption is beneficial in absolute terms while the weak form of the hypothesis postulates that corruption only mitigates the malign effects of bad governance. From the latter perspective, GWH and SWH are not radically inconsistent since GWH considers the easing of exogenous distortions caused by ineffective governance.

In the literature, there are various empirical tests on the relative veracity of GWH and SWH, but the results remain somewhat mixed. A descriptive example of the ambiguity is that Méon and Sekkat (2005) find strong evidence for the holding of SWH, while Méon and Weill (2008) conclude that GWH may hold in countries where institutions are dysfunctional.

Inspired by the ambiguity in previous findings, this paper adopts and amends the framework of Méon and Sekkat (2005) to retest the validity of GWH with reference to the general quality of governance. The main findings are two-fold: First, SWH is verified by showing that corruption is negatively correlated with the development of GDP. Second, also GWH is supported by showing that, under certain defaults in the quality of governance, corruption tends to alleviate the otherwise negative effects on real GDP per capita and investments.

The rest of the paper is organized as follows. Section 2 provides a brief review of the relevant literature. Section 3 describes the empirical methodology and data. The estimation results are reported and discussed in Section 4. Section 5 focuses on the robustness of the empirical findings, and Section 6 concludes.

2. Literature Review

Both SWH and GWH acknowledge that deficient public governance hinders economic performance and that corruption is one of the factors that describe bad governance. The main difference is that while SWH states that corruption generates economic dead weight losses among the other factors of bad governance, GWH postulates that corruption may alleviate the negative effects of at least some of the other factors.

In the GWH literature, the relevant factors of the quality of governance are originally connected to bureaucratic malfunctions. Attention has been paid to slack and complexity in procedures concerning approvals, licenses, permits and other such matters under the thumb of bureaucrats. Taken that administrative delays cause inefficiency, corruption has been seen a device to considerably fasten the administrative processes thus improving bureaucratic efficiency (Leys, 1964; Huntington, 1968).

Several empirical studies have tested the acceptability of GWH. Studies that reject the hypothesis include for example that by Mankiw and Whinston (1986), who demonstrated that corruption benefits the market entrant but causes an output reduction in the existing firms and leads to a loss in social welfare. Kurer (1993) connected the costs of corruption to the quality of officials and public services by claiming that pervasive corruption can prevent competent people from applying top positions thus spoiling the production chain of public services.

Mauro (1995) tested GWH against two samples, namely high and low red tape, and failed to show a significant difference between the two regimes. Rose-Ackerman (1997) showed that when the highest bidder pays the highest bribe, the quality of production may be compromised in the future. Kaufmann, Kraay and Zoido-Lobaton (1999) found that corruption hinders growth especially when rule of law is weak and governance is inefficient. Méon and Sekkat (2005) used a set of World Bank's governance variables and found no proof for GWH. Aidt, Dutta and Sena (2008) did not find statistically significant evidence for GWH while SWH was clearly

supported in countries with high-quality institutions. Cooray and Schneider (2018) examined corruption in the financial sector and found substantial support for SWH.

An important argument by Myrdal (1968) is that bureaucrats are motivated by self-interest to create extra obstacles to the running errands (see also Reinikka and Svensson, 2004; Li and Wu, 2007; Pande, 2008; Rosenbaum, Billinger and Stiglitz, 2013). Kaufman and Wei (2000) rejected GWH by using firm-level data and finding that firms that pay more bribes also spend more time in negotiations with local administrations. In other words, opportunistic bureaucrats use administrative bottlenecks as vehicles of rent-seeking and try to amplify them to the maximum. Thus, corruption can endogenously lead to poor governance and exacerbate the associated distortions.

On the other hand, a profound argument in favor of GWH is that corruption can incorporate market-like efficiency into governance. As Leff (1964) argued, "If the government erred in its decision, the course made possible by corruption may well be a better one". He also claimed that licenses tend to be allocated to the most efficient firm and that the willingness to offer a bribe is associated with talent. Thus, corruption may have a positive impact on the productivity of capital.

Lui (1985) showed that bribes can significantly cut the time spent in queues thus emphasizing the lubricative effect of corruption on bureaucracy. Beck and Maher (1986) used a bribery game model where permits are illicitly issued to the private bidder who offers the highest bribe. They concluded that, under incomplete information, the lowest-cost firm always wins the license. To sum up, if there is asymmetric information between public officials and private bidders, corruption can facilitate the right decision.

Méndez and Sepúlveda (2006) supported GWH by estimating a quadratic model of the impacts of corruption on growth with respect to different regimes of political freedom. They found that corruption tends to foster long-run growth in countries with low political freedom and that there exists a growth-maximizing level of corruption. Méon and Weill (2008) analyzed the interaction between aggregate efficiency, corruption, and other governance quality dimensions among 54 developed and developing countries. They observed that corruption is detrimental in countries where institutions are effective, but that it may enforce efficiency in countries with ineffective institutions thus producing reasonable evidence for GWH. Aidt (2009) stressed that a fast route to investments and straightforward access to the market are essential stimulants of the economy.

Other speculations concerning GWH include possible effects on political stability and risks. According to Nye (1967), corruption may strengthen people's confidence in institutions because bribery facilitates access to scarce services. By Amundsen (1999), corruption is like a risk insurance especially in non-democratic and patrimonial political systems thereby enhancing risky investments. However, enforcement of corruptive contracts may be difficult, costly and even dangerous. By Bardhan (1997), the uncertainty inherent in corruption-tainted agreements may wipe out the possible GWH effect. According to Campos, Lien and Pradhan (1999) and Lambsdorff (2003), the unpredictability of corrupt environments constitutes a risk by its own thus expelling investments and capital inflows (see also Fisman and Golden, 2017).

3. Methodology

3.1. The Model

As discussed in the above sections, GWH does not deny the detrimental effect of corruption but argues that it may have some benefits through the interaction with other aspects of bad governance. Therefore, our main interest is in the countervailing effects concerning the influence of corruption on economic growth. The baseline model of the study reads:

$$G_{i,t} = \alpha_0 + \alpha_1 Y_{i,0} + \alpha_2 Z_{i,t} + \alpha_3 Gov_{i,t} + (\alpha_4 + \alpha_5 Gov_{i,t}) Cor_{i,t} + \varepsilon_{i,t} \quad (1)$$

where the subscripts i and t stand for individual countries and time (in years), respectively, where $i = 1, \ldots, N$ and $t = 0, \ldots, T$. The α:s and β:s are the coefficients to be estimated, and ε denotes the error term. On the left-hand side of Equation (1), $G_{i,t}$ measures the real per capita gross domestic product (GDP) of country i in period t.

