Social media use for offline political action (OPA) and corruption in Africa: impacts and transmission channels

Forthcoming: Information Development

Sylvain B. Ngassam
School of Economics, University of Johannesburg,
Johannesburg, South Africa
E-mail: ngasbertelet@yahoo.fr

Simplice Asongu
(Corresponding author)
African Governance and Development Institute,
P.O. Box 8413, Yaoundé, Cameroon
E-mails: asongusimplice@yahoo.com,
asongus@afridev.org

Gildas T. Ngueleweu
Faculty of Economics and Management
University of Dschang, P.O Box 110 Dschang, Cameroon
E-mail : ttiwangg@gmail.com

Abstract

Despite a growing literature on the determinants of corruption, existing studies are sparse on the channels through which social media curbs corruption using panel data. Social media is captured by the percentages of the population and elites that use social media for offline political actions (OPA). This research uses annual data from a panel of 47 African countries over the period 2000–2018. Results show that social media used by the population for OPA directly curbs executive, judicial and legislative corruption. The use of social media by elites for OPA boosts corruption in the judicial sector. Moreover, social media indirectly curbs corruption through their effects on civil society participation. Reducing corruption in Africa requires *inter alia*, policies aimed at promoting the use of social media for OPA, the emergence of dynamic and effective civil society participation and the improvement of the quality of democracy.

Keywords: social media, executive corruption, judicial corruption, legislative corruption, democracy, civil society

JEL Classification: G20; O38; O40; O55; P37

1. Introduction

Corruption is commonly defined as the misuse of public office power for private gain. It is considered as one of obstacles to economic and social development in Africa because it has a detrimental impact on economic growth (Mauro, 1995) and represents a critical issue for policymakers and civil society (Jha & Sarangi, 2017) in the world, but particularly in Africa. For this reason, and on the intellectual ground, an abundant literature on the drivers of corruption highlights the effects of economic factors (Fisman & Gatti, 2002), institutional factors (Kunicova & Ackerman, 2005; Lederman *et al*., 2005), historical factors (Jha & Sarangi, 2017) and cultural factors (Kolstad & Wiig, 2009; Picón, 2012; Jha & Sarangi, 2017).

The potential of social media[1] in curbing corruption has been defended in the extant literature (Chowdhury, 2004; Diamond, 2010). For instance, citizens might use social media as a cheap tool for organizing protests against wrongdoings of governments and force them to resign as it was the case during Arab springs or sack them through free and fair elections (Asongu & Nwachukwu, 2016). Social media can also improve accountability by constraining officials to be more transparent (Jha & Sarangi, 2017) in their decisions.

However, these potential effects of social media remain highly speculative and need to be supported by empirical foundations. To the best of our knowledge, there are only a handful of empirical studies on the direct and indirect effects of social media on corruption (see, Starke *et al*., 2016; Jha & Sarangi, 2017; Enikolopov *et al*. 2018; Asongu & Odhiambo, 2019). Inspired by these facts, this study proposes to enrich the existing literature, since it seems to be the first to deal with the effect of social media on corruption across various sectors in sub-Saharan African countries while explicitly integrating the role of civil society, civil liberties, democracy, free and fair election and fragility of the state as mediation variables. This study fills the gap on the empirical literature on the topic in four ways:

Firstly, the study analyzes the effect of social media on corruption across various powers existing in a country, contrary to Jha and Sarangi (2017) who consider corruption as a general phenomenon and then focus on a unique and global indicator of corruption. Departing from that common ground, corruption is decomposed into the three main political powers that are apparent in a state (Keneck-Massil *et al.*, 2021), which are executive, legislative and judicial. Secondly, this study to the best of knowledge is the first that questions the role of mediation variables such as civil society participation, democracy and civil liberties in the relationship under consideration in

[1]We borrow definition from Kietzmann *et al.* (2011) who define social media as a computer-driven technology that boosts the sharing of information, thoughts and ideas through the construction of communities and virtual networks. Social media is driven by the internet and provides quick electronic content of communication.

Africa. Thirdly, most studies capture social media use by Facebook penetration rate which unfortunately, does not account for the specific reason for which social media is used. These different aspects of social media use could potentially have different effects that need to be disentangled (Zhuravskaya *et al*., 2020). To circumvent these drawbacks, we capture social media in two ways: the percentage of the population that uses social media for offline political actions (OPA) and the percentage of elites that use social media for OPA. The advantages of these two indicators are their relative precision in terms of what social media is used for and the availability of the time series and cross-country data that enables panel analyses. Finally, as mentioned by Jha and Sarangi (2017), panel data on social media usage is not available enough, restricting past studies to analyses of cross-sectional nature, making it difficult to assess the dynamic nexus between social media and corruption and hence formulating common policies across countries.

It is important to articulate the difference between offline political action and online political action as well as the reason for positioning this study on the former. On the main difference between the former (e.g., contacting government officials in person by phone or letter, signing a paper petition, making political contributions in person and person-to-person political communications) and the latter (e.g., respectively by e-mail), is the reliance on the internet (Smith *et al*., 2009). Moreover, the choice of the former compared to the latter is motivated by data availability constraints at the time of the study on the one hand and on the other, the perspective that the former is higher compared to the latter (Smith *et al*., 2009), especially in a continent such as Africa with a comparatively low level of internet penetration which limits possibilities of online political action compared to offline political action (Acha-Anyi *et al.,* 2020; Asongu & Odhiambo, 2019).

The positioning of this study largely departs from the extant OPA literature which has largely focused on, *inter alia*: observational and conceptual schemes to understanding OPA(Kim & Ellison, 2022; Ruess et al., 2023); the nexus between social media and political participation (Toros & Toros, 2022; Theocharis et al., 2023); young, family and mature movements in OPA (Lo, 2022; Bernroider et al., 2022; Stattin et al., 2023) and nexuses between online and offline political participation and representation (Lee et al., 2022; Oser et al., 2022). The rest of the paper is organized as follows. In the next section, we briefly present the literature review while section 3 describes our data sources and outlines the empirical strategy. In section 4, we present results and discussions while section 5 concludes.

2. Literature review and hypotheses formulation

Although a handful studies had previously focused on the one hand, on the direct link between social media and corruption and on the other hand, on the role of transmission channels, as clarified in the introduction, some related areas have not been explored, which motivates the positioning of the present study.

2.1. Direct effects of social media on corruption

The literature posits that access to social media can reduce corruption (Norris, 2004; Jha & Sarangi 2017; Enikolopov *et al*., 2018). In fact, citizens and activists might use social media for propagating information about misconducts by politicians and public officials, in order to constrain them to more transparency and improved accountability (Jha & Sarangi, 2017; Enikolopov *et al*., 2018). Social media have the potential to empower individuals, to increase their participation in political life, to facilitate communication and to mobilize people on social issues and to strengthen participation of the civil society (Diamond, 2010; Saleh, 2012) in fighting corruption in Africa. By articulating failures at the policy level with corruption, corporate sector level scandals as well as poor public administration (Norris, 2004), public pressure from the media can constraint corrupt politicians to resign and hence, for them lose political power (Jha & Sarangi, 2017). By providing information about corruption, mass media improves transparency within the society, which curbs corruption (Kolstad & Wiig, 2009). The negative association of media freedom and corruption is also approved by Kunicova and Ackerman (2005). Kalenborn and Lessmann (2013) understand social media as a tool for external controls of corruption. This is essentially because, it enables victims to share the incident of corruption, it is a cheap and speedy means to organize public protests with the aim of condemning corrupt activities from politicians and government officials. Based on the preceding observations we formulate the following hypothesis:

H1: Social media use for OPA is a tool to curb corruption in executive, judicial and legislative sectors

2.2 Other determinants of corruption

Further evidence is provided by Chowdhury (2004) on a significant negative incidence of press freedom and democracy on corruption. Elbahnasawy and Revier (2012), in the same vein, find that whereas the rule of law, free media, accountability and perception of free expression reduce corruption, factors such as ethnic fractionalization, political stability and natural resource abundance do not matter for corruption. Conversely, empirical evidence is provided by Nur-Tegin

and Czap (2012) on the position that the durability of democracy matters and corruption decreases after 10-12 years since the inception of democratic governments.

