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- TESTING THE HYPOTHESIS IN AFRICAN COUNTRIES

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Efficient Corruption?
-Testing the hypothesis in African countries

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Abstract

The paper is an econometric study of the economic effects of corruption in African countries. In economic literature, the mainstream view is that corruption is plainly detrimental (the Sanding the Wheels Hypothesis, SWH). Still, efficient corruption gains considerable support, too, particularly in the context of bad governance (the Greasing the Wheels Hypothesis, GWH). In this paper, the effects of corruption on Gross Domestic Product (GDP per capita) and investments (Investment to GDP Ratio) are estimated with respect to several indicators that measure the quality of governmental and social institutions. The paper finds substantial proof for GWH. Corruption enhances economic growth in countries suffering from problems in public management, business environment, infrastructure, or rural sector. Corruption fosters investments in countries encountering shortcomings in terms of safety and legislation, or political participation and human rights. Corruption has positive effects on both growth and investments, if public health, social welfare, or education are flawed by bad institutions. To sum up, while SWH holds in the big picture, GWH is also valid for many African economies with depressing socioeconomic conditions. Therefore, efforts should be put rather on reinforcing institutions than on plain battle against corruption.

Keywords: Corruption, Growth, Institutions, Investments
JEL classification: D73

1. Introduction

A common wisdom is that corruption must be fought out at all costs. This opinion is shared by governments and non-governmental organizations, international institutions, media, the public, politicians, and mainstream academics. Transparency International portrays corruption as "one of the greatest challenges of the contemporary world. It undermines good governance, systematically distorts public policy, leads to a misallocation of public resources, deteriorates private and public sector development and especially affects the poor". This worldwide concern is highlighted for example by the UN anti-corruption agreement in Mexico, 2003, ratified by 140 countries. Nevertheless, corruption in all its forms is a resilient phenomenon that can still be found behind many grave upheavals, such as the Arab Spring (Ramadan, 2012), or the European refugee tsunami (UNCHR, 2015).

In terms of economics, the mainstream view is that corruption constitutes a serious impediment to economic development. The seminal idea of Shleifer & Vishny (1993) is that corruption hampers the economy because of its distortive effects on investments, particularly on foreign direct investments. Mauro (1995), Mo (2001), and Méon & Sekkat (2005) confirm the idea that investments, economic growth, and welfare are significantly reduced by corrupted bureaucracy. The argument of Bliss & Di Tella (1997) is that corruption fosters monopolies, whose profits are then drained by the bureaucrats. Myrdal (1968) and Kurer (1993) emphasize bureaucrats' self-interests in the creation of economic distortions, and Kaufmann *et al.* (2000) states that corruption endogenously leads to poor governance and exacerbates the distortions.

Most of the economic literature clearly finds corruption indefensible, and the so-called 'Sanding the Wheels Hypothesis' (SWH, Murphy *et al.*, 1993) is certainly the prevalent idea. Popov (2015) sums up the current view with noteworthy references to Mauro (1997), Ades & Di Tella (1999), La Porta *et al*. (1999), Djankov *et al*. (2002), and Fan *et al*. (2009). In the light of this commonly shared opinion, any economic reasoning in favour of corruption might sound provocative by questioning the legitimacy of the worldwide combat against corruption.

Still, some early papers like Leff (1964) argue that corruption is an applicable tool, when the bureaucracy is not functioning well enough. Méndez & Sepúlveda (2006) and Méon and Weill (2008) also highlight the benefits of corruption in countries with deficient institutions and poor governance. The theory of 'efficient corruption', or 'Greasing the Wheels Hypothesis' (GWH), builds on the plain fact that governance is not always perfect. Huntington (1968) goes even further: '[…] in terms of economic growth, the only thing worse than a society with a rigid, over-centralized, dishonest bureaucracy is one with a rigid, over-centralized, honest bureaucracy'.

A moderate version of GWH is that while corruption impedes economic development in general, it may still have some benefits in special cases of institutional malfunctioning. Organizational slack is a typical malfunction. Leys (1965) and Lui (1985) argue that bribes may significantly cut the time spent in queues and speed the process of sluggish administration thus reducing bureaucratic inefficiency. By Bardhan (1997), in a second-best world with pre-existing distortions, additional distortions caused by corruption may indeed improve welfare, and Aidt *et al.*, (2008) states that corruption may alleviate distortions and make the bureaucratic practices more efficient by making

them more fluid, cutting red tape and bypassing rigid practices. Aidt (2009) concludes that corruption has a considerable role in paving the firms' way to the market.

Corruption is defended also by arguing that it has positive effects on the productivity of capital. Leff (1964) claims that turning to corruption is associated with individual skills and talents with the implication that licenses tend to be allocated to the most efficient firms. Beck & Maher (1986) shows that, in a bribery game where licenses are illicitly issued to the firm bidding the highest bribe, the lowest-cost firm always wins the game. Thus, corruption enables the imperfectly informed bureaucrat to choose the best from potential investments with due effects on proper allocation of capital. As Leff (1964) put it, 'if the government erred in its decision, the course made possible by corruption may well be the better one'. Yet, Svensson (2003) contradicts this idea by claiming that corruption makes resources allocate to less profitable sectors with better reversibility of investments.

Another excuse for corruption is that it may reduce risk it the economy, and less risk means more investments (Bayley, 1966). By Nye (1967), corruption reduces risk by stabilizing social unrest, because it eases citizens' access to public services and cements their confidence in existing institutions. Furthermore, Amundsen (1999) argues that, in new patrimonial political systems, corruption can be used to hedge from the risk of expropriations or other unfair actions by the government. The counterargument of Alesina & Angeletos (2005) is that corruption in fact distorts redistributive policies thus provoking social unrest.

The above list of cons and pros of corruption is not at all exhaustive, but it suffices to illustrate the controversial nature of the issue. The aim of this paper is to shed light on the controversy by taking SWH and GWH under closer scrutiny. The hypotheses are tested against empirical data from 48 African countries. The presumption is that there are notable differences between African economies with respect to both the existence of corruption and the quality of socioeconomic conditions. The research question is: Does GWH get support from African data, and if it does, what are the crucial institutional aspects behind it? Section 2 of the paper describes the data and the econometric models used in the study, and Section 3 presents and discusses the empirical findings. Section 4 reports recursive tests on the validity of SWH and GWH and illustrates the findings, and Section 5 concludes.