On the right-hand side, $Y_{i,0}$ denotes the growth rate of country i at the initial period 2006. Its use in the model is justified by the *conditional* convergence hypothesis (Barro, 1991; Mankiw and Weil, 1992). The hypothesis suggests that when countries possess the same technological possibilities and population growth rate, there should be convergence to the same growth rate, even if they do not display the same savings propensities and initial capital–labor ratio. In other words, poorer countries catch up to the richer ones.

In Equation (1), $Z_{i,t}$ is a vector of variables that take into account classical determinants of real GDP per capita growth (see Levine and Renelt, 1992). The

weight parameter α_2 symbolizes a vector of coefficients. Moreover, *Gov* symbolizes the influence of other aspects of the quality of governance and *Cor* represents the corruption variable, which presents the prevalence of corruption within countries. In fine, as stressed in the GWH literature, corruption is intertwined with other dimensions of the quality of governance. The interaction is described by *CorXGov*. Note that Méon and Sekkat (2005) considered only the interaction but not the direct effect of corruption captured by the parameter α_4 in Equation (1).

3.2. The Data

We use panel data from 99 countries worldwide (listed in Appendix) over the years 2006–2014. In the forthcoming estimations, three main data sources are used. First, economic data come from Penn World Tables version 9.0 (Feenstra, Inklaar and Timmer, 2015). They include per capita real GDP growth (in 2005 PPP US dollars), which is used for the dependent variable $G_{i,t}$ and for the explanatory variable $Y_{i,0}$ (the initial level in 2006) in Equation (1). We expect that the *conditional* convergence hypothesis holds (i.e. $\alpha_1 < 0$) meaning that poorer countries catch up the richer ones. Note that Méon and Sekkat (2005) used the average growth rate of per capita income over 1970–1998 as the dependent variable.

The vector of variables $Z_{i,t}$ includes physical and human capital, population growth and inflation over 2006–2014. Following Levine and Renelt (1992), investments in both physical and human capital should enhance growth. For physical capital, we use the capital stock (also in 2005 PPP US dollars) over the study period, and for human capital, we use the index of human capital per person as a combination of schooling years (Barro and Lee, 2010) and returns to education (Psacharopoulos, 1994). A standard assumption is that the marginal product of education diminishes in schooling time (see also Caselli, 2005). Note that in Méon and Sekkat (2005), the variable for physical capital was the average ratio of investment to GDP over time, and the proxy for human capital was the initial level of schooling.

Population growth rate incorporates the demographic factor of economic growth, and population growth should hinder GDP per capita growth. Inflation is accounted by taking US GDP in 2011 as 1, and inflation should be negatively correlated with economic growth. The estimated coefficients associated with population growth and inflation should then be negative (Levine and Renelt, 1992). Note that Méon and Sekkat (2005) used the average growth rate of population over

their sample period. They also applied openness of trade as a control variable, which is omitted here.

What comes to the quality of governance variable Gov in Equation (1), we follow Méon and Sekkat (2005) and consider five WGI indices described in Kaufmann, Kraay and Zoido-Lobaton (1999). The upgraded version provides statistics for the time span 1996–2014 (Worldwide Governance Indicator dataset, World Bank, 2014). The perceptions concerning the quality dimensions of governance are:

Voice and accountability (VA) reflects citizens' ability to participate in selecting their government, freedom of expression, freedom of association, and free media; *Political stability and lack of violence/terrorism (LV)* reflects the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political violence and terrorism; *Government effectiveness (GE)* reflects the quality of public services and civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies; *Regulatory quality (RQ)* reflects the government's ability to formulate and implement sound policies and regulations that enhance private sector development; *Rule of law (RL)* reflects the extent to which agents trust and abide by the rules of society, the quality of contract enforcement, property rights, the police, and the courts, and the likelihood of crime and violence".

The original WGI index values vary from -2.5 to 2.5 where the upper bound represents ultimate quality and the lower bound represents lowest possible quality. For interpretational ease, the index values are transformed by subtracting them from 3.5. Consequently, the transformed index values vary from 1 to 6, where 1 stands for the best quality and 6 stands for the lowest quality. Note that while Méon and Sekkat (2005) used the same governance indicators, their observations were only from one data point at 1998.

For the corruption variable *Cor*, we use two indicators that measure the prevalence of bribery. The data come from the World Bank Enterprise Survey of Business Managers, based on surveys of more than 131,000 firms from 139 countries worldwide. The first prevalence of bribery indicator is *Bribe incidence (BI)*, which measures the proportion of firms experiencing at least one bribe payment request out of six transactions dealing with utilities access, permits, licenses and taxes. The second indicator *Bribe depth (BD)* captures the percentage of transactions in which a

gift or informal payment was requested, again out of six transactions dealing with utilities access, permits, licenses and taxes. The estimated coefficients of both *BI* and *BD* are expected to be negative, meaning that corruption should hamper the per capita GDP growth rate.

Note that our corruption measures are based on track record of illicit transactions, not on surveys concerning people's vague perceptions of corruption (about the critics of perception-based corruption indicators, see Fisman and Golden, 2017). Méon and Sekkat (2005) also used two corruption indices, the CPI index from Transparency International and the WGI corruption index from the World Bank, but both indices are based on people's perceptions.

As commented above, corruption clearly interacts with other dimensions of the quality of governance. Therefore, Equation (1) includes the interaction term denoted *CorXGov*. It is constructed by multiplying the corruption variables (*BI* and *BD*) and the transformed governance variables (*VA*, *LV*, *GE*, *RQ*, and *RL*), thus yielding 10 interaction terms in total. Descriptive statistics, expected signs of the estimated coefficients and the stationarity test are reported in Appendix 2, Tables 2.1 – 2.3.

4. Results

The baseline model presented in Equation (1) is estimated in three specifications. First, the independent variables include only the variables of interest, namely corruption, quality of governance and their interaction terms. Second, basic control variables of growth are incorporated. Third, regional dummies are added. In line with Mankiw and Weil (1992), logarithmic values of variables are used in the estimations to make the observations conform to normal distribution and improve the quality of predictions. The estimation results with Panel Least squares and Fixed Effects methods are reported in Tables 1–4 below. Like Méon and Sekkat (2005), we did not get conclusive findings from the estimations involving *VA*. To save space, they are not reported. Likewise, the estimated coefficients of the time dummies used in the Fixed Effects regressions are not reported because they were not statistically significant.