The hypothesis of a negative correlation between corruption and income is supported by a large number of studies (Treisman, 2000; Kunicova & Ackerman, 2005; Lederman *et al*., 2005). However, Frechette (2001) and Fisman and Gatti (2002) also establish the positive relationship between these variables.

Truex (2011) found that social norm establishment that emanates from education as well as social norms that emanate from good education will change people from corruption-tolerant to corruption-resistant (Cheung & Chan, 2008). Moreover, by boosting civic responsibility, social cohesion and legal awareness via education, a negative nexus with participation in corruption is apparent (Oreopoulos & Salvanes, 2009; Merloni 2018). Truex (2011) has found a negative nexus between corruption and education in Nepal. The findings are consistent with Asongu and Nwachukwu (2015) and Jetter and Parmeter (2018). It is suggested by Hunt and Laszlo (2012) that increasing literacy coupled with the official publication of public services costs could reduce poor people's vulnerability to corruption. Conversely, bribery can also be increased by education because more educated individuals tend to be characterized by, *inter alia*, higher income, frequent interactions with officials and are reluctant to spend time on bureaucratic matters and hence are more likely to use bribes to hasten the process (Kaffenberger, 2012). According to Dridi (2014) the influence of secondary education on corruption is not significant. Lastly, Uslaner and Rothstein (2016) emphasized on the favorable incidences of better education on constraining corruption. In order for corruption to be exposed by journalists, media must be free from economic, political and legal constraints (Freedom House, 2015). Moreover, competition within the media as well as the media's economic independence contributes towards fighting corruption (Suphachalasai, 2005). In spite of the abundance of the literature on factors of corruption, the roles of the duration of chief executive in power, the free and fair elections and civil society participation have not been enough or at all explored. We then formulate the following hypothesis:

H2: Other factors such as Gdp, natural resources, education, free and fair elections, democracy and civil society participation reduce corruption in executive, judicial and legislative sectors.

2.3 Some possibilities of mediation

Extant empirical research has ignored the relevance and the significance of moderators via which corruption can be affected by social media. This could, nontheless be relevant in establishing principal features on which policy makers could operate to mitigate corruption in

Africa in the era of the social media revolution. Transparency emerging exclusively from social media information is not enough to mitigate corruption and access to widespread information should be accompanied by the ability to process information as well as incentives to act on the information that is processed (Kolstad & Wiig, 2009). Accordingly, access to better information does not necessarily engender outcomes that are socially beneficial (Malesky *et al*., 2012; Fergusson *et al*., 2013; Chong *et al*., 2015). Social media effectiveness in fighting corruption is contingent on various factors that interact together. Ferraz and Finnan (2008), Snyder and Strömberg (2010) stressed the role of democracies, Qin *et al*. (2016) stressed the importance of governments censorship of news and the suppression or the weakening of electoral institutions. Freedom House (2015), Jha and Sarangi (2017) insisted on media freedom from legal, political, and economic constraints while Camaj (2012) stressed on the role of political regimes.

Moreover, the nexus between corruption and freedom of the media is stronger in nations in which legislation on information freedom has been adopted (Nam, 2012). With regard to political constraints, Camaj (2012) found that the linkage between corruption and media freedom is strongest in nations characterised by parliamentary systems compared to those that are characterized by presidential systems. Moreover, competition within the media as well as the media's economic independence contributes towards mitigating corruption (Suphachalasai, 2005).

Malesky *et al*. (2012) suggested that using online media to monitor public officials in an authoritarian country may lead to unfavorable consequences. While Dyck *et al*. (2008) found the contrary and stress that within the remit of an imperfect democracy, accountability can be promoted by social media even in scenarios in which traditional local media does not make a significant difference. The roles of civil liberties, civil society participation, free and fair elections, democracy and state fragility as moderators of the relationship between social media use for OPA and corruption are not yet or enough explored. In the light of the above, the following hypothesis is formulated:

H3: Parts of the effects of social media on corruption are mediated through civil liberties, civil society participation, free and fair elections, democracy and the fragility of the state.

3 Empirical strategies

3.1 Baseline specification and mediation analysis

3.1.1 Baseline specification

Most analyses of the effects of social media on corruption are based on cross country data. As mentioned by Starke *et al*. (2016), Jha and Sarangi (2017), the longitudinal analysis of the effects of social medial on corruption has often been neglected in previous studies. Furthermore, no study to the best of knowledge has analyzed the type of corruption not least, because previous studies acknowledge corruption as a general phenomenon (Keneck-Massil *et al*., 2021). We then differentiate corruption into three institutionalized powers existing in a state (legislative, executive, and judicial bodies).

The intergenerational transmission of corruption implies that actual levels of corruption would determine future ones. To account for these drawbacks, while investigating the social media-corruption nexus, we use the following dynamic equation.

$$Courrupt_{it}^{k} = \propto_0 + \eta_t + \beta_0 Corrupt_{it-1}^{k} + \beta_1 Socialmed_{it} + \beta_2 Mediation_{it}^{j} + \lambda_i + e_{it} + \varepsilon_t \quad (1).$$

Where $\propto_0$ is the intercept; η_t is the time-specific fixed effect; β_i are coefficients to be estimated; e_{it} is the stochastic error term; λ_i is country specific effect; i and t stand respectively for countries and years. The dependent variables, $Courrupt_{it}^{k}$ are the types of corruptions that we study through individual regressions with k = Legislature corrupt activities index, corrupt judicial decisions index and executive corruption index. $Corrupt_{it-1}^{k}$ is the set of lagged dependant variables.

Social media ($Socialmed_{it}$) is the people's propensity to use social media to organize offline political action of any kind. To deepen our analyses, we integrate the elite's propensity to use social media ($Socialmelite_{it}$) to organize offline political action of any kind.

$Mediation_{it}^{j}$ is a set of mediation variables which may reduce or increase the effect of social media on corruption. J = Civil liberties (Civilib), democracy (Democracy), level of state fragility (Fragility), free and fair elections (Fairelect) and civil society participation (Csop).

X_{it} is the vector of control variables composed of the educational level (Education), per capita real domestic product (GDP), the chief executive power duration (Duration) and natural resource rent (Rent).

3.1.2. The mediation variables

In order to verify if mediation variable mediates the effect of social media on corruption, we use causal mediation analysis (Zhao *et al*., 2010). This approach helps to understand if and to what extent the effect of social media on corruption is mediated through the mediators. This

analysis follows the methodology of Yogo and Mallaye (2015) which is based on mediation analysis to examine the transmission mechanisms from aid to health and Avom *et al*. (2020) who used the mediation analysis to investigate the transmission channels of ICT to environmental pollution and Fomba *et al*. (2022) who used the mediation analysis to investigate transmission of political stability to employment prospects of the youth. To the best of our knowledge, no previous attempt has investigated the channels from social media to corruption. The mediation analysis is made possible through the estimation of the following models:

$$Mediation_{it}^{j} = \alpha_0 + \alpha_1 Socialmedia_{it} + \psi_{it} \qquad (2)$$

Where $Mediation_{it}^{j}$ is the j[th] mediator. α_1 is the effect of social media on the mediator. The remaining signs and symbols are same as previously.