2. Data and modelling

The study is based on panel data of 48 African countries (listed in Appendix 1), and the time span is from 2000 to 2013. The data includes real economic variables (from International Monetary Fund, IMF, and World Bank, WB), corruption indices (from Transparency International, TI), and a broad set of indicators of the quality of governmental and institutional aspects (from Ibrahim Mo Foundation). Furthermore, ethnolinguistic fractionalization data by Roeder (2001) is used to test the robustness of the empirical findings.[1]

The Corruption Perception Index (*CPI*) by TI is based on surveys and assessments conducted by reliable institutions, and it has been in standard use in previous empirical studies (e.g. Mo, 2001; Méon & Sekkat, 2005). The perceptive approach behind *CPI* is quite unavoidable, because

[1] The test is similar to that in Méndez and Sepúlveda, 2006, which is based on political instability variable.

corruption is a deliberately hidden action by definition. The original *CPI* indices vary from 0 to 10 with the lower bound indicating utmost corruption and the upper bound indicating full integrity. For ease of interpretation, the indices are transformed by 11-*CPI* calculations to make *CPI* vary between 1 and 11, where 1 means no corruption and 11 means utmost corruption.

The Ibrahim Mo Foundation indicators of the quality of governmental and socioeconomic institutions (denoted *GOV*) correspond to the following quality categories: Safety and Rule of Law *(SRL)*, Participation and Human Rights *(PHR)*, Sustainable Economic Opportunity *(SEO)*, and Human Development *(HD)*. These four categories are constructed from 14 sub-categories (described more closely in Appendix 2) as follows:

SRL = f (Rule of law; Accountability; Personal safety; National security)
PHR = f (Participation; Rights; Gender)
SEO = f (Public management; Business environment; Infrastructure; Rural Sector)
HD = f (Welfare; Education; Health).

The original quality indicators vary from 0 to 100 with quality improving upwards. Here, the original indicator values are again transformed by subtracting them from 101 to make them vary between 1 and 101 with quality decreasing upwards.

Two baseline models are constructed. The first model attempts to estimate the impact of corruption on economic development by focusing on GDP per capita growth, and the second model focuses on the impact of corruption on investments to GDP ratio, which should be a key component of growth and development.[2] Logarithmic forms of variables are used in order to eliminate heteroscedasticity and asymmetry in residuals. The models read:

(1) $\Delta G^i = \gamma_0 + \gamma_1 y_0 + \gamma_2 \omega + (\gamma_3 + \gamma_4 GOV)CPI + \varepsilon$,

(2) $I^i/G^i = \lambda_0 + \lambda_1 y_0 + \lambda_2 \psi + (\lambda_3 + \lambda_4 GOV)CPI + \mu$.

In equation (1), the dependent variable $\Delta G^i = y_t - y_0$ stands for the variation of the purchasing-power-parity corrected GDP per capita, with y_0 symbolizing GDP per capita in the initial period (year 2000). The superscript *i* refers to individual countries in the sample, γ:s are the coefficients to be estimated, and ε is the error term.

On the right-hand side of equation (1), y_0 appears to test the *conditional* convergence hypothesis. Negative coefficient estimates ($\gamma_1 < 0$) would say that poorer countries catch up the richer ones by more rapid growth, facilitated by imitation of developed technologies, best business practices and so on (Mankiw *et al.*, 1992). ω is a vector of standard real economic variables contributing to economic growth (Levine & Renelt, 1992). They include the following factors: physical capital, reflected by investment to GDP ratio (denoted *Investment*, data from World Economic Outlook Database, IMF); human capital, reflected by primary school completion (denoted *Education*, data from World Development Indicator, WB); economic liberalism, reflected by the ratio of the average values of total imports and exports to GDP (denoted *Openness*, data of exports and imports

[2] The use of GDP growth and investments to GDP ratio data to trace economic development is reasonable because of its good availability. However, a dismal fact is that both figures measure also inappropriate and inefficient elevations. Other metrics, such as the Genuine Progress Indicator (GPI) might be better, but is has not been calculated for African countries so far.

from IMF); and population growth (denoted *Population*, data from IMF). The coefficient estimates for all these variables should be positive ($\gamma_2>0$) except that of *Population*, which should be negative ($\gamma_2<0$), when growth is monitored in per capita terms. The corruption variable *CPI* appears in two interpretations. Negative coefficient estimates $\gamma_3<0$ would say that corruption hampers growth (SWH), while $\gamma_3>0$ would claim the opposite (GWH). Moreover, since the multiplication of the institutional indicators (*GOV*) with the corruption indices (*CPI*) implies the interaction of them, positive coefficient estimates ($\gamma_4>0$) would suggest further hampering of growth (SWH), while $\gamma_4<0$ would claim the opposite (GWH).

In equation (2), the dependent variable I^i/G^i symbolizes the investment to GDP ratio. On the right-hand side, λ:s stand for the coefficients to be estimated, μ is the error term, and y_0 appears again as a test of the *conditional* convergence hypothesis (with the expectation that $\lambda_1<0$). In accordance with Levine *et al.* (1992), ψ is a vector of the real economic variables that determine investments. They include *Education*, *Openness*, *Exchange rate*, and *Gross saving*. The first two are the same as in equation (1). Likewise, the estimated coefficients of *Education* should be positive ($\lambda_2>0$), because the stock of human capital is supposed to attract investments (Levine *et al.*, 1992; Benhabib & Spiegel, 1994). Similarly, by Scully (2002), *Openness* should enhance investments by increasing competition and the transfer of technologies and ideas, and by removing restraints and creating new opportunities. Hence, the estimated coefficient should be positive ($\lambda_2>0$).

The new variables, particularly important to investments, are *Exchange rate* (from WB) and *Gross saving* (from IMF). Exchange rate variation causes both positive and negative effects, and the sign of the estimated coefficient depends on which of the two opposing effects dominates (Goldberg, 1993; Blonigen, 1997). *Gross saving* is used as a proxy variable for the main financial source of investments (cf. Levine *et al.*, 1992, where the standard deviation of the growth rate of domestic credit is used to assess the investment potential). Quite intuitively, the estimated coefficient should be positive ($\lambda_2>0$). Corruption (*CPI*) and the quality of institutions (*GOV*) appear again in the same way than in equation (1). Therefore, coefficient estimates $\lambda_3<0$ and $\lambda_4>0$ would say that corruption *hampers* investments the more the worse the institutions are (SWH), while estimates $\lambda_3>0$ and $\lambda_4<0$ would claim that corruption *enhances* investments the more the worse the institutions are (GWH).

3. Empirical analysis

The estimations are based on Generalized Least Squares (GLS) estimators, which are sufficiently robust to eliminate heteroscedasticity (ref. Méon & Sekkat, 2005). The estimations are conducted in two specifications of the models (1) and (2). The preliminary specifications (denoted PM) do not take into account the role of institutional quality that is the *GOV* variable (so that $\gamma_4=0$), while the full specifications include the potential implications of bad institutional arrangements described in the previous section (that is $\gamma_4\neq0$).