Table 1 collects the results from the estimations of Equation (1) when *LV* (Political stability and lack of violence/terrorism) is used as the quality of governance variable.

Table 1: Estimation of per capita GDP growth, based on *LV*

Column	*(1)*		*(2)*		*(3)*		*(4)*	
Method	*Panel Least Squares*		*Panel Least Squares*		*Panel Least Squares*		*Fixed Effects*	
Cor Index	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Corruption	-0.004***	-0.005***	-0.004***	-0.005***	-0.007***	-0.008***	-0.025***	-0.02**
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)	(0.019)	(0.019)
LV	-0.0064*	-0.0081	-0.0036*	-0.0087*	-0.0081**	-0.006	-0.089*	-0.08**
	(0.009)	(0.009)	(0.010)	(0.011)	(0.012)	(0.012)	(0.058)	(0.055)
Corruption×*LV*	0.002**	0.002*	0.002**	0.0025**	0.004***	0.004***	0.021***	0.019***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.015)	(0.015)
$Growth_{2006}$			-0.016**	-0.015**	-0.002*	-0.003*		
			(0.089)	(0.091)	(0.095)	(0.098)		
Capital stock			0.002***	0.002***	0.002***	0.001***	0.028***	0.027***
			(0.0006)	(0.0007)	(0.0008)	(0.0008)	(0.010)	(0.010)
Human capital			0.006**	0.0039***	0.005***	0.005***	0.255***	0.244**
			(0.005)	(0.005)	(0.006)	(0.007)	(0.088)	(0.089)
Population growth			-0.184**	-0.181**	-0.210**	-0.208**	-0.289**	-0.275
			(0.063)	(0.063)	(0.073)	(0.073)	(1.067)	(1.085)
Inflation			-0.006***	-0.006***	-0.008**	-0.008***	-0.010**	-0.01**
			(0.004)	(0.004)	(0.004)	(0.005)	(0.012)	(0.012)
Latin America					0.007***	0.006***		
					(0.008)	(0.008)		
Africa					-0.004	-0.004		
					(0.009)	(0.009)		
Middle East					0.008**	0.009***		
					(0.011)	(0.012)		
Southeast Asia					0.003***	0.004***		
					(0.010)	(0.010)		
Southwestern Asia					-0.0003**	-0.0003*		
					(0.011)	(0.011)		
Eastern Europe					0.0006***	0.001***		
					(0.009)	(0.009)		
Central Europe					-0.002	-0.001		
					(0.010)	(0.010)		
Intercept	0.044***	0.034**	0.011***	0.012*	0.012***	0.010		
	(0.0120)	(0.011)	(0.015)	(0.014)	(0.019)	(0.018)		
Adj.-R^2	0.1801	0.1923	0.6359	0.6375	0.6693	0.6686	0.5063	0.5185
N	78	77	76	75	70	69	76	75

Notes: Robust standard errors are in parentheses. The superscripts ***,** and * represent statistical significance at 0.1, 1 and 5 % level, respectively.

The results in Table 1 show that the estimated coefficients of the variables of interest display the same negative sign throughout. In particular, the partial effects of *Corruption* and *LV* are found to be negatively associated with GDP growth. The increase of the number of independent variables (from Column 1 to 3) does not change the signs of the coefficient estimates. Controlling for fixed effects (Column 4), the conclusion also stays unchanged. The results also show that the economic variables display their expected signs with 5 % statistical significance. The negative effects of *Corruption* and *LV* on growth are even more obvious when one looks at the interaction variable *CorruptionXLV*. The positive sign of all estimated coefficients of the interaction variable ($\alpha_5 > 0$) means that the negative effect of corruption on growth is magnified if *LV* grows (that is if political instability and violence/terrorism increases). A reverse interpretation is that the negative effect of *LV* is amplified when corruption spreads saying that corruption generates an additional dead weight loss to growth. These findings are consistent with SWH.

Table 2 presents the estimation results when *GE* (Government effectiveness) measures the quality of governance.

Table 2: Estimation of per capita GDP growth, based on *GE*

Column	*(1)*		*(2)*		*(3)*		*(4)*	
Method	*Panel Least Squares*		*Panel Least Squares*		*Panel Least Squares*		*Fixed Effects*	
Cor index	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Corruption	0.003***	0.006***	0.002***	0.006***	0.002***	0.01***	0.007***	0.01***
	(0.004)	(0.005)	(0.004)	(0.006)	(0.006)	(0.007)	(0.019)	(0.019)
GE	-0.008***	-0.003**	-0.008***	-0.002***	-0.005***	-0.003***	-0.03**	-0.054**
	(0.009)	(0.009)	(0.010)	(0.010)	(0.012)	(0.011)	(0.066)	(0.065)
Corruption×GE	-0.001***	-0.003**	-0.001***	-0.003**	-0.001***	-0.004***	-0.001**	-0.003*
	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.005)	(0.015)	(0.015)
$Growth_{2006}$			-0.011***	-0.007***	-0.031**	-0.033*		
			(0.086)	(0.087)	(0.093)	(0.094)		
Capital stock			0.002***	0.003***	0.003***	0.004***	0.023***	0.023**
			(0.0006)	(0.0007)	(0.001)	(0.001)	(0.01)	(0.010)
Human capital			0.004***	0.004***	0.004***	0.003***	0.022**	0.02***
			(0.005)	(0.005)	(0.007)	(0.006)	(0.086)	(0.086)
Population growth			-0.193**	-0.190*	-0.213**	-0.214*	0.484	0.497
			(0.062)	(0.062)	(0.072)	(0.072)	(1.051)	(1.054)
Inflation			-0.006**	-0.0070*	-0.007**	-0.0087*	-0.013**	-0.013**
			(0.004)	(0.004)	(0.005)	(0.005)	(0.012)	(0.012)

contd. table 2

Column	*(1)*		*(2)*		*(3)*		*(4)*	
Method	*Panel Least Squares*		*Panel Least Squares*		*Panel Least Squares*		*Fixed Effects*	
Cor index	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Latin America					0.0057**	0.006***		
					(0.01)	(0.006)		
Africa					-0.003*	-0.004*		
					(0.009)	(0.009)		
Middle East					0.005***	0.01***		
					(0.011)	(0.012)		
Southeast Asia					0.002**	0.004**		
					(0.010)	(0.01)		
Southwestern Asia					-0.003	-0.001		
					(0.011)	(0.011)		
Eastern Europe					0.001**	0.002*		
					(0.009)	(0.009)		
Central Europe					-0.002**	-0.001*		
					(0.01)	(0.01)		
Intercept	0.004***	0.004**	0.001**	0.001***	0.004**	0.0012		
	(0.010)	(0.011)	(0.015)	(0.015)	(0.018)	(0.017)		
Adj.-R^2	0.2003	0.2057	0.6128	0.6298	0.6401	0.6318	0.5110	0.5243
N	78	77	70	76	76	69	76	75

Notes: Robust standard errors are in parentheses. The superscripts ***,** and * represent statistical significance at 0.1, 1 and 5 % level, respectively.