The first step of the algorithm in Eq. (2) consists of determining the effect of social media on each transmission mechanism. If α_1 is statistically significant, it implies that social media use for OPA elucidates part of difference in the transmission mechanism. The step is followed by a computation social media indirect effect on corruption. Substituting Eq. (2) in Eq. (1) yields:

$$Corrupt_{it} = \beta_0 + \beta_1 Socialmedia_{it} + \beta_2 (\alpha_0 + \alpha_1 Socialmedia_{it}) + \beta_3 X_{it} + \boldsymbol{\theta}_t + \lambda_i + \boldsymbol{\varepsilon}_{it} \qquad (3)$$

Rearranging Equation (3) give the following Eq. (4):

$$Corrupt_{it} = \beta_0 + (\beta_1 + \beta_2\alpha_1)\, Socialmedia_{it} + \beta_2 \alpha_0 + \beta_3 X_{it} + \boldsymbol{\theta}_t + \lambda_i + \boldsymbol{\varepsilon}_{it} \qquad (4)$$

β_1 is the direct effect of social media on corruption; $\beta_2\alpha_1$ is the indirect effect of social media use for OPA on corruption and $(\beta_1 + \beta_2\alpha_1)$ is the total effect of social media use for OPA on corruption. These incidences are estimated using the structural equation modeling technique which enables the study to test these impacts in a single analysis as opposed to testing separate regressions. With respect to Zhao *et al*. (2010), for the mediation to be empirically valid the indirect effect (*i.e.* $\beta_2\alpha_1$) should be statistically significant.

3.2 Estimation of the coefficients

We use three different estimation techniques to estimate equations (1), (2). We first use OLS Fixed effect (FE) and random effect (RE). However, FE and RE estimations approaches have limitations. The OLS RE limit is that, the non-observed heterogeneity and time-series components generate heterosckedasticity and autocorrelation whereas the FE model related to OLS is efficient only in the presence of time-varying regressors. Regressors that are time-invariant are collinear with the dummy variables that are unit-specific, leading to the impossibility to establish the

validation of the hypothesis of individual heterogeneity with the Fisher-type test (Greene, 2002). Moreover, FE and RE coefficients that are estimated are inconsistent and by extension, are likely to be biased owing to the lagged value of corruption ($Corrupt_{it-1}$) which is correlated linked to the error term (Nickell, 1981) hence, raising the concern of endogeneity. We address this endogeneity issue by applying the two steps system GMM which main advantage over Difference GMM is among other its weak instrumentation, especially when non-contemporary levels may transmit less information especially as it pertains to future changes, so that lags that are not transformed are weak instruments for the variables that are transformed. Furthermore, social media can be endogenous to corruption in the light of the possibility of omitted variable bias and the concerns of reverse causality and some variables in the model may be time invariant. Application of difference GMM will hence not identify these variables.

3.3 Data and descriptive statistics

3.3.1 Data

This write-up exploits annual data of a balanced panel of 47 African countries for the period 2000–2018. The data are from secondary sources and collected from various databases including V-Dem, Bertelsmann Stiftung, Lee-Lee; Barro-Lee, UNDP, World Bank's WDI database and Data base of Political Institutions. The dependent variable used in this paper is the corruption. Previous literature on corruption has long used the corruption perception index of Kauffman. Its main weakness is the fact that, it does not account for corruption in various institutionalized powers existing in a state. To propose a measure that incorporates the three institutionalized powers existing in a state, the project called Varieties of Democracy, piloted by more than 50 researchers since 2010 evaluates corruption in institutionalized powers existing in countries. In this study, we focus on legislative corruption, judicial corruption and executive corruption from V-Dem database.

Our main explanatory variable is social media use for offline political actions. The literature on social media has used the Facebook penetration rate ( ). One of the weaknesses of this indicator as proxy of social media is the fact that, it lacks precision on the end for which Facebook is used, what social media indicator from V-Dem does. Also, the social media use from V-Dem differentiates between the use of social media by people and the use of social media by elites for political actions. Finally, data are available for up to 167 countries and since almost 1900. More details in measurement scales and sources of data are provided in Table Appendix 1.

3.3.2 Descriptive statistics

Descriptive statistics are summarized in Table 1. The peoples' propensity to use social media for OPA over the period 2000-2018 varies from a minimum value of 0.147 to a maximum

value of 3.737, with a mean of 1.78 and a standard deviation of 0.810. Also, the elites' propensity to use social media for OPA over the same period varies from a minimum value of 0.110 to a maximum value of 3.836, with a mean of 1.881 and a standard deviation of 0.822. In addition, the mean values of executive, judicial and legislative corruptions are respectively 0.657, -1.696 and -1.579 with a standard deviation of 0.238, 0.672 and 0.695 respectively.

Table 1: Descriptive statistics

	Means	Max	Min	Std	N
Socialmelite	1.881	3.836	0.110	0.822	874
Socialmed	1.780	3.737	0.147	0.810	874
Civilib	4.326	7.000	1.000	1.411	874
Education1	4.715	10.633	1.100	2.076	874
Gdp	7.858	10.301	6.000	0.964	874
Rent	13.102	67.918	0.001	12.726	874
Duration	11.257	42.000	1.000	10.265	874
Fragility	14.323	24.000	0.000	5.173	874
Fairelect	13.755	193.000	-1.312	24.851	874
Csop	0.572	0.952	0.146	0.152	874
Csop2	4.197	9	0.000	93.297	874
Democracy	1.63	10	-9	5.09	874
Democracy 2	37.03	100	0.000	529.703	874
Execor	0.657	1.264	0.068	0.238	874
Judcor	-1.696	0.658	-3.688	0.672	874
Legcor	-1.579	0.683	-3.247	0.695	874

Before we begin the formal empirical estimations, we plot the correlation between social media use by population or by elites for OPA and corruptions in Figure 1. Graphs in the corresponding figure clearly indicate a negative correlation between social media use by population and by elites for OPA and executive, judicial and legislative corruptions. The full definitions of variables are apparent in Appendix 1.