3.1 The Growth model

The estimation results of the effects of corruption on per capita GDP growth, that is regressions on equation (1), are presented in *Table 1*.

Table 1: Estimation results of the effects on the variation of GDP per capita

	PM	EQ-1 & *SRL*	EQ-1 & *PHR*	EQ-1 & *SEO*	EQ-1 & *HD*
	EQ-1.0	EQ-1.1	EQ-1.2	EQ-1.3	EQ-1.4
Intercept	-0.221**(0.08)	-0.115(0.101)	-0.195*(0.098)	-0.422**(0.099)	-0.341***(0.09)
y_0	-7.6e-7(3.8e-6)	-1.2e-6(3.8e-6)	-4.3e-7(3.8e-6)	-1.2e-6(3.5e-6)	-7.4e-6·(4.0e-6)
Investment	0.056***(0.007)	0.056***(0.007)	0.056***(0.007)	0.055***(0.007)	0.052***(0.007)
Education	0.009(0.012)	0.007(0.012)	0.005(0.012)	0.001(0.011)	-0.01(0.012)
Population	1.16***(0.103)	1.213***(1.037)	1.184***(0.102)	1.141***(0.099)	1.172***(0.101)
Openness	0.047**(0.015)	0.046**(0.015)	0.047**(0.015)	0.057***(0.014)	0.053***(0.014)
CPI	-0.013**(0.004)	-0.061(0.042)	-0.025(0.04)	0.156**(0.053)	0.127**(0.048)
*CPI * SRL*		-0.027(0.025)			
*CPI * PHR*			-0.048·(0.025)		
*CPI * SEO*				-0.156***(0.04)	
*CPI * HD*					-0.135***(0.03)
Adjusted-R^2	0.355	0.363	0.360	0.382	0.3761
N	48	48	48	48	48

Note: The table reports the estimated coefficients of the regression variables with superscripts "***", "**", "*", "·" indicating statistical significance at 0, 0.1, 1, 5, 10 % error level, respectively. GLS standard deviations are in parentheses.

Table 1 shows that the basic economic variables used to explain growth fit the model, and their coefficients stay stable over all regressions performed. The estimated signs of the intercept are negative ($\gamma_0<0$), and statistically significant, except with *SRL* (column EQ-1&*SRL*). The estimates of the coefficients of initial income are also always negative, but not significant. Hence, the results do not confirm the *conditional* convergence hypothesis (c.f. Mankiw *et al.*, 1992), and catching-up does not seem to prevail in Africa. The estimated coefficients of *Education* are mostly positive, but very small and insignificant. Thus, changes in human capital doesn't seem to have notable effects on economic growth in Africa. In contrast, the results quite unambiguously show that physical capital and trade liberalism constitute important factors of African growth. The estimated coefficients for *Investment* and *Openness* are systematically positive (albeit relatively small) and significant (ref. Levine *et al.*, 1992; Scully, 2002). The positive, relatively big and highly significant coefficient estimates of *Population* are somewhat surprising, because they contrast the expectation of a negative effect. The main source of African growth still seems to be in the increase of unskilled labour force.

In the preliminary specification (column PM, EQ-1.0), the coefficient of corruption is negative ($\gamma_3<0$) and significant, which means that corruption is harmful to economic growth. Literally, one-unit increase in the standard deviation of *CPI* should directly cut the average per capita GDP growth rate by 0.013. Such results are in line with the mainstream idea that SWH is correct (Mauro, 1995; Mo, 2001.)[3]. Furthermore, even by controlling the dependent variable using either *Investment* or *Education*, the impact of corruption on ΔG^i remains unchanged, with γ_3 always negative and statistically significant. This suggests that beyond its negative impact on the accumulation of production factors (capital and labor), corruption has also a direct effect on GDP per capita. Earlier studies such as Mo (2001) and Méon & Sekkat (2005) take the same approach and find that, by taking into account the accumulation of capital, corruption has a direct effect on the growth of real GDP and the average growth rate of per capita income. On the contrary, Mauro (1995) does not

[3] Méon & Sekkat, 2005 also finds a negative, but not significant correlation.

find a direct effect of corruption on per capita GDP growth by using Business International indices for the corruption variable and investments as a control variable, and Mo (2001) does not support such a correlation in the special case, where human capital is included in the regression. The direct effect of corruption on economic growth might be reasoned by the relationship between corruption and public investments, which are often singled out as corruption's favorite playing field (Tanzi *et al.*, 1997). Another plausible explanation might be in incentives: Méon & Sekkat (2005) contradicts Leff (1964) by claiming that corruption tends to distort the allocation of talents, and favors less productive activities.

Turning to the full specification, the coefficients of corruption reflect the impact of corruption on GDP per capita growth with reference to possible flaws in institutions. The estimations including *SRL* and *PHR* do not lead to significant results. In both cases, neither corruption nor its interaction with the two quality variables is significant in explaining the endogenous variable (regressions EQ-1.1 and EQ-1.2). The Davidson-McKinnon J-test on EQ-1.0 against the alternative models EQ-1.1, and EQ-1.2 validates the null hypothesis, with the implication that models EQ-1.1 and EQ-1.2 can be rejected in favour of EQ-1.0. As a result, this confirms that the interaction terms including *SRL* or *PHR* do not bring statistically relevant information in explaining growth. Therefore, the mechanical increase of the explanatory power (Adjusted-R^2) of EQ-1.1 (0.363), and EQ-1.2 (0.360) in comparison with EQ-1.0 (0.355) is somewhat counter-intuitive.[4]

On the other hand, when the focus is on *SEO* and *HD* (EQ-1.3 and EQ-1.4), the findings unequivocally support GWH. In both cases the coefficient of corruption is positive and statistically significant ($\gamma_3 > 0$) meaning that, with flawed institutions in terms of *SEO* or *HD*, corruption turns out to be clearly beneficial to GDP per capita growth (ref. Leff, 1964; Bardhan, 1997). In addition, the coefficients of the interaction terms are negative ($\gamma_4 < 0$) and voluminous, and highly significant. This says that the positive impact of corruption on economic performance further increases, as the institutional aspects deteriorate. This contradicts Méon & Sekkat (2005), but coheres with Méon & Weill (2008), which also finds that the positive effect of corruption is strongly linked to the state of institutions. In particular, the findings suggest that the marginal effect of corruption on growth is beneficial in countries with deficient institutions or policies, while the effect is detrimental in countries with solid institutions (ref. Méndez & Sepúlveda, 2006).[5] Moreover, both the alternative models EQ-1.3 and EQ-1.4 pass the J-test against EQ-1.0. This suggests that the inclusion of *SEO* or *HD* in the regressions is statistically relevant, making the model perform better compared to the preliminary specification (PM). The substantial increase in the adjusted-R^2 accords with this finding.