The results in Table 2 notably differ from those in Table 1. Regardless of the specifications and estimators adopted, the partial effect of corruption on growth is now positive and statistically significant at 0.1% level. Thus, the more firms are subject to bribe claims (*BI*), and/or the more transactions are tainted by illegal payments (*BD*), the greater the growth in per capita GDP. The effect of the quality of governance (*GE*) remains negative at no less than 1% level. The estimated sign of the coefficient of the interaction variable *CorruptionXGE* is now negative and statistically significant. This means that the positive influence of corruption is mitigated as *GE* gets worse, which is intuitive but not quite in the spirit of GWH. On the other hand, the negative sign of the interaction term also means that corruption tends to alleviate the negative effects of bad governance described by *GE*. In fact, this is what GWH claims.

Table 3 reports the estimation results of Equation (1) with respect to *RQ* (Regulatory quality)

Table 3: Estimation of per capita GDP growth, based on *RQ*

Column	*(1)*		*(2)*		*(3)*		*(4)*	
Method	*Panel Least Squares*		*Panel Least Squares*		*Panel Least Squares*		*Fixed Effects*	
Cor index	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Corruption	0.004***	0.006***	0.002***	0.005***	0.002***	0.007***	0.002**	0.004*
	(0.004)	(0.006)	(0.005)	(0.006)	(0.006)	(0.007)	(0.014)	(0.015)
RQ	-0.004***	-0.002**	-0.003***	-0.0006**	-0.004***	-0.008*	-0.038*	-0.038*
	(0.009)	(0.01)	(0.01)	(0.015)	(0.012)	(0.011)	(0.055)	(0.053)
Corruption×*RQ*	-0.001**	-0.003***	-0.003***	-0.002**	-0.001***	-0.004***	-0.002**	-0.003*
	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.011)	(0.014)
$Growth_{2006}$			-0.006***	-0.005***	-0.026***	-0.028***		
			(0.087)	(0.100)	(0.100)	(0.093)		
Capital stock			0.007***	0.011***	0.0002***	0.0002***	0.023**	0.037**
			(0.006)	(0.006)	(0.001)	(0.0008)	(0.010)	(0.015)
Human capital			0.005***	0.004***	0.006**	0.005*	0.221**	0.413**
			(0.005)	(0.005)	(0.007)	(0.006)	(0.086)	(0.081)
Population growth			-0.194**	-0.192**	-0.221**	-0.223**	-0.480*	-0.488*
			(0.062)	(0.063)	(0.073)	(0.073)	(1.028)	(1.027)
Inflation			-0.006**	-0.007*	-0.008**	-0.009**	-0.013*	-0.034
			(0.004)	(0.004)	(0.005)	(0.005)	(0.012)	(0.013)
Latin America					0.007***	0.008***		
					(0.01)	(0.009)		
Africa					0.004*	0.005**		
					(0.01)	(0.01)		
Middle East					0.007	0.011		
					(0.011)	(0.012)		
Southeast Asia					0.003*	0.005**		
					(0.010)	(0.010)		
Southwestern Asia					0.0004	0.002*		
					(0.011)	(0.011)		
Eastern Europe					-0.0002*	0.001		
					(0.009)	(0.009)		
Central Europe					-0.001***	-0.001***		
					(0.010)	(0.010)		
Intercept	2.e-05**	0.003**	0.006**	0.008**	0.007**	0.010*		
	(0.010)	(0.010)	(0.015)	(0.014)	(0.017)	(0.017)		
Adj.-R^2	0.1844	0.1823	0.5090	0.5156	0.5731	0.5716	0.4452	0.4534
N	78	77	76	75	70	69	76	75

Notes: Robust standard errors are in parentheses. The superscripts ***,** and * represent statistical significance at 0.1, 1 and 5 % level, respectively.

In Table 3, the estimation results concerning the variables of interest resemble those in Table 2, albeit with somewhat lower statistical significance (but no less than 5 %). The partial effects of corruption are positive, *RQ* tends to reduce GDP growth, and the estimated coefficients of the interaction term *CorruptionXRQ* are negative and statistically significant. Thus, the conclusion is the same as above: The positive influence of corruption is mitigated as regulatory quality worsens, and the negative effect of bad regulatory quality is alleviated as corruption increases. Again, corruption tends to mitigate the negative effect of bad regulatory quality thus implying support for GWH.

Table 4 reports the estimation results of Equation (1) with respect to *RL* (Rule of law).

Table 4: Estimation of per capita GDP growth, based on *RL*

Column	*(1)*		*(2)*		*(3)*		*(4)*	
Method	*Panel Least Squares*		*Panel Least Squares*		*Panel Least Squares*		*Fixed Effects*	
Cor index	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Corruption	0.006***	0.010***	0.005***	0.010***	0.005***	0.011***	0.006**	0.007***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)	(0.007)	(0.017)	(0.018)
RL	-0.002***	-0.003***	-0.004***	-0.012**	-0.028***	-0.022***	-0.046***	-0.045**
	(0.009)	(0.008)	(0.017)	(0.008)	(0.012)	(0.011)	(0.070)	(0.069)
Corruption×RL	-0.003***	-0.006***	-0.023***	-0.005**	-0.002***	-0.005***	-0.004**	-0.006**
	(0.004)	(0.004)	(0.004)	(0.006)	(0.005)	(0.005)	(0.013)	(0.013)
$Growth_{2006}$			-0.002***	-0.005***	-0.028***	-0.02***		
			(0.086)	(0.087)	(0.093)	(0.130)		
Capital stock			0.001***	0.004***	0.038***	0.053***	0.024**	0.072***
			(0.006)	(0.0006)	(0.001)	(0.001)	(0.010)	(0.031)
Human capital			0.004**	0.003***	0.004***	0.003***	0.228**	0.226**
			(0.005)	(0.007)	(0.019)	(0.007)	(0.087)	(0.086)
Population growth			-0.184**	-0.177**	-0.209**	-0.211**	-0.579*	-0.570
			(0.062)	(0.062)	(0.073)	(0.072)	(0.108)	(0.10)
Inflation			-0.006**	-0.007**	-0.008*	-0.01**	-0.012**	-0.01***
			(0.004)	(0.004)	(0.005)	(0.005)	(0.013)	(0.034)
Latin America					0.005*	0.006*		
					(0.018)	(0.009)		
Africa					0.003***	0.005**		
					(0.01)	(0.01)		