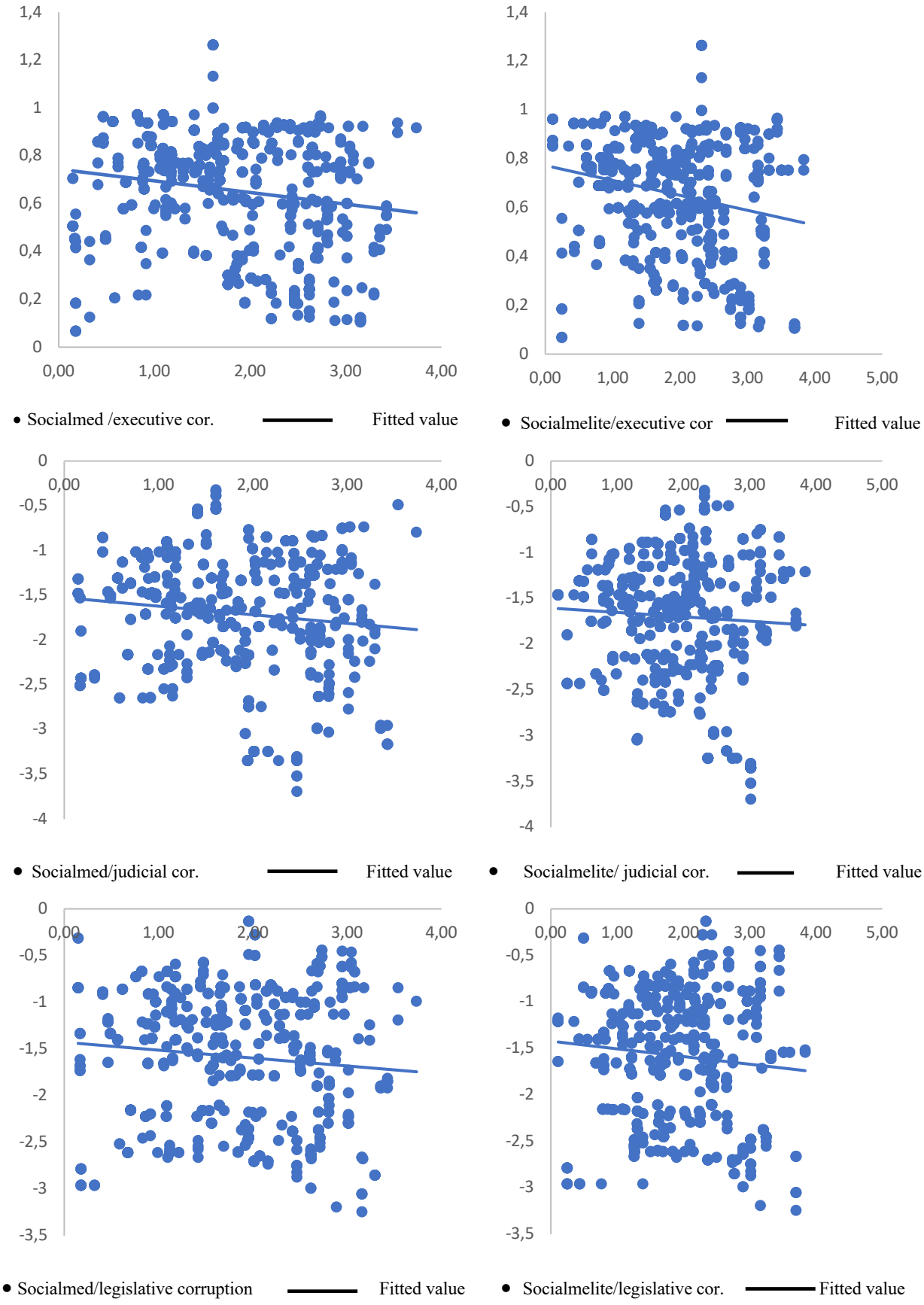

Fig. 1. *Scattered plots of social media use by people and by elites correlated with different dimensions of corruption*

We move to the formal empirical analysis to investigate whether the observed correlations between social media and corruptions are causal.

4. Results and discussions

4.1The effects of social media use by people for OPA: Baseline regression results

The Hausman specification test reveals that the *p*-value is lower than 1% threshold value. This enables the rejection of the null hypothesis for the position of no systemic variation between the coefficients of FE and RE. Then, the FE estimator is appropriate. However, RE estimation results which are identical in terms of signs and significances are presented in Appendix Table 2.

Table 2: Effects of social media on corruptions (FE estimators)

Variables	Executive		Judicial		Legislative	
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
	(1)	(2)	(3)	(4)	(5)	(6)
Civilib		-0.0064		-0.0143		-0.0131
		(0.0060)		(0.0130)		(0.0166)
Democracy		-0.0050**		-0.0196***		-0.0106**
		(0.0018)		(0.0039)		(0.0050)
Fragility		-0.0008		0.0222***		0.0154***
		(0.0019)		(0.0041)		(0.0053)
Fairelect		-0.0000		-0.00006		0.0003
		(0.0001)		(0.0002)		(0.0003)
Csop		-0.6743***		-0.3915***		-1.7917***
		(0.0543)		(0.1165)		(0.1486)
Socialmed	-0.0558***	-0.0261***	0.0031	0.0486*	-0.1290***	-0.0489*
	(0.0094)	(0.0087)	(0.0191)	(0.0187)	(0.0249)	(0.0239)
Gdp	0.0345**	0.0154	-0.1016***	-0.0820**	-0.0525	-0.0539
	(0.0180)	(0.0185)	(0.0364)	(0.0398)	(0.0476)	(0.0508)
Rent	-0.0002	-0.0003	-0.0001	0.0008	-0.0007	0.00007
	(0.0005)	(0.0004)	(0.0011)	(0.0010)	(0.0014)	(0.0013)
Duration	0.0033***	0.0004	0.0012	-0.0014	0.0068***	0.0001
	(0.0004)	(0.0004)	(0 .0009)	(0.0010)	(0.0068)	(0.0012)
Education1	-0.0283***	-0.0082	-0.1004***	-0.0561***	0.0556***	0.1029***
	(0.0077)	(0.0072)	(0.0156)	(0.0010)	(0.0556)	(0.0199)
Constant	0.5856***	1.0628***	-0.4419*	-0.8425***	-1.2682***	-0.6664*
	(0.1248)	(0.1498)	(0.2517)	(0.3215)	(-1.268)	(0.4102)
Obs	870	794	870	794	870	794
Groups	46	46	46	46	46	46
R-sq	0.0485	0.1538	0.1575	0.2758	0.0452	0.1507

F	34.37***	44.98***	26.48***	25.06***	14.65***	33.47***
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: *** 1% level significant; ** 5% level significant; * 10% level significant

Table 3: Effects of social media by population on corruptions (FE estimators)

Variables	Executive		Judicial		Legislative	
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
	(1)	(2)	(3)	(4)	(5)	(6)
Execor	0.4267***	0.3549***				
	(0.0187)	(0.0286)				
Judcor			0.3129***	0.3355***		
			(0.0048)	(0.0138)		
Legcor					0.3347***	0.451**
					(0.0081)	(0.0191)
Civilib		0.0007		0.0087***		-0.0060
		(0.0017)		(0.0026)		(0.0043)
Democracy		-0.0062***		-0.0110***		-0.0052***
		(0.0003)		(0.0009)		(0 .0011)
Fragility		0.0007*		0.0010		-0.0011
		(0.0004)		(0.0009)		(0.0014)
Fairelect		0.00004**		-0.0008		0.0002***
		(0.00001)		(.00003)		(0.00003)
Csop		-0.3731***		-0.4073***		-0.9377***
		(0.0413)		(0.0809)		(0.0720)
Socialmed	**-0.0312*****	-0.0165***	**-0.0372*****	-0.0205***	-0.0895***	-0.0857***
	(0.0020)	(0.0017)	(0.0015)	(0.0071)	(0.0129)	(0.0086)
Gdp	0.0245***	0.0340***	-0.0323**	-0.0817***	0.0082	-0.0215
	(0.0042)	(0.0075)	(0.0169)	(0.0166)	(0.0108)	(0.0328)
Rent	0.0002***	0.0002*	0.0010***	0.0002*	-0.0001	-0.0005***
	(0.00007)	(0.00007)	(0.00002)	(0.0003)	(0.0001)	(0.0002)
Duration	0.0019***	0.0008***	0.0024***	0.0020***	0.0030***	0.0013***
	(0.0002)	(0.0001)	(0.0004)	(0.0003)	(0.0005)	(0.0004)
Education1	-0.0202***	-0.0146***	-0.0420***	-0.0246***	0.0580***	0.0687***
	(0.0026)	0.0039)	(0.0068)	0.0085)	(0.0092)	(0.0091)
Constant	0.3195***	.4530***	-0.6199***	-0.1661	-1.2426***	-0.3610*
	(0.0284)	(0.0386)	(0.1199)	(0.1045)	(0 .0722)	(0.1980)
Obs	777	685	777	685	777	685
Groups	46	46	46	46	46	46
Inst	39	44	39	44	39	44
AR1	0.0021	0.0098	0.0002	0.0002	0.0795	0.0562
AR2	0.0733	0.2026	0.5007	0.9699	0.0932	0.1220
Sargan	0.2838	0.2620	0.2087	0.3391	0.7791	0.6444
Wald (Chi2))	2567.18***	6932.55***	1497.13***	2704.82***	9475.30***	3296.99***