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[4] Méon & Sekkat (2005) uses governance variables by WB on a range of countries worldwide. Regression including the quality of *rule of law* ("… reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence", Kaufmann *et al.*, 1999) concludes that corruption is pernicious to the growth of per capita income in countries encountering this type of governance shortcomings. Yet, when the focus is on the aspect of *voice and accountability* ("… reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media", *ibid.*), the findings are not meaningful.

[5] With respect to *Government effectiveness* ("… reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality if policy formulation and implementation, and the credibility of the government's commitment to such policies", Kaufmann *et al.*, 1999), Méon & Sekkat (2005) rather supports SWH.

To sum up the findings, SWH holds in the preliminary specification (EQ-1.0), where the institutional quality of the sample economies is not considered. Taking the quality aspects into account changes the picture. In particular, when the quality of *SEO* or *HD* (EQ-1.3 or EQ-1.4, respectively) is considered, GWH is unambiguously validated. The robustness of the results is tested by including additional variables among the regressors to see whether it statistically affects the conclusions. The use of ethnolinguistic fractionalization (ELF) index 1961, or 1985 explanatory variable does not change the findings (see Appendix 4, which displays only results including the ELF index 1961, since those with ELF 1985 are quite similar).

3.2 The Investment model

The estimation results of the effects of corruption on investments to GDP ratio, namely regressions on equation (2), are presented in *Table 2*.

Table 2: Estimation results of the effects on Investments to GDP ratio

	PM	EQ-2 & *SRL*	EQ-2 & *PHR*	EQ-2 & *SEO*	EQ-2 & *HD*
	EQ-2.0	EQ-2.1	EQ-2.2	EQ-2.3	EQ-2.4
Intercept	2.39***(0.353)	1.792***(0.334)	2.098***(0.339)	2.016***(0.342)	2.202***(0.326)
y_0	9.6e-6(1.0e-5)	3.4e-6(9.6e-6)	1.08e-5(1.0e-5)	3.47e-6(1.0e-5)	-1.35e-5(1.0e-5)
Education	0.044(0.035)	0.005(0.035)	0.001(0.035)	-0.01(0.036)	-0.115**(0.038)
Openness	0.132**(0.049)	0.126**(0.047)	0.134**(0.049)	0.144**(0.049)	0.158***(0.049)
Exchange rate	0.034*(0.013)	0.034**(0.012)	0.028*(0.013)	0.04**(0.013)	0.038**(0.012)
Gross saving	0.213***(0.013)	0.207***(0.013)	0.213***(0.013)	0.197***(0.013)	0.194***(0.012)
CPI	-0.402**(0.118)	0.214·(0.126)	-0.036(0.134)	0.11(0.154)	0.312*(0.134)
*CPI * SRL*		-0.127***(0.02)			
*CPI * PHR*			-0.068***(0.02)		
*CPI * SEO*				-0.112***(0.02)	
*CPI * HD*					-0.197***(0.02)
Adjusted-R^2	0.300	0.367	0.329	0.335	0.360
N	48	48	48	48	48

Note: The table reports the estimated coefficients of the regression variables with superscripts "***", "**", "*", "·" indicating statistical significance at 0, 0.1, 1, 5, 10 % error level, respectively. GLS standard deviations are in parentheses.

Table 2 shows that the predictors used to estimate equation (2) fit the model, and the results are mainly as expected. The estimates of the intercept are now positive and highly significant over all regressions (from EQ-2.0 to EQ-2.4). Initial income gets mostly positive but insignificant coefficient estimates saying that no catching-up can be observed. Likewise, human capital does not seem to attract investments, because the estimated coefficients of *Education* are mostly insignificant, except that in regression EQ-2.4, where the coefficient quite surprisingly gets a negative and significant estimate (c.f. Benhabib & Spiegel, 1994). On the other hand, international *Openness* seems to have notable and statistically significant positive effects on investments, and *Gross saving* has even clearer positive effects. Somewhat smaller, but significant positive effects on investments come from the depreciation of domestic currency that is from the rise of the *Exchange rate*. (Ref. Scully, 2002); Blonigen, 1997; and Levine *et al.*, 1992.)

In the preliminary modelling (EQ-2.0), it appears that corruption is inversely linked to investment as well as to GDP growth. The estimated coefficient of corruption is negative ($\lambda_3<0$), relatively voluminous, and statistically significant. To put it more precisely, one-unit increase in *CPI* standard deviation in average would result in about 0.4 fall in the investment to GDP ratio. The finding is in line with the SWH results by Shleifer & Vishny (1993), Tanzi *et al.* (1997), and Mauro (1995).

In the full specification, the coefficients of corruption turn more ambiguous. For example, the estimates including *PHR* and *SEO* are insignificant even if the interaction variables associated with them are negative and significant (EQ-2.2 and EQ-2.3)[6]. However, they nevertheless pass the J-test against EQ-2.0. Considering *SRL* and *HD*, the coefficients of corruption are positive and significant at 10 and 5 % level (EQ-2.1 and EQ-2.4, respectively), and the respective interaction terms are negative and highly significant. Namely, $\lambda_3>0$ says that, in countries whose institution concerning *SRL* or *HD* are unsatisfactory, corruption has positive impacts on capital accumulation, and $\lambda_4< 0$ says that corruption becomes even more beneficial to capital investment as the institutional quality gets poorer. This validates GWH in strict contrast with Méon & Sekkat (2005). The J-test again verifies that the alternative specifications EQ-2.1 and EQ-2.4 perform better in explaining investments compared to the preliminary specification EQ-2.0. This also is in line with the higher explanatory power of the two specifications compared to the other ones.

To sum up, the estimations of the investment model (2) show that SWH is validated when the focus is on the preliminary specification omitting the aspects of institutional quality (EQ-2.0). However, the opposite claim GWH holds when the quality of *SRL* or *HD* is taken into account (regressions EQ-2.1 and EQ-2.4, respectively). Moreover, when fractionalization indices are added among predictors in the regressions, the findings remain unchanged (for the robustness check, see Appendix 3).

4. Recursive tests

The synthesis of the results of the previous section is the following: If institutional quality is not considered, corruption is in average detrimental to both growth and investments (that is SWH holds). Taking the quality aspects under consideration, corruption not only turns beneficial to growth in countries with poor *SEO* or *HD* and beneficial to investments in countries with poor *SRL* or *HD* but also even more so, if the respective quality aspects get worse. This means that, under these specified circumstances, GWH holds. The next step is to pinpoint the critical threshold levels between poor and good institutional quality in order to derive notions about the scale of possible attraction to corruption. This is done with reference to the average quality indicator values presented in Appendix 1.