contd. table 4

Column	*(1)*		*(2)*		*(3)*		*(4)*	
Method	*Panel Least Squares*		*Panel Least Squares*		*Panel Least Squares*		*Fixed Effects*	
Cor index	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Middle East					0.0049**	0.010		
					(0.011)	(0.012)		
Southeast Asia					0.001**	0.004*		
					(0.010)	(0.010)		
Southwestern Asia					-0.001	-0.001		
					(0.011)	(0.011)		
Eastern Europe					-0.001	-0.0006		
					(0.01)	(0.01)		
Central Europe					-0.002	-0.002		
					(0.010)	(0.010)		
Intercept	0.001***	0.032***	0.045**	0.005***	0.001***	0.003***		
	(0.010)	(0.01)	(0.014)	(0.013)	(0.017)	(0.016)		
Adj.-R^2	0.2119	0.2247	0.5141	0.5202	0.5363	0.5398	0.4550	0.4661
N	78	77	76	75	70	69	76	75

Notes: Robust standard errors are in parentheses. The superscripts ***, ** and * represent statistical significance at 0.1, 1 and 5 % levels, respectively.

The results in Table 4 are in line with those in Tables 2 and 3. The estimated signs of the main effects tell that corruption enhances economic growth while deficient rule of law hinders growth. The sign of the coefficient of the interaction variable *CorruptionXRL* is negative and statistically significant (no less than 1 % level). Therefore, the positive influence of corruption is mitigated as *RL* gets worse or, to put it the other way round, corruption tends to alleviate the negative effects of bad governance described by *RL*. Again, GWH is supported.

Table 5 collects the main implications from the above analyses.

Table 5: Signs of the estimated coefficients of the variables of interest with SWH/GWH implications

	LV	*GE*	*RQ*	*RL*
α_3 (Gov)	–	+	+	+
α_4 (Cor)	–	–	–	–
α_5 (Gor×Cov)	+	–	–	–
Implication	SWH	GWH	GWH	GWH

By Table 5, our empirical analyses give credit to SWH when the estimations include *LV* (*Political stability and lack of violence/terrorism*). Instead, GWH is supported when the estimations involve *GE* (*Government effectiveness*), *RQ* (*Regulatory quality*) or *RL* (*Rule of law*). Recall that the quality indicators *LV*, *GE*, *RQ* and *RL* were used in transformed form so that a higher index value means lower quality. Since the estimates of the interaction terms showed relatively weak (but still noteworthy) effects, GWH cannot be justified in the strict sense, which would mean that corruption is overall virtuous. Instead, the main findings collected in Table 5 partially support the weak version of GWH, meaning that corruption alleviates the distortions caused by otherwise deficient governance.

5. Robustness Tests

As the first robustness test, we control the dependent variable with another determinant. The results are considered robust if the estimations with the new determinant variable do not affect our previous conclusion about the validity of SWH or GWH. Following Méon and Sekkat (2005), we use the interaction variable $Growth_{2006}$X*Human capital* based on the regressions in Column 2 of Tables 1–4, which include the basic economic variables into the estimations. The results are shown in Table 6.

The findings in Table 6 show an overall reduction in the significance of estimated coefficients. Still, the coefficient signs of the variables of interest are statistically significant at no less than 5 % level. Note that the coefficients of human capital have turned negative but statistically insignificant, and that the coefficients of the interaction term $Growth_{2006}$X*Human capital* are quite substantial. More importantly, the estimations are robust concerning the validity of SWH with respect to *LV* (regression *2.1*), while GWH still holds with *GE*, *RQ* and *RL* (regressions *2.2 – 2.4*, respectively).

The second robustness test follows the "preliminary investigations" of Méon and Sekkat (2005). As Tables 5 and 6 indicate, our estimations of Equation (1) yielded somewhat mixed results about the role of corruption. To test the conclusions, we perform recursive estimations based on the partial effects of corruption and the quality of governance on GDP growth. These inversed partial effects are computed as follows:

$$\Delta G_{i,t}/\Delta Gov_{i,t} = \alpha_3 + \alpha_5 Cor_{i,t} \qquad (2a)$$

Table 6: Robustness test on Estimation of per capita GDP growth

Column	(2.1)		(2.2)		(2.3)		(2.4)	
Gov index	*LV*		*GE*		*RQ*		*RL*	
Cor index	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Corruption	-0.007**	-0.008**	0.004***	0.007**	0.004**	0.006***	0.007**	0.011**
	(0.0051)	(0.005)	(0.005)	(0.006)	(0.004)	(0.006)	(0.005)	(0.006)
LV	-0.005**	-0.007*	-0.0004**	-0.002*	-0.001**	-0.002**	-5.6e-5**	- 0.002**
	(0.0106)	(0.001)	(0.010)	(0.010)	(0.010)	(0.009)	(0.016)	(0.008)
Corruption×*LV*	0.003**	0.004*	-0.001**	-0.003*	-0.001**	-0.002**	-0.003**	-0.005**
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
$Growth_{2006}$	-0.939**	-0.919**	-0.935**	-0.903**	-0.957**	-0.925**	-0.912**	-0.862*
	(0.337)	(0.338)	(0.343)	(0.342)	(0.334)	(0.332)	(0.337)	(0.336)
Capital stock	7.1e-05*	6.4e-05	0.0003*	0.0003*	0.0001**	0.0001*	0.0002**	0.0002*
	(0.0006)	(6.8e-04)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Human capital	-0.017	-0.016	-0.017	-0.016	-0.017	-0.016	-0.016	-0.015
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$Growth_{2006}$×	1.703**	1.6711**	1.655**	1.598**	1.694**	1.634**	1.628**	1.542**
Human cap	(0.581)	(0.584)	(0.595)	(0.592)	(0.576)	(0.571)	(0.583)	(0.579)
Population growth	-0.201**	-0.200**	-0.210**	-0.205**	-0.209***	-0.206**	-0.201**	-0.195**
	(0.061)	(0.062)	(0.060)	(0.060)	(0.060)	(0.061)	(0.061)	(0.061)
Inflation	-0.006*	0.007*	0.007*	0.0073**	0.006*	0.007*	0.006*	0.007*
	(0.004)	(0.004)	(0.004)	(0.004)	-(0.003)	-(0.004)	(0.003)	(0.004)
Intercept	0.0154	0.025*	0.0159*	0.017**	0.018**	0.018	0.016*	0.017**
	(0.0154)	(0.015)	(0.0160)	(0.0157)	(0.015)	(0.014)	(0.014)	(0.014)
Adj.-R^2	0.6455	0.6569	0.6605	0.6652	0.6795	0.6831	0.6878	0.6914
N	78	77	76	75	76	75	76	75