Note: *** 1% level significant; ** 5% level significant; * 10% level significant

Table 2 below presents different results of FE estimation of the impact of social media, moderators variables and other control variables on different types of corruption using in Eq. (1). Results in Columns (1), (3) and (5) in Table 2 are related to the effects of social media and only control variables on different types of corruption, while results in Columns (2), (4) and (6) present the effect of social media and all variables including mediation variables on different types of

corruption. The Fisher statistic is significant at 1%. This shows that at least one of the model coefficients is non-zero, showing the overall significance of the model. Globally these baseline results show that lower levels of corruption are associated with an increase in social media use for OPA.

However, the Wald test for group wise heteroskedasticity reveals that heteroskedasticity is apparent. Hence, FE estimators are inconsistent and biased. In order to address this econometric limitation, the GMM estimator is used. The results presented in Table 3 show that the basic statistical tests for these models are satisfactory.

The AR (1) values reveal the presence of first-order autocorrelation while the AR (2) values show the absence of second-order autocorrelation. In addition, the Sargan and Hansen instrument validity tests indicate that the instruments are valid and the numbers of instruments are less than the number of individuals (countries).

Results in Column (1), (3) and (5) concern the effects of social media and control variables on corruption in executive, judicial and legislative sectors, respectively. These results still indicate that higher level of social media use by population for OPA is negatively associated with executive, judicial and legislature corruption.

In Columns (2), (4) and (6), we associate to social media and control variables, the mediation variables. With this introduction, signs and significances of social media coefficients remain unchanged but the effect is reduced. In fact, a one-point increase in people's propensity to use social media for OPA reduces executive corruption from 0.0389 to 0.0165-point, judicial corruption from 0.0604 to 0.0205 point and legislature corruption from 0.0895 to 0.0503 point. Signs and significations of control variables remain unchanged, showing the robustness of the relationship. These results corroborate findings in the extant literature (Camaj, 2012; Jha & Sarangi, 2017) and partially confirm the first hypothesis according to which social media use for OPA negatively impacts corruption in executive, judicial and legislative sectors.

A one-point increase in gross domestic product (GDP) accentuates executive corruption by 0.0340 point, judicial corruption by 0.0817 but it still has no significant effect on legislature corruption. These results are consistent with conclusions of Frechette (2001) who found that income is positively associated with corruption**.** These results contradict the theoretical discussions in the extant literature (Kunicova & Ackerman 2005; Lederman *et al*., 2005) in which higher GDP per capita is a deterrent to corruption.

A one-point increase in duration of the chief executive on power significantly increases executive corruption by 0.0008, judicial and legislature corruption respectively, by 0.002 and

0.0013 point. These results seem to indicate that corruption, with the use of resources from rent, is one the means through which chief executive officers finance their stay in power. This idea is partially reinforced by the fact that a point increase in resource rent significantly increases executive and judicial corruption by 0.0002 point. Similar results have been found by Omgba (2009) for whom politicians may use natural resource income to guarantee their stay in power.

We now appreciate the direct effects of mediation variables on corruption in different sectors. Civil liberties have a significant and positive effect only on judicial corruption. In fact, a one-point increase in civil liberty increases judicial corruption by 0.0087 point. This result contradicts findings of Elbahnasawy and Revier (2012) and Chowdhury (2004) who provided evidence of a significant and negative impact of press freedom on corruption. This result specific to Africa is paradoxical and may be explained by many reasons among which, the fact that the poor working conditions of journalists expose them to corruption and bring them captive to public financing from officials**.**

Democracy significantly reduces executive, judicial and legislative corruption by respectively 0.0062; 0.011 and 0.0052 point. The negative association between democracy and corruptions has been observed in former studies by Nur-Tegin and Czap (2012).

In a fragile state that is characterized among others by poor access to key basic resources, people are more prone to corruption, specifically in the executive sector. This is why a point increase in state fragility positively and significantly boosts executive corruption.

A one-point increase in free and fair election increases executive and legislature corruption by 0.0004 and 0.0002 point, respectively. These results are once more paradoxical since free and fair elections are a way for voters to sack corrupt executive and legislative officers. The interpretation one can give to such result is that under fair and free elections, candidates may decide to buy votes as it has been observed in many Africa countries during various elections.

A one-point increase in the civil society participation reduces executive, judicial and legislature corruption respectively by 0.3731, 0.4073 and 0.9377 point. These findings are in line with findings of Diamond (2010) and Saleh (2012).

These results almost confirm the second hypothesis according to which other factors such as GDP, natural resources, education, free and fair elections, democracy and civil society participation are significantly associated with corruption in executive, judicial and legislative sectors. Accordingly, the second hypothesis is only partially confirmed because: (i) free and fair elections and society participation have a positive effect; (ii) democracy has a negative effect while (iii) the effects of education, GDP and natural resources are both positive and negative. It is important to recall that these factors were expected to negatively affect corruption.

We now examine the indirect effects of social media through some transmission channels identified in the literature and retained for this study, namely civil liberties, democracy, fragility of the state, free and fair elections and civil society participation. This requires, first estimating the effect of social media use for OPA on the potential transmission channels and approve their significance before calculating the indirect effects and the percentage of mediation of each variable.

Table 4 shows that the use of social media by people for OPA has a positive and significant effect on civil liberties, democracy, fragility, civil society participation and a negative and significant effect on free and fair elections. In fact, a one-point increase in people's propensity to use social media for OPA increases civil liberties, democracy, fragility and civil society participation by respectively 0.0865, 0.5636, 0.8003 and 0.0303 but reduces free and fair election by 13.0761 points.

These results are in consistent with the literature. Accordingly, several empirical studies have seen social media as a tool that strengthens democracy (Shirky, 2008; Jha & Sarangi, 2017; Enikolopov *et al.,* 2018), boosts fragility (Zhuravskaya *et al*., 2020; Laub 2019), increases civil liberties (Diamond, 2010; Saleh, 2012) and civil society participation (Shirky, 2008 ; Diamond, 2010).