To seek for the critical thresholds, the sample countries are categorized from the lowest to the best quality separately according to the transformed indicator values of *SEO*, *SRL*, and *HD*. Then, 15 sub-samples are constructed so that sub-sample number 1 includes the first 34 countries with the lowest quality observations (that is biggest indicator values), sub-sample number 2 includes country observations from the 2nd lowest to the 35th lowest, and so on. To test the growth model, equation

[6] In Méon *et al.* (2005), the estimation including the aspect of voice and accountability, which seems closer to *PHR*, also lead to inconclusive results.

(1) with γ_4=0 is sequentially estimated using the sub-samples constructed against *SEO* and *HD*, and the transformed *CPI* index values. The investment model is tested by estimating equation (2) with λ_4=0, and using *SRL* and *HD* related sub-samples. The average measures of *SRL*, *SEO*, and *HD* in each sub-sample, and the corresponding *CPI* coefficient estimates are calculated for the marginal effects of corruption on GDP per capita growth, and capital investments. The results are discussed separately below.

4.1 The Growth model

Carrying out the estimation procedure described above for model (1) with respect to the average values for *SEO*, and *HD* in each sub-sample yields corresponding estimates for the marginal effects of corruption on GDP per capita growth. The results are presented in *Table 3*.

Table 3: Average institutional quality and the corresponding estimates of the effects of corruption on GDP per capita growth (in parenthesis)

Sub-samples	Growth model	
	SEO	*HD*
1	61.6 (0.0033)	51.94 (0.0171) *
2	60.8 (0.0016)	51.11 (0.0134)·
3	60.01 (0.0025)	50.29 (-0.0056)
4	59.26 (0.0023)	49.64 (-1.59e-5)
5	58.5 (0.0060)	48.3 (-0.0098)·
6	57.68 (0.0016)	48.14 (-0.0140) *
7	56.84 (-0.0283) ***	47.38 (-0.0128) *
8	55.97 (-0.0272) ***	46.56 (-0.0133) *
9	55.14 (-0.0328) ***	45.74 (-0.0097) *
10	54.34 (-0.0368) ***	44.85 (-0.0073)
11	53.59 (-0.0313) ***	43.89 (-0.0079)·
12	52.67 (-0.0286) ***	42.9 (-0.012) **
13	51.77 (-0.0300) ***	41.86 (-0.0101) *
14	50.86 (-0.0304) ***	40.76 (-0.0084)·
15	49.86 (-0.0279) ***	39.64 (-0.0008)

Inspection of *Table 3* yields some support to the view that institutional quality matters to the effects of corruption on GDP per capita growth, and thus to GWH. With respect to *SEO*, the effects are positive (albeit very weak and statistically insignificant) up to the sub-sample number 7, after which they turn negative and highly significant. With respect to *HD*, the first two sub-samples yield positive and significant marginal effects, which turn significantly negative from sub-sample 5 on. *Figure 1* illustrates the findings.

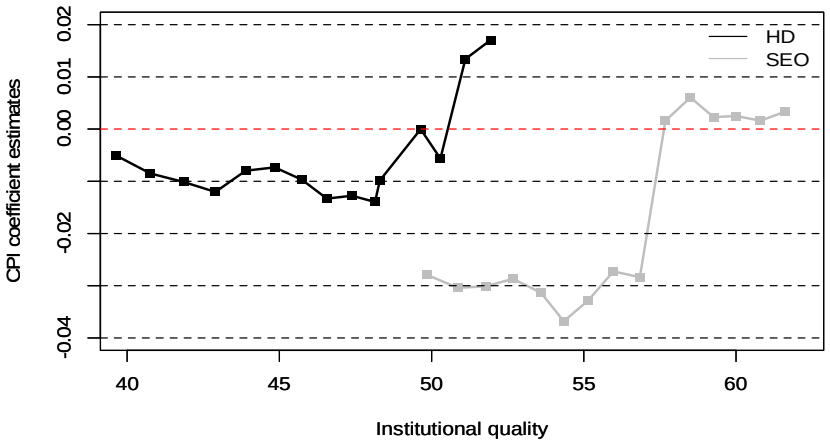

Figure 1: Effects of corruption on GDP per capita growth with respect to *SEO* and *HD*

In *Figure 1,* the horizontal axis depicts the *deterioration* of institutional quality, measured by the average indicator values in each sub-sample of 34 countries (recall that the indicator values grow as quality gets worse). The *CPI* coefficient estimate values γ_3 from each sample are depicted on the vertical axis for the *SEO* and *HD* based estimations. The ordinate is at γ_3=0, which is the threshold that separates the validation of GWH (γ_3>0) from that of SWH (γ_3<0). The graphs connecting the plots of the respective coefficient estimates in each sub-sample show that the impact of corruption on growth is mainly negative for both *SEO* and *HD*. Both curves have an upward trend, and they strike through the threshold line from below meaning that the marginal effect of corruption diminishes and eventually gets more and more negative as institutional quality deteriorates. That most of the plots lay on the negative area is in line with the estimation results of the preliminary specification in *Table 1* (regression EQ-1.0) saying that corruption is harmful to growth. However, *Figure 1* shows also that, in countries with the poorest levels of governance, corruption has a positive impact on growth. This is in line with regressions EQ-1.3 and EQ-1.4 in *Table 1*.

Takin a closer look on the *SEO* related plots shows that positive effects of corruption on growth appear within the first six sub-samples of lower institutional quality. The γ_3 estimates are statistically insignificant, but it may be due to the fact that these sub-portions together cover as many as 39 of the 48 countries. Thus, the positive effects receive at least some appreciation. In sub-sample number 6, the average of *SEO* measures is 57.68, and in sub-sample 7 it is 56.84. By *Table 3*, it is quite safe to set the critical turning point from GWH to SWH roughly at 60. Comparison to Appendix 1 says that over one third of the sample countries are likely to find corruption feasible. Similar assessment with respect to *HD* shows that only the first two coefficients of corruption are clearly positive. They correspond to the two worst governance levels that is sub-samples number 1 and 2, which together cover 35 countries from the whole sample of 48 countries. The estimated coefficients of corruption turn significantly negative in sub-sample 5, in which the average *HD* measure is 48.3. By Table 3, the critical turning point from GWH to SWH could be roughly set at 50. Comparison of this threshold level to the average *HD* indicator values reported in Appendix 1 shows that, again, more than one third of the sample countries are likely to find corruption as an acceptable tool in creating economic growth. Furthermore, GWH gets support from both *HD* and *SEO* perspectives in about one fourth of all sample countries.