Notes: Robust standard errors of PLS estimators are in parentheses. The superscripts ***, ** and * represent statistical significance at 0.1, 1 and 5 % levels, respectively.

$$\Delta G_{i,t}/\Delta Cor_{i,t} = \alpha_4 + \alpha_5 Gov_{i,t} \quad (2b)$$

In Equation (2a), the parameter indicates how much deficient governance costs to growth in terms of corruption. Then, < 0 would imply that a one-percentage point increase in the corruption index leads to a greater respective decrease in GDP growth by damaging the quality of governance further. In Equation (2b), the parameter inversely tells what corruption costs to growth in terms of poor governance. Thus, < 0 would imply that a one-percentage point increase in the

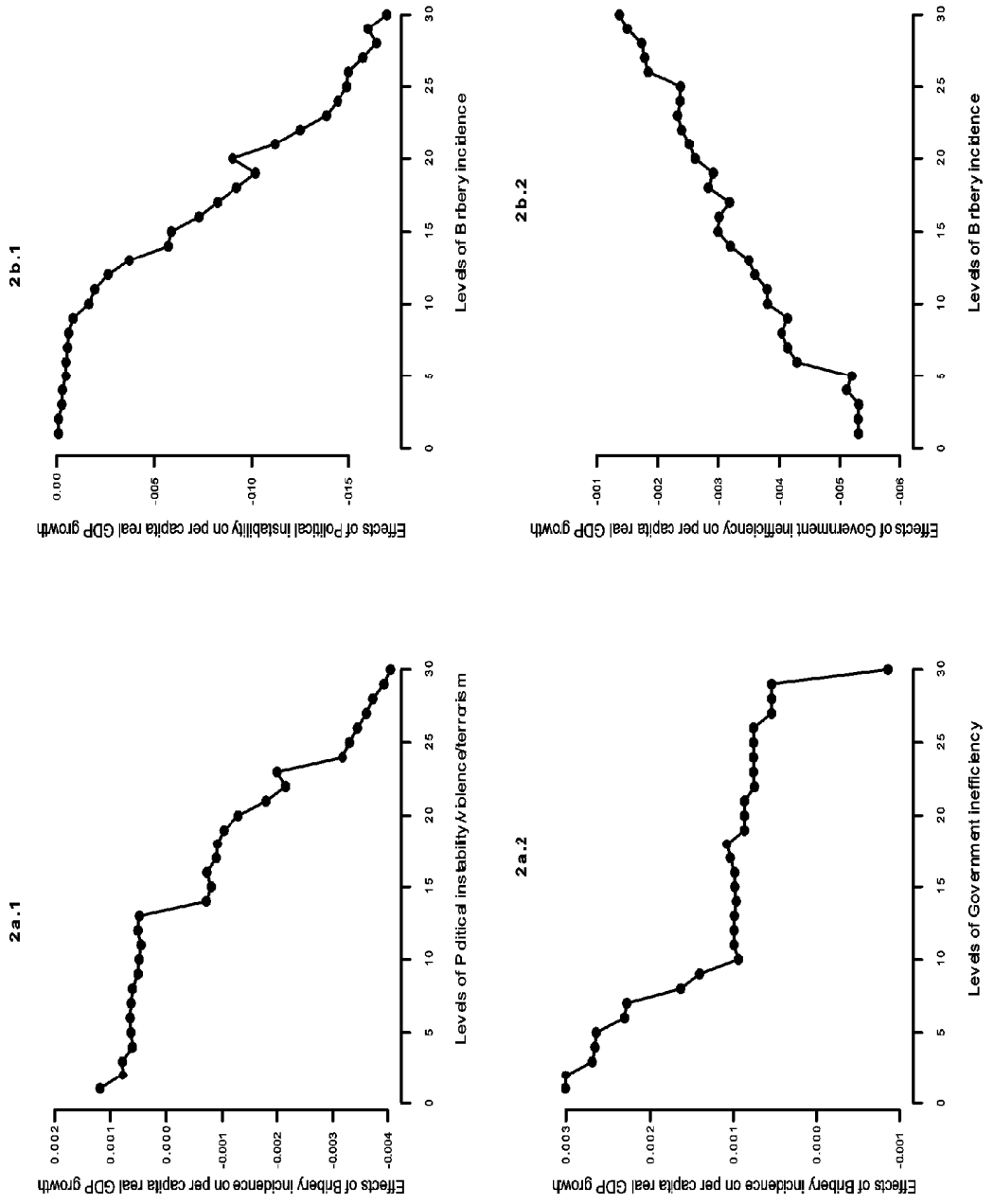
quality of governance index (that is worsening of the quality) generates a greater respective decrease in the level of growth with higher level of corruption.

The recursive estimations of Méon and Sekkat (2005) focused on the effects of corruption on different *RL* regimes like in Equation (2a), but they did not consider the potential additional costs of corruption coming from bad governance as described by Equation (2b). Since this is an essential point of GWH, we estimate both Equations (2a) and (2b) with respect to the quality of governance and corruption. Following Méon and Sekkat (2005), we split the full sample of countries into sub-samples with different levels of the quality of governance and corruption over 2006–2014.

We rank the sample countries from the highest to the lowest level of average quality according to *LV*, *GE*, *RQ* and *RL*, and *BI* which we use as the sole corruption variable in the recursive estimations. We construct the ranking so that, for example, our sub-sample 1 according to *LV* includes the 70 countries with the best average scores that is the smallest values of the transformed *LV* index over the time span. Sub-sample 2 includes observations from the second-best country to the 71st best, and so on. Thus, the average level of *LV* gradually falls from the first to the last sub-sample. The same technique is applied for *GE*, *RQ*, *RL* and *BI*. The procedure generates 30 successive sub-samples for each index.