Table 4: Effects of social media use by people for OPA on transmission channels

	Civilib	Democracy	Fragility	Fairelect	Csop
LAGGED	0.6409***	0.6746 ***	1.066***	-0.1810***	0.0121
	(.0144)	(0.0037)	(0.030)	(0.0059)	(0.0193)
Socialmedia	0 .0865***	0.5636***	0.8003***	-13.0761***	0.0303***
	(0.0033)	(0.0988)	(0.1572)	(1.1428)	(0.0054)
Constant	1.3751***	-0.4552*	-2.5660***	39.5075***	0.4965***
	(0.0958)	(0.2525)	(0.7159)	(2.3089)	(0.0194)
Obs	748	775	782	717	768
Groups	46	46	46	46	46
Inst	34	35	35	35	35
AR1	0.0001	0.0008	0.0000	0.0000	0.2899
AR2	0.2687	0.5783	0.3577	0.0101	0.7233
Sargan	0.3506	0.7842	0.2776	0.0976	0.2675
Wald (Chi2)	770.31***	3431.01***	6154.51***	929.26***	362.4***

Note: *** 1% level significant; ** 5% level significant; * 10% level significant

An overview of the contributions of the transmission channels is presented in Table 5. The direct effect of social media use by people for OPA on executive corruptions is captured through the coefficient β_1, such that the contribution of the direct incidence relative to the total incidence is $\beta_1/(\beta_1 + \beta_2\alpha_1)$. The transmission channels are captured through the factor $\beta_2\alpha_1$.

From Table 5, the relative direct contribution of social media use by people for OPA on executive corruption is 52.88%. About 11.21% of the total desirable effect of social media use by people for OPA on executive corruption is mediated by democracy, while 1.60% is from free and fair elections. The civil society participation channel has a relative contribution of 35.21%. Conversely, the undesirable indirect effect through civil liberties and state fragility account respectively for 0.32% and 1.92 % of the total effect. The main indirect effect of social media use by people for OPA on executive corruption is transmitted through civil society participation. The effect of social media use for OPA through democracy is the second most important. Jointly, the transmission channel studied in this work accounts for 47.12% of the total effect of social media use by people for OPA on executive corruption.

The relative contribution of the direct effect of social media use for OPA on judicial corruption is 54.81%. About 16.84% of the total indirect effect of social media use by people for OPA on judicial corruption is mediated through democracy while 33.16% is mediated through civil society participation channel.

Table 5: The relative contribution of mediation variables when social media is used by population

Variables	Executive				Judcorr				Legislative			
	β_1 in table 4	β_2 in table 3 column (2)	$\beta_1 + \beta_2\alpha_1$	Relative Contribu-tion (%)	β_1 in table 4	β_2 in table 3 column (2)	$\beta_1 + \beta_2\alpha_1$	Relative Contribu-tion (%)	β_1 in table 4	β_2 in table 3 column (2)	$\beta_1 + \beta_2\alpha_1$	Relative Contribu-tion (%)
Socialmed			-0.0165	52.88			-0.0205	54.81			-0.0503	58.62
Civilib	0.0866	0.0008	0.0001	-0.32	0.0866	0.0088	0.0008	-2.14	0.0866	-0.0060	-0.0005	0.58
Democracy	0.5637	-0.0062	-0.0035	11.22	0.5637	-0.0111	-0.0063	16.84	0.5637	-0.0053	-0.0030	3.50

Fragility	0.8004	0.0007	0.0006	-1.92	0.8004	0.0011	0.0009	-2.41	0.8004	-0.0011	-0.0009	1.05
Fairelect	-13.0761	0.0000	-0.0005	1.60	-13.076	-0.0008	0.0001	-0.27	-13.076	0.0002	-0.0027	3,15
Csop	0.0304	-0.3731	-0.0113	36.22	0.0304	-0.4074	-0.0124	33.16	0.0304	-0.9377	-0.0285	33.22
Total effect			**-0.0312**	100.00			**-0.0374**	100.00			**-0.0858**	100.00

Conversely, the undesirable indirect effects of social media use for OPA on judicial corruption are mediated through civil liberties, fragility and fair elections, respectively for 2.14%, 2.41% and 0.27% of the total effect. The main indirect effect of social media use by people for OPA on judicial corruption is transmitted through civil society participation. The reducing effect of social media use for OPA through democracy is the second most important. Jointly, the transmission channel studied in this work accounts for 45.19% of the total effect of social media use by people for OPA on judicial corruption.

The relative contribution of the direct effect of social media use for OPA on legislative corruption is 58.62%. About 33.22% of the total indirect effect of social media use by people for OPA on legislative corruption is mediated through civil society participation, 3.5% through democracy, 3.15% through free and fair elections, 1.5% through state fragility and 0.58% through civil liberties. The main indirect effect of social media use for OPA on legislative corruption is transmitted through civil society participation. The undesirable effect of social media use by people for OPA through democracy is second most important. Jointly, the transmission channel studied in this work accounts for 41.38% of the total effect of social media use by people for OPA on legislative corruption.

4.2 Sensitivity of results to social media use by elites for OPA

Results presented so far have concerned the effects of social media use by people. We now present the effect of social media use by elites for OPA on corruption. Elites are groups or classes of persons considered being superior to others because of their abilities, intelligence, social standing or wealth.

Their consumption behavior of social media and their consequences on corruption may be different. This section analyses and compares the effects of social media use by elites to organize OPA executive, judicial and legislature corruption. Results are presented in Table 6.

Social media use by elite for OPA has almost the same effects on executive, judicial and legislature corruption in terms of sign and significance. The main differences are in the magnitude of the coefficients (i.e. thus of effects are lower) and with the introduction of mediation variables.

The effects of social media use by elites to organize OPA shifts from negative value of -0.0398 in Table 3 Column (2) to positive 0.0182, in Column (2) of Table 6.

Also, after replacing 'social media use by people' by 'social media use by elites' for OPA, the signs and significance of all control and mediation variables remain unchanged.

We verify if the variables retained as mediation are still playing the same role when the social media is used by elites for OPA. Results presented in Table 7 show once more that the use of social media by elites for OPA has a positive and significant effect on civil liberties, democracy, fragility, civil society participation and a negative and significant effect on free and fair elections. In other words, social media use by elites impact corruption via these mediation variables.

Table 6: Effects of social media use by elites for OPA on corruptions (FE estimators)

	Executive		Judicial		Legislative corruption	
	Coef. (1)	Coef. (2)	Coef. (3)	Coef. (4)	Coef. (5)	Coef. (6)
Execor	0.4207***	0.3492***				
	(0.034)	(0.0273)				
Judcor			0.3099***	0.3509***		
			(0.0665)	(0.0116)		
Legcor					0.36303***	0.4451***
					(0.0090)	(0.0219)
Civilib		00001		0.0091***		-0.0057
		(0.0018)		(0.0024)		(0.0047)
Democracy		-0.0062***		-0.0108***		-0.0058***
		(0.0005)		(0.0009)		(0.0007)
Fragility		0.0001		0.0010*		-0.0033**
		(0.0003)		(0.0006)		(0.0014)
Fairelect		0.00004***		-0.00001		0.0001***
		(0.00001)		(0.00003)		(0.0003)
Csop		-0.4200***		-0.4692***		-1.0204***
		(0.0376)		(0.0795)		(0.0616)
Socialmelite	-0.0306***	-0.018 ***	**0.0061****	0.0182**	-0.1345***	-0.1015***
	(0.0067)	(0.0376)	(0.0072)	(0.0094)	(0.0212)	(0.0081)
Gdp	0.038***	0.0442***	-0.0316**	-0.0717***	0.0199*	0.0519*
	(0.0046)	(0.0055)	(0.0134)	(0.0108)	(0.0081)	(0.0203)
Rent	0.0002***	0.0001**	0.0011***	0.0003	-0.0003**	-0.0008***
	(0.00007)	(0.0055)	(0.0002)	(0.0003)	(0.0002)	(0.0002)
Duration	0.0018***	0.0007***	0.0020***	0.0020***	0.0032***	0.0012
	(0.0002)	(0.0001)	(0.0005)	(0.0002)	(0.0003)	(0.0003)