4.2 The Investment model

The sequential estimation procedure for model (2) with respect to the average values for *SRL*, and *HD* in each sub-sample yields corresponding estimates for the marginal effects of corruption on the Investments to GDP ratio. The results are presented in *Table 4*.

Table 4: Average institutional quality and the corresponding estimates of the effects of corruption on investments (in parenthesis)

Sub-samples	Investment model	
	SRL	*HD*
1	52.42 (-0.9894) ***	51.94 (-1.0285) ***
2	51.34 (-0.8242) ***	51.11 (-0.9500) ***
3	50.31 (-0.9226) ***	50.29 (-0.8150) ***
4	49.44 (-0.9986) ***	49.64 (-0.8730) ***
5	48.59 (-0.9964) ***	48.3 (-0.6820) ***
6	47.76 (-1.0649) ***	48.14 (-0.6300) ***
7	46.94 (-0.9775) ***	47.38 (-0.3570) **
8	46.14 (-0.7681) ***	46.56 (-0.3630) **
9	45.28 (-0.9939) ***	45.74 (-0.3340) **
10	44.44 (-0.9826) ***	44.85 (-0.2070) *
11	43.6 (-0.5814) ***	43.89 (-0.2180) *
12	42.65 (-0.4444) ***	42.9 (-0.2840) **
13	41.58 (-0.4917) ***	41.86 (-0.3530) ***
14	40.39 (-0.4739) ***	40.76 (-0.2970) **
15	39.24 (-0.4916) ***	39.64 (-0.2690) **

Table 4 shows that the recursive test on the effects of corruption on investments provides a different result that that concerning the effects on growth. Now, the estimations based on sub-samples constructed along *SRL* and *HD* provide systematically negative and statistically significant corruption coefficients. Thus, the finding clearly supports SWH, and mirrors the estimation result of the preliminary specification in *Table 2* (EQ-2.0). This sounds striking, because the results of *Table 2*, EQ-2.1 and EQ-2.4 meanwhile give unequivocal support to GWH. Therefore, the results of this recursive test must be assessed closer.

A reasonable explanation to this puzzle is in the fact that the sub-sampling technique used above in effect yields biased pools of low and high quality countries. This concerns especially sub-sample number 1 with the lowest quality, since it includes as much as 34 of the 48 countries. It is quite plausible that 71 % of the whole sample does not catch the idea of bad institutions properly. As a matter of fact, the median indicator values of all the sub-samples are considerably smaller than the respective average values saying that, in average terms, quite few countries with very high institutional quality overwhelm a relatively big number of very low quality countries in all sub-samples. However, using the median values in the regressions would be inconsistent, because the estimates of the corruption coefficients reflect average values.

To check this explanation, a progressive deterioration of institutional quality is simulated in order to monitor the low quality end more accurately. This is done by narrowing sub-sample number 1 from below. Dropping the countries with the lowest indicator values (that is the observations of the highest quality in the sub-sample) for *SRL* and *HD* from sub-sample 1, respectively, and carrying out the estimation of equation (2) with λ_4=0 yields higher average values with corresponding estimates for the corruption coefficients. Then, the next lowest observations (that is the lowest that remain) are dropped, and the regression is carried out again. This progression is continued until the number of country observations is reduced to 3 in the last regression. *Table 5* shows the estimation results based on the progressively deteriorated quality indicator averages.

Table 5: Simulated impacts of corruption on investment according to *SRL* and *HD*

Number of countries	*SRL* average indices	λ_3	*HD* average indices	λ_3
33	52.79	-1.006***	52.26	-1.0074***
32	53.19	-0.8433***	52.60	-0.8207***
31	53.60	-0.8235***	52.94	-0.8003***
30	54.01	-0.8255***	53.28	-1.2110***
29	54.43	-0.5111***	53.60	-1.3097***
28	54.87	-1.0594***	53.94	-1.3376***
27	55.30	-1.1655***	54.28	-0.2093**
26	55.72	-1.4785***	54.60	-1.2881***
25	56.15	-1.3404***	54.93	-0.9587***
24	56.59	-0.71455***	55.28	-0.5168***
23	57.05	-1.0233***	55.62	-1.0722***
22	57.53	-1.0114***	55.97	-1.4208***
21	58.04	-1.1381***	56.31	-1.4934***
20	58.55	-1.1628***	56.67	-1.6133***
19	59.09	-0.6349**	57.05	-2.096***
18	59.67	0.1783	57.47	-2.9854***
17	60.32	-0.00859	57.87	-2.6686***
16	61.00	-2.5742***	58.24	-2.1234***
15	61.66	-1.8764***	58.55	-2.248***
14	62.17	-1.4389***	58.89	-2.2217***
13	62.73	-0.1857	59.25	-1.0769*
12	63.26	0.7345·	59.67	-1.0214*
11	63.88	0.0081	60.13	-1.7893**
10	64.42	1.3984***	60.65	-2.6883***
9	65.06	1.9983***	61.18	-3.8300***
8	65.86	0.3461**	61.80	-2.3842*
7	66.79	-0.4462	62.42	-4.4309**
6	67.58	-1.5273	63.22	-3.6192*
5	68.54	4.981***	63.99	-0.6376
4	69.78	5.1794*	64.85	5.1387**
3	71.44	7.1334	66.28	10.4937

Table 5 shows that the effects of corruption stay persistently negative over the simulation rounds. With respect to *SRL*, the effect turns significantly positive at 12 countries in the simulated sub-sample, and with respect to *HD*, the same happens with only 4 countries. Thus, the message of *Table 5* must be taken with caution, because the number of country observations get very small in the vicinity of the respective breaking points. In any case, the simulated effects of corruption on

investments are positive, when institutional quality is very low, and that they turn negative, when quality improves. With both *SRL* and *HD*, the critical threshold level is roughly 64, which says that a couple of countries of the whole sample are in serious danger to find corruption beneficial for capital accumulation (see Appendix 1, which tells that at least Central Africa and Chad clearly suffer from insufficient institutional quality in both respects).

To sum up, the recursive tests verify the results of *Table 2* saying that corruption enhances investments in countries with poor institutional arrangements. Thus, GWH is supported. The results of the tests also clarify the fact that, while GWH is unambiguously supported in the growth model, the issue is notably more ambiguous in the investment model. This vindicates the commonly made observation in the literature that there must be other channels for corruption to affect growth than that through investments in physical capital (see e.g. Méon & Sekkat, 2005).