Equations (2a) and (2b) are estimated by the Fixed Effects method with respect to the sub-samples. The findings are summarized in Figure 1 as plotter displays of the estimates. The estimation results of Equation (2a) are illustrated in Panels 2a.1 – 2a.4 according to *LV*, *GE*, *RQ* and *RL*, respectively. In each panel, the horizontal axis presents the deterioration of the quality of governance from the average level in sub-sample 1 to that in sub-sample 30, and the vertical axis presents the effect of corruption on GDP growth. Likewise, the estimation results of Equation (2b) are illustrated in Panels 2b.1 – 2b.4, where the horizontal axles depict the increase of corruption over the sub-samples 1-30, and the vertical axles depict the effect of *LV*, *GE*, *RQ* and *RL* on growth, respectively.

In Figure 1, Panels 2a.1 and 2b.1 show the respective estimation results of Equation (2a) and (2b) in terms of the quality of governance measured by *LV*. The downwards sloping plotting in Panel 2a.1 illustrates how the negative effect of corruption on economic growth is amplified as the quality of *LV* deteriorates over the sub-samples 1-30. The plotting in Panel 2b.1 is also downwards sloping as corruption increases over the sub-samples 1-30. The message is that while the


2a.1
Effects of Bribery incidence on per capita real GDP growth
0.002
0.001
0.000
-0.001
-0.002
-0.003
-0.004
0
5
10
15
20
25
30
Levels of Political instability/violence/terrorism
2a.2
Effects of Bribery incidence on per capita real GDP growth
0.003
0.002
0.001
0.000
-0.001
Levels of Government inefficiency
2b.1
Effects of Political instability on per capita real GDP growth
0.00
-005
-010
-015
Levels of Bribery incidence
2b.2
Effects of Government inefficiency on per capita real GDP growth
-001
-002
-003
-004
-005
-006
Levels of Bribery incidence

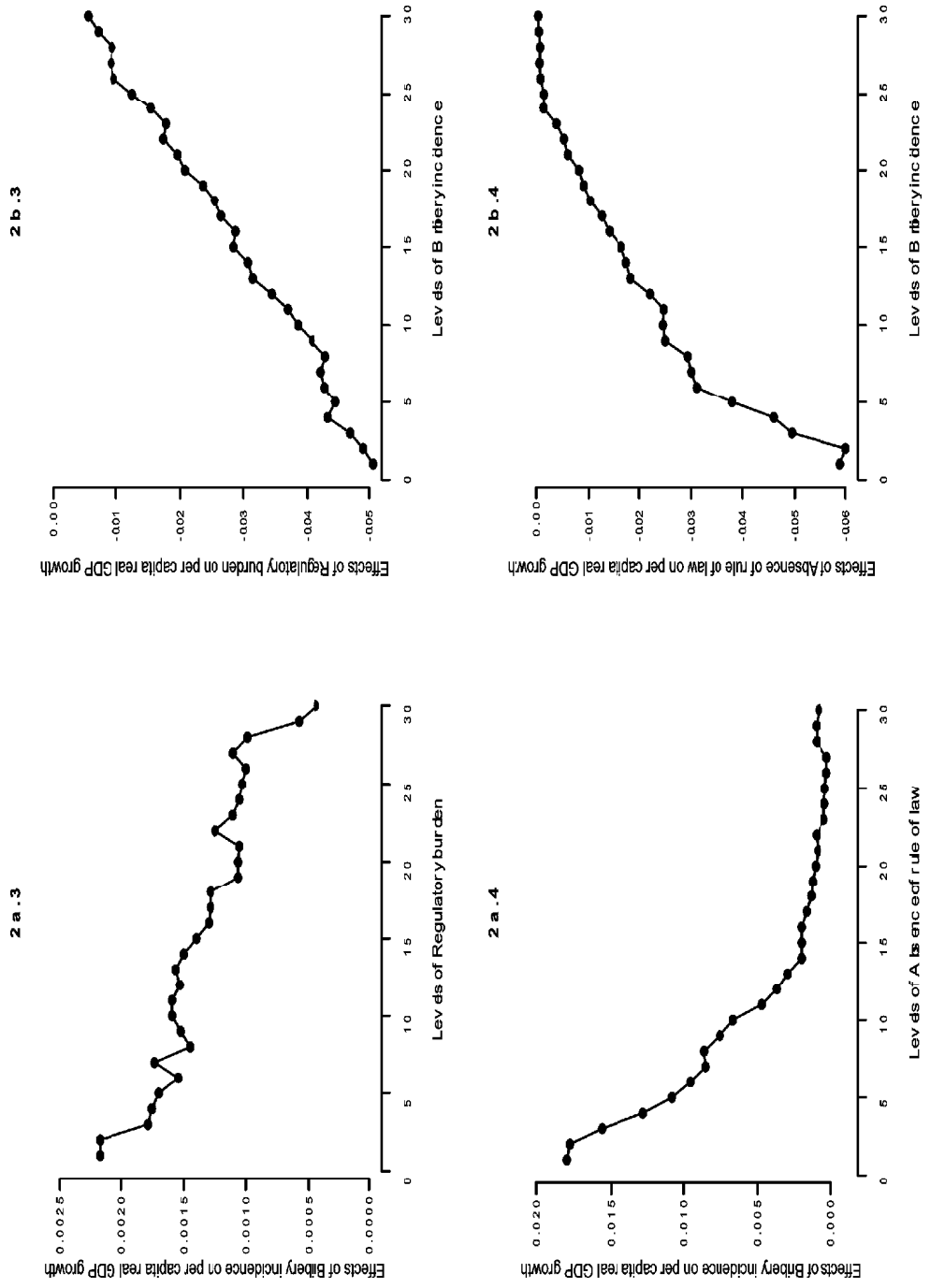


Figure 1: The joint effect of poor governance and corruption on real GDP per capita growth

deterioration of *LV* tends to hinder GDP growth, the negative effect is the stronger the higher is the level corruption. The finding that corruption amplifies the negative effect of bad governance suggests that SWH holds in this case.

On the other hand, Figure 1 shows that the recursive estimations with respect to *GE*, *RQ* and *RL* produce downwards sloping graphs in Panels 2a.2 – 2a.4 but upwards sloping graphs in Panels 2b.2 – 2b.4. The observations in Panels 2a.2 – 2a.4 mean that the beneficial effects of corruption on GDP growth gradually dissipate as the quality of governance captured by *GE*, *RQ* and *RL* deteriorates over the sub-samples 1-30. Yet, Panels 2b.2 – 2b.4 show that the negative effect of bad quality of governance on economic growth gradually diminishes as corruption increases over the sub-samples 1-30. The interpretation is that corruption tends to mitigate the economic dead weight losses caused by bad governance, which is in favor of the weak form of GWH.