Education1	-0.0237***	-0.0188***	-0.0522***	-0.0446***	0.0574***	0.0479***
	(0.0021)	(0 .0032)	(0.0058)	(0.0084)	(0.0079)	(0.0078)
Constant	0.2589***	0.4355***	-0.6113***	-0.1458**	-1.2463***	-0.6935***
	(0.0388)	(0.0414)	(0.1001)	(0.0665)	(0.0501)	(0.1387)
Obs	777	685	777	685	777	685
Groups	46	46	46	46	46	46
Inst	39	44	39	44	39	44
AR1	0.0029	0.0110	0.0002	0.0001	0.08	0.0709
AR2	0.0786	0.2361	0.4604	0.9867	0.0963	0.1539
Sargan	0.2835	0.1940	0.2473	0.2695	0.5671	0.6975
Wald	4264.41***	3541.15***	1796.90***	4547.83***	4458.74***	2043.59***

Note: *** 1% level significant; ** 5% level significant; * 10% level significant

Table 7: Effects of social media use by elites for OPA on transmission channels

	Civilib	Democracy	Fragility	Fairelect	Csop
LAGGED	0.6404***	0.644 ***	0.971***	-0.189***	0.178***
	(.0229)	(.0015)	(0.030)	(0.0071)	(0170)
Sociamelite	0.108***	0.165***	0.410***	-20.298***	0.0256***
	(.0114)	(0.220)	(0.148)	(1.424)	(0.0046)
Constant	1.314***	-0.218	-.555***	54.359***	0.411***
	(.114)	(0.2525).	(0.705)	(3.114)	(0.0131)
Obs	748	775	782	717	768
Groups	46	46	46	46	46
Inst	34	35	35	35	35
AR1	0.0001	0.0008	0.0000	0.0000	0.2899
AR2	0.3687	0.5783	0.3577	0.0101	0.7233
Sargan	0.3506	0.7842	0.2776	0.0976	0.2675
Wlad (Chi2)	964.36***	693.85***	372.76***	755.92***	143.96**

Note: *** 1% level significant; ** 5% level significant; * 10% level significant

In Table 8, we present the relative contribution of mediation variables when social media is used by elites, compared to the relative contribution of mediation variables when social media is used by the population (in Table 5). The relative contribution of reducing the direct effect of social media use by elites for OPA on executive corruption is 58.86 against 52.88% when social media is used by people. About 3.27 % of the total desirable effect of social media use by elite for OPA on executive corruption is mediated by democracy against 11.27% when used by people, while 2.94% is from free and fair elections against 1.60% when used by people. Civil society participation channel still has a highest relative contribution of almost 35%. Conversely, the undesirable indirect effect through civil liberties account respectively for 0.07% against 0.32% of the total effect when social media is used by people. The main indirect effect of social media use by elites for OPA on executive corruption is still transmitted through civil society participation.

The effect of social media use by elites for OPA through democracy is still the second most important. Jointly, the transmission channel studied in this work accounts for 41.14% of the total effect of social media use by elites for OPA on executive corruption.

Table 8: The relative contribution of mediation variables when social media is used by elites

Variables	Executive				Judicial				Legislative			
	β_{1} in table 7	β_2 in table 6 column (2)	$\beta_1 + \beta_2\alpha_1$	Relative Contribu-tion (%)	β_{1} in table 7	β_2 in table 6 column (2)	$\beta_1 + \beta_2\alpha_1$	Relative Contribu-tion (%)	β_{1} in table 7	β_2 in table 6 column (2)	$\beta_1 + \beta_2\alpha_1$	Relative Contribu-tion (%)
Socialmelite			-0.0180	58.86			0.0182	293.55			-0.10156	75.48
Civilib	0.1080	0.00018	0.00002	-0.07	0.1080	0.0091	0.0010	16.13	0.1080	-0.0057	-0.0006	0.45
Democracy	0.1650	-0.0062	-0.001	3.27	0.1650	-0.0108	-0.0018	-29.03	0.1651	-0.0058	-0.0010	0.74
Fragility	**0.4104**	**0.0001**	**0.0000**	**0.00**	0.4104	0.0011	0.0005	8.06	0.4104	-0.0033	-0.0014	1.04
Fairelect	-20.2983	0.00002	-0.0009	2.94	-20.2983	-0.00001	0.0003	4.84	-20.298	0.0002	-0.0038	2.82
Csop	0.0256	-0.4200	-0.0107	34.99	0.0256	-0.4692	-0.0120	-193.55	0.0256	-1.0204	-0.0262	19.47
Total effect			-0.0306	100.00			0.0061	100.00			-0.1345	100.00

The relative direct undesirable effect of social media use by elites for OPA on judicial corruption is 293.55%. About 29.03% of the total desirable indirect effect of social media use by elites for OPA on judicial corruption is mediated through democracy against 16.84% when social media is used by people. 193.55% of desirable effects are mediated through civil society participation channel against 33.16% when social media is used by elites. Conversely, the undesirable indirect effect of social media use by elites for OPA on judicial corruption are positive and mediated through civil liberties, fragility and fair election, respectively for 16.13; 8.06 and 4.84 against 2.14%; 2.41% and 0.27% of the total effect when social media is used by people.

The main indirect desirable effect of social media use by elites for OPA on judicial corruption is transmitted through civil society participation. The undesirable indirect effect of social media use by elites for OPA through democracy is the second most important. Jointly, the transmission channel studied in this work accounts for -193.55% of the total effect of social media use for OPA on judicial corruption.

The relative contribution of direct desirable effect of social media use by elites for OPA on legislative corruption is 75.48% against 58.62% when used by people. About 19.47% of the total indirect effect of social media use by elites for OPA on legislative corruption is mediated through civil society participation against 33.22% when used by people, 0.74 through democracy against 3.5% when used by people, 2.82% through fair elections against 3.15% when used by people, 1.04 through state fragility against 1.5% when used by people and 0.45% through civil liberties against 0.58% when used by people. The main indirect effect of social media use by elites for OPA on legislative corruption is transmitted through civil society participation. The undesirable effect of social media use by elites for OPA through democracy is the second most important. Jointly, the transmission channels studied in this work account for 24.52% against 41.38 % of the total effect of social media use for OPA on legislative corruption.

The third hypothesis of the study according to which parts of the effects of social media on corruption are mediated through civil liberties, civil society participation, free and fair elections, democracy and the fragility of the state, is confirmed.

4.3. Sensitivity to the use of alternative measures of civil society participation and democracy indicators

The preceding results have revealed that civil society participation and democracy are the main mediators through which social media use by people for OA impacts corruptions. In order to certify the leading role of these mediators, we use alternative indicators of the two variables

provided by the Bertelsmann Stiftung data base. Results in Table 9 below still indicate negative effects of civil society participation and democracy on corruption.

The significant positive effect of social media use by people for OPA on civil society participation and democracy in Table 10 certifies the roles of the two variables as mediators. Finally, in Table 11, the relative contributions of executive, judicial and legislative corruption are respectively 29.606%, 33.673% and 80.22%. These relative contributions remain important though less than the preceding 52.88%, 54.81% and 58.62% obtained with former civil society participation and democracy indicators.

Table 9: Effects of social media use by population for OPA on corruptions (alternative indicator of civil society and democracy using s-GMM estimator)

Executive	Executive		Judicial		Legcor	
Lagged	0.4267***	0.3673***	0.3129***	0.2502***	0.3347***	0.2104***
	(0.0187)	(0.0182)	(0.0048)	(0.0154)	(0.0081)	(0.0260)
Civilib		.01031***		.0282***		0.0284***
		(0.0015)		(0.0035)		(0.0260)
Democracy 2		-0.0005***		-0.001***		-0.0001***
		(0.0005)		(0.0001)		(0,0001)
Fragility		0.0002		0.0017**		-0.0045**
		(0.0002)		(0.0007)		(0.0020)
Fairelect		0.0003*		0.0008***		0.0001***
		(0.0001)		(0.0002)		(0.0020)
CSOP2		-0.0018***		-0.0004***		-0.0004***
		(0.00015)		(0.0003)		(0.0008)
Socialmed	-0.1720***	-0.0509***	-0.190***	-0.0641	-0.147***	-0.1177***
	(0.002)	(0.0034)	(0.0015)	(0.0043)	(.0129)	(.0148)
Gdp	0.0244***	0.0212***	-0.0323*	0-.0316*	0.0082	0.0067

	(0.0042)	(0.0030)	(0.0169)	(0.0195)	(0.0108)	(0.0134)
RENT	0.0002***	0.0002***	0.0010***	0.0002	-0.0002	-0.0004*
	(0.0007)	(0.0000)	(0.0002)	(0.0002)	(0.0001)	(0.0002)
Duration	0.0019***	0.0024***	0.0024***	0.0049***	0.0030***	0.0041***
	(0.0002)	(0.0001)	(0.0004)	(0.0005)	(0.0005)	(0.0005)
Education1	-0.0202***	-0.019***	-0.0420***	-0.0483***	0.5808***	0.0637***
	(0.0026)	(0.0032)	(0.006)	(0.0083)	(0.0092)	(0.0133)
Constant	0.3195***	0.3441***	-0.6199***	-.8319***	-1.2426***	-1.4617***
	(0.0284)	(0.0271)	(0.1199)	(0.1325)	(0.0722)	(0.1267)
Obs	777	672	777	672	777	672
Groups	46	45	46	45	46	45
Instr	39	44	39	44	39	43
AR1	0.0021	0.0064	0.0002	0.0046	0.0795	0.1847
AR2	0.0733	0.1653	0.5007	0.6518	0.0932	0.1173
Sargan	0.2838	0.2130	0.2087	0.7642	0.7791	0.7313
Wald (Chi2)	4264.41***	3521.15***	4258.74***	4447.83***	1796.90***	2041.59***

Note: *** 1% level significant; ** 5% level significant; * 10% level significant

Table 10: Effects of social media use by population for OPA on transmission channels (alternative indicator of civil society and democracy)

	Civilib	Democracy	Fragility	Fairelect	Csop
Lagged	0.6409***	-4.3033***	1.066***	-0.1810***	-.00496***
	(0.0144)	(0.0107)	(0.030)	(0.0059)	(0.0002)
Social media	0.0865***	114.4284***	0.8003***	-13.0761***	33.917***
	(0.0033)	(9.3744)	(0.1572)	(1.1428)	(2.856)
Constant	1.3751***	-27.876	-2.5660***	39.5075***	89.545***
	(0.0958)	(19.878)	(0.7159)	(2.3089)	(5.4910)
Obs	748	708	782	717	721
Groups	46	45	46	46	45
Inst	34	35	35	35	35
AR1	0.0001	0.3227	0.0000	0.0000	0.3167
AR2	0.2687	0.3024	0.3577	0.0101	0.3345
Sargan	0.3506	0.1372	0.2776	0.0976	0.1420
Wald (Chi2)					

	934.36***	673.85***	372.76***	745.92***	143.96**

Note: *** 1% level significant; ** 5% level significant; * 10% level significant

Table 11: The relative contribution of mediation variables when social media is used by the population (alternative indicator of civil society and democracy)

Variables	Executive				Judicialr				Legislative			
	α_1 in table 9	β_2 in table 10 column (4)	$\beta_1 + \beta_2\alpha_1$	Relative Contribu-tion (%)	α_1 in table 9	β_2 in table 10 column (4)	$\beta_1 + \beta_2\alpha_1$	Relative Contribu-tion (%)	α_1 in table 9	β_2 in table 10 column (4)	$\beta_1 + \beta_2\alpha_1$	Relative Contribu-tion (%)
Socialmed			-0.0509	29.606			-0.064	33.673			-0.1177	80.22
Civilib	0.087	0.01031	0.0009	-0.519	0.087	0.0282	0.002	-1.284	0.087	0.0285	0.002	-1.681
Democracy	114.428	-0.0005	-0.0609	35.395	114.428	-0.0010	-0.114	60.092	114.428	-0.0001	-0.011	7.799
Fragility	0.800	0.00002	0.0000	-0.010	0.800	0.0018	0.001	-0.752	0.800	-0.0045	-0.004	2.466
Fairelect	-13.076	0.00003	-0.0004	0.228	-13.076	0.0001	-0.001	0.542	-13.076	0.0002	-0.002	1.604
Csop	33.917	-0.00179	-0.0607	35.299	33.917	-0.0004	-0.015	7.730	33.917	-0.0004	-0.014	9.593
Total effect			-0.1720	99.999			-0.190	100.00			-0.147	100.002

The main indirect effects of social media use by population for OPA on corruption dynamics are still transmitted through civil society participation and democracy. Most of the indirect effects of social media use by population for OPA on corruptions are transmitted through democracy.

Globally, changing civil society participation and the democracy indicator have not fundamentally modified conclusion concerning the direct and indirect effects of the social media use for OPA on corruption dynamics.

5. Conclusion

This research highlights the effect of social media use for OPA on corruption in Africa by considering transmission channels. The literature review has explored the potential mechanisms via which this impact is possible. We then examined the direct effect of the reduction of executive, judicial and legislative corruption due to social media use for OPA. The corresponding channels were also examined through civil society participation, democracy, free and fair elections, civil liberties and state fragility. It uses annual data within a balanced panel, including 47 African countries over the period 2000–2018. For the search of robustness, this work applies the OLS FE, RE estimation and the GMM techniques to investigate such effects. To account for the specific characteristics of users and the end for which social media is used, we capture social media by the propensities of population and elites to use social media for OPA to analyze such effects. After having used different regression equations corresponding to corruption in various institutionalized powers existing in a state (executive, judicial and legislative sectors), results indicate that the use of social media by population directly and indirectly reduces corruption in executive, judicial and legislative sector. Social media use by elites reduces corruption in the executive and legislative sector but boosts corruption in judicial sector. The findings broadly confirm the first hypothesis which posits that social media use for OPA by population or by elites reduces executive, judicial and legislative corruption.

Globally, results also indicate that, civil society participation, democracy, the educational level of the population are negatively associated with corruptions, while the number of years of chief executives in power and natural resources are positively associated with corruption. The second hypothesis is therefore almost confirmed.

An analysis of the transmission channels shows that social media use for OPA by population or by elites also reduces executive, judicial and legislative corruption through its desirable effect on civil society participation, democracy