5. Conclusions

The paper tests the impacts of corruption on economic performance, namely on GDP per capita growth and investments to GDP ratio. This theme is subject to a considerable debate in the literature on corruption. Some authors suggest that corruption dampens economic growth and investments (Sand the Wheels Hypothesis, SWH), while others claim the opposite, particularly under institutional failures (Grease the Wheels Hypothesis, GWH). Using panel data of 48 African countries, the paper intends to solve the SWH-GWH debate in this frame.

The paper finds that, if institutional quality is not taken into account, corruption reduces both GDP per capita growth and investment to GDP ratio in African economies. In particular, the negative correlation between corruption and economic growth prevails even if the latter is controlled by physical investments, or human capital. This implies that, besides hampering these production factors, corruption also has a direct effect on growth. In this preliminary setting, SWH is thus validated.

The most noteworthy result of the paper is the verification of the link between socioeconomic arrangements and corruption - the way that corruption influences economic performance is clearly conditional on the quality of governance and institutions. In other words, considerable support for GWH is found in those African countries that have major problems in this field.

Corruption is found to unequivocally foster economic growth in countries with flaws in Sustainable economic opportunity (*SEO*), particularly in public administration. It is quite typical to many African countries that bureaucracy is not only deficient but also overly heavy, and that corruption tends to fatten it further. This has direct effects on GDP in the form of excessive salaries, pompous administrative buildings and monuments, military bluster and so on. Excessive bureaucracy also radiates to the business life, where bigger firms mimic the glory of the ruling elite, and where corruption is a standard instrument to bypass queues, sluggishness and red tape. Integrated to this system, smart firms find their ways, and growth emerges. Another explanation is the undeniable need to build up physical infrastructure. Countries with high corruption often record massive public investments, too, and a reasonable assumption is that corrupted bureaucrats tend to favor them in order to get personal benefits. Allocating investments to public infrastructure at the expense of private investments is a double-edged sword: it may distort the allocation of scarce

resources, but it also creates economic growth, whether it is sound or not. After all, the GDP growth figures do not separate the inappropriate additions from the appropriate ones thus telling very little about economic efficiency.

Furthermore, corruption has a clearly positive impact on physical investments in those countries that have profound flaws in terms of Safety and rule of law (*SRL*). Low values of the *SRL* indicator capture the absence of democracy, and lack of security, both of which are typical features of many African countries and their *neo-patrimonial* political systems. In such non-democratic or semi-democratic political regimes, power is exclusively concentrated to authoritarian groups that abuse that power to extract collective wealth for their own purposes. This creates a deeply corrupted wealth distribution system, where people at the lower levels also engage in corruption in order to get their share, and to hedge against the ruling elite. As a result, there exists a seemingly stable business environment that attracts investments.

Finally, corruption tends to boost both growth and investments in the context of deficient Human development (*HD*). *HD* portrays social equity in terms of welfare, education and health. A distinctive feature of western welfare state models is that there are powerful institutions to take care of proper human development. This is reasoned not only by ethical and moral reasons but very strongly so also by positive effects on economic performance. On the other end, a common earmark of African countries is that such institutions are utterly deficient or totally absent, and that informal systems, often involving corruption, take their place. Therefore, it is not a surprise that the positive economic effects channel through corruption. The efficiency of such informal systems compared to properly organized institutional, or welfare state type arrangements, remains an open question.

To conclude, the paper hints that corruption may well be beneficial, if the quality of governance and institutions is unsatisfactory. In this kind of a second best world, the distortive effects of corruption in effect mitigate the more profound distortions caused by governmental and institutional malfunctioning. In many African countries, the virtues of corruption are quite evident, and its extermination is not an easy undertaking. The policy implication would then be that the effort should be put rather on the reinforcement of institutions than on the plain fight against corruption. However, implanting a western welfare state type socioeconomic model into African cultural and mental soil would not be so easy either.

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Appendix 1. The 48 sample countries with average (over 2000-2013) indicator values for corruption and institutional quality

Country	*CPI/SRL/ SEO/HD*	Country	*CPI/SRL/ SEO/HD*	Country	*CPI/SRL/ SEO/HD*	Country	*CPI/SR/ SEO/HD*
Algeria	8.107 51.1 50.75 29.73	Djibouti	8.129 46.53 54.91 47.49	Kenya	8.829 48.76 48.75 41.31	Rwanda	7.6 44.46 45.27 41.08
Angola	9.036 63.57 69.24 60.57	Dem. Republic of Congo	9.043 74.93 75.44 59.36	Lesotho	7.479 34.78 54.02 44.64	Sao Tome and Principe	8.179 35.31 60.01 41.39
Benin	7.964 36.61 52.54 49.04	Egypt	7.843 43.18 42.56 29.46	Madagascar	8.114 44.81 55.02 48.04	Senegal	7.736 40.45 48.29 44.06
Botswana	5.057 15.79 35.72 26.11	Equatorial Guinea	9.2 59.37 72.64 45.99	Malawi	7.864 35.08 57.08 49.51	Seychelles	6.414 30.18 42.51 19.21
Burkina Faso	7.643 37.96 51.14 54.58	Eritrea	8.393 62.79 72.93 54.94	Mali	8.071 41.96 53.82 52.05	Sierra Leone	8.786 56.36 65.38 60.56
Burundi	8.9 58.68 67.12 55.91	Ethiopia	8.236 54.84 50.01 53.58	Mauritania	8.421 48.59 58.91 50.62	South of Africa	6.393 30.19 34.78 23.2
Cameroon	8.764 54.49 58.21 46.57	Gabon	7.857 46.02 64.12 42.74	Mauritius	6.207 15.95 30.11 16.88	Swaziland	7.979 42.18 56.05 40.33
Cap Verde	6.043 20.17 43.76 21.13	Gambia	8.314 45.61 52.41 39.24	Morocco	7.436 40.07 42.17 34.37	Tanzania	8.157 40.29 48.37 46.3
Central Africa	8.75 72.93 74.09 69.05	Ghana	6.921 30.15 48.64 33.56	Mozambique	8.314 41.06 55.81 53.78	Togo	8.5 47.83 74.1 54.28
Chad	9.307 64.79 70.88 68.22	Guinea	9.05 56.51 65.27 57.59	Namibia	6.314 25.92 41.82 35.95	Tunisia	6.443 35.89 34.47 16.01
Comoros	8.507 46.87 71.98 48.81	Guinea Bissau	8.957 58.63 75.78 56.17	Niger	8.386 48.26 62.37 61.56	Uganda	8.529 49.42 50.4 42.05
Congo	8.814 62.03 67.2 54.09	Ivory Coast	8.707 66.47 58.72 57.52	Nigeria	8.979 58.45 63.08 49.47	Zambia	8.071 38.29 52.84 43.95

Note: Transformed indicators are used saying that, as the indicator values grow from 1, corruption and institutional quality get worse.

Appendix 2. Description of institutional indicators

SRL, Safety and rule of law = f (Rule of law; Accountability; Personal safety; National security)

- Rule of law = f (judicial process; judicial independence; sanctions; transfers of power; property rights)
- Accountability = f (Accountability, transparency and corruption in the public sector; Accountability, transparency and corruption in rural area; Bureaucracy and corruption; Accountability of public officials; Corruption in government and public officials; Prosecution of abuse of office; Diversion of public funds; Public sector corruption bodies; Access to information)
- Personal safety = f (Political terror; Social unrest; Safety of the person; Police services; Violent crime; Human trafficking)
- National security = f (Cross-border tensions; Government involvement in armed conflict; Domestic armed conflict; Political refugees; Internally displaced people)

PHR, Participation and human rights = f (Participation; Rights; Gender)

- Participation = f (Free and fair executive elections; Free and fair elections; Political participation; Elective power to govern; Political rights)
- Rights = f (International human rights conventions; Human rights; Freedom of expression; Freedom of association and assembly; Civil liberties)
- Gender = f (Gender equality; Gender balance in education; Women's participation in the labour force; Equal representation in rural areas; Women in parliament; Legislation on violence against women; Gender equality in the workplace; Gender equality in appointments into cabinet)

SEO, Sustainable economic opportunity = f (Public management; Business environment; Infrastructure; Rural sector)

- Public management = f (Statistical capacity; Public administration; Diversification; Reserve; Budget management; Ratio of total revenue to total expenditure; Fiscal policy; Ratio of external debt service to exports; Revenue collection; Access to financial records of state-owned companies)
- Business environment = f (Competitive environment; Investment climate; Investment climate for rural businesses; Rural financial services development; Bureaucracy and red tape; Customs procedures; Soundness of banks)
- Infrastructure = f (Electricity supply; Road network; Rail network; Air transport; Telephone and IT infrastructure; Digital connectivity; Access to water)
- Rural sector = f (Public resources for rural development; Land and water for low-income rural populations; Agriculture research and extension services; Agriculture input and produce markets; Policy and legal framework for rural organisations; Dialogue between government and rural organisations; Agriculture policy costs)

HD, Human development = f (Welfare; Education; Health)

- Welfare = f (Welfare regime; Social protection and labour; Social exclusion; Welfare services (Health and education); Equity of public resources use; Environmental policy; Environmental sustainability)
- Education = f (Education provision and quality; Educational system quality; Ratio of pupils to teachers in primary school; Tertiary enrolment; Literacy)
- Health = f (Maternal mortality; Child mortality; Immunisation (Measles; DPT and; Hepatitis B); Antiretroviral treatment provision; Disease (Malaria and TB); Undernourishment; Access to sanitation).

Appendix 3: Robustness check

Model (1):

	PM	EQ-1 & SRL	EQ-1 & PHR	EQ-1 & SEO	EQ-1 & HD
	EQ-1.0	EQ-1.1	EQ-1.2	EQ-1.3	EQ-1.4
Intercept	-0.126(0.084)	-0.035(0.10)	-0.125(0.09)	-0.257**(0.092)	-0.229*(0.09)
y_0	1.56e-6(4.38e-6)	5.07e-7(4.3e-6)	1.95e-6(4.33e-6)	2.28e-6(4.0e-6)	-4.45e-6(4.3e-6)
Investment	0.048***(0.007)	0.049***(0.007)	0.047***(0.007)	0.048***(0.006)	0.043***(0.007)
Education	-0.0019(0.012)	-1.54e-3(0.012)	-0.004(0.012)	-0.006(0.011)	-0.025*(0.012)
Population	1.18***(0.10)	1.22***(0.104)	1.20***(0.10)	1.16***(0.10)	1.21***(0.107)
Openness	0.032*(0.015)	0.031·(0.016)	0.035*(0.015)	0.039**(0.014)	0.035*(0.015)
Elf61	-0.005(0.02)	-0.007(0.02)	-0.011(0.02)	-2.19e-7(0.018)	0.002(0.019)
CPI	-0.01**(0.003)	-0.08*(0.038)	-0.021(0.034)	0.093*(0.044)	0.14***(0.043)
CPI * *SRL*		-0.009(0.02)			
CPI * *PHR*			-0.03(0.023)		
CPI * *SEO*				-0.103**(0.033)	
CPI * *HD*					-0.145***(0.033)
Adjusted-R^2	0.3491	0.3558	0.3550	0.3655	0.3765
N	48	48	48	48	48

Note: The table reports the estimated coefficients of the regression variables with superscripts "***", "**", "*", "·" indicating statistical significance at 0, 0.1, 1, 5, 10 % error level, respectively. GLS standard deviations are in parentheses.

Model (2):

	PM	EQ-2 & *SRL*	EQ-2 & *PHR*	EQ-2 & *SEO*	EQ-2 & *HD*
	EQ-2.0	EQ-2.1	EQ-2.2	EQ-2.3	EQ-2.4
Intercept	2.57***(0.34)	2.095***(0.307)	2.174***(0.32)	2.20***(0.334)	2.443***(0.311)
y_0	9.39e-6(1.03e-5)	5.82e-6(1.01e-5)	1.66e-5(1.05e-5)	5.59e-6(1.03e-5)	-1.31e-5(1.07e-5)
Education	0.005(0.035)	-0.052(0.032)	-0.039(0.034)	-0.038(0.035)	-0.131***(0.035)
Openness	0.117*(0.049)	0.107*(0.044)	0.128**(0.048)	-0.126**(0.048)	0.135**(0.047)
Exchange rate	0.012(0.011)	0.021.(0.011)	0.014(0.011)	0.022·(0.011)	0.027*(0.011)
Gross saving	0.19***(0.012)	0.204***(0.012)	0.20***(0.012)	0.18***(0.012)	0.182***(0.012)
Elf61	0.033(0.05)	0.025(0.049)	0.012(0.051)	0.014(0.05)	0.055(0.051)
CPI	-0.307**(0.104)	0.231*(0.098)	0.063(0.109)	0.112(0.137)	0.324**(0.109)
CPI * *SRL*		-0.119***(0.018)			
CPI * *PHR*			-0.071**(0.018)		
CPI * *SEO*				-0.089***(0.026)	
CPI * *HD*					-0.197***(0.026)
Adjusted-R^2	0.2593	0.3121	0.2857	0.2922	0.3076
N	48	48	48	48	48

Note: The table reports the estimated coefficients of the regression variables with superscripts "***", "**", "*", "·" indicating statistical significance at 0, 0.1, 1, 5, 10 % error level, respectively. GLS standard deviations are in parentheses.