The deduction from Figure 1 is that, while SWH is supported when the quality of governance is measured by the index *LV* (Political stability and lack of violence/ terrorism), GWH gets considerable support when considering *GE* (Government effectiveness), *RQ* (Regulatory quality) and *RL* (Rule of law) as the indicators of the quality of governance. This corresponds to our previous findings summarized in the respective columns of Tables 5 and 6 above thus confirming their robustness.

6. Conclusions

The paper investigated the effects of corruption on economic growth with special attention to the long-lived hypothesis that corruption may "grease the wheels" of the economy. In the spirit of the hypothesis, the effects of corruption were considered in the context of broader quality of governance. The panel data consisted of 99 countries world-wide over the time span 2006–2014. As a benchmark for the analyses, we applied the previous study by Méon and Sekkat (2005) who found no evidence for the hypothesis but urged the need for further studies.

We made some elaborations to the benchmark setting. First, we used alternative corruption measures and utilized other sources of economic data. Second, instead of using a fixed data point per country for the corruption and governance variables, we used as many data points as possible in a panel setting, which captures both country and time dimensions. Third, we also considered the direct effects of corruption along with the indirect effects represented by interaction between corruption and the quality of governance.

The empirical results unambiguously showed that our select governance indicators have negative effects on per capita GDP growth. The analyses demonstrated that politically unstable environment marked by violence and terrorism slows down economic growth. Likewise, it was found that ineffective government with deficient public policies as well as unqualified regulation and weak rule of law hinder economic growth.

Regarding corruption, our estimations revealed two-sided influences. On one hand, corruption was found to clearly hamper economic growth in the presence of political instability, violence and terrorism because it tends to exacerbate the negative impacts of the otherwise bad governance. This supports the "sand in the wheels" (SWH) hypothesis. On the other hand, corruption was found to be beneficial in contexts of ineffective government policies, bad regulation of the private sector, or when the quality of rule of law is questionable. In those contexts, corruption was observed to mitigate the negative effects of poor governance. This corresponds to the weak form of the alleged "grease the wheels" (GWH) effect of corruption. The robustness of the findings was carefully tested.

The main findings of the study are in line with sophisticated growth theories which emphasize the economic role of social institutions. By perceiving effective institutions as key factors of capital and labor productivity, the theory suggests that economic development cannot be based only on the accumulation of traditional factors of production. Our findings advocate the idea that sound social institutions are crucial in promoting total factor productivity in the use of economic resources.

An interesting lesson from the findings is that while SWH seems to hold in surroundings marked by unstable political regimes and violence, GWH gets support in surroundings with problems mainly in the field of bureaucratic enforcement. A casual observer might interpret them as steps of development: once a developing country has got rid of severe political instability and violent conflicts, it can concentrate on the general quality of its governance and institutions. Thoroughgoing reforms in domestic public affairs are vital both in promoting economic development and in gradual eviction of corruption.

As always, there are some caveats in the study. First, the study was benchmarked to the earlier one, which may not be the best framework in analyzing the SWH-GWH dilemma. Second, due to the availability of the applied corruption indices, the time span 2006–2014 is too short for exhaustive conclusions concerning

development paths. For those purposes, alternative approaches and measures should be used. We leave these elaborations for further studies.

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Appendix 1
List of the 99 countries/territories in the dataset

Albania, Argentina, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bolivia, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Cyprus, Democratic Republic of the Congo, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Finland, France, Gabon, Gambia, Germany, Ghana, Greece, Guatemala, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Kuwait, Laos People's, Liberia, Lesotho, Malawi, Maldives, Mali, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Namibia, Nepal, Niger, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Republic of Congo, Republic of Korea, Romania, Rwanda, Senegal, Sierra Leone, South Africa, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, Tanzania, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Kingdom, Uruguay, Venezuela, Vietnam, Zambia.

Appendix 2

Table 2.1:: Descriptive statistics of variables in logarithm

Variable	*Mean*	*Std. dev.*	*Min*	*Max*	*Source*
Real GDP per capita	11.468	1.94941	7.634	16.657	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Human capital	0.8342	0.2948	0.1191	1.3176	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Population	2.480	1.6736	1.291	7.222	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Inflation	-0.5995	0.4436	-1.4705	0.5750	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Capital stock	12.547	2.0725	7.979	18.055	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
BI	2.747	1.0552	2.545	4.256	Bank Enterprise Survey of Business Managers, World Bank
BD	2.2643	1.03609	-0.3567	4.1636	Bank Enterprise Survey of Business Managers, World Bank
VA	1.2693	0.26772	1.2164	1.6630	World Development Indicators 2014, World Bank
LV	1.2720	0.2474	0.6949	1.8446	World Development Indicators 2014, World Bank
GE	1.203	0.319936	0.134	1.677	World Development Indicators 2014, World Bank
RQ	1.1928	0.2883	0.3664	1.6706	World Development Indicators 2014, World Bank
RL	1.2305	0.30815	0.3363	1.6908	World Development Indicators 2014, World Bank

Table 2.2: Expected effects on economic growth

Independent variable	*Expected sign of the dependent variable*	*Studies*
Yo	–	Barro (1991), Mankiw and Weil (1992)
$Z_{(Capital\ stock)}$	+	Levine and Renelt (1992)
$Z_{(Human\ capital)}$	+	Levine and Renelt (1992)
$Z_{(Population)}$	–	Levine and Renelt (1992)
$Z_{(Inflation)}$	–	Barro (1995)
Cor	–	Mauro (1995), Mo (2000), Méon and Sekkat (2005)
Gov	–	Méon and Sekkat (2005)
Cor×Gov	+	Méon and Sekkat (2005)

Table 2.3: Unit-root test for stationarity

Variables	*Augmented-Dickey-Fuller test*		*Philipps-Perron test*	
	D-F statistics	*p-value*	*D-F statistics*	*p-value*
Real GDP per capita	-10.045	< 0.01	-32.198	0.01
Capital stock	-9.0461	< 0.01	-30.809	0.01
Bribery incidence	-9.4731	< 0.01	-33.635	0.01
Bribery depth	-9.073	< 0.01	-29.338	0.01
VA	-9.8467	< 0.01	-31.332	0.01
LV	-10.778	< 0.01	-32.583	0.01
GE	-10.035	< 0.01	-31.959	0.01
RQ	-9.9539	< 0.01	-31.645	0.01
RL	-10.821	< 0.01	-31.664	0.01
Human capital	-9.3407	< 0.01	-30.515	0.01
Population	-11.458	< 0.01	-33.032	0.01
Inflation	-10.397	< 0.01	-31.15	0.01

Notes: Series are stationary if the probabilities associated with the DF statistics are smaller than 0.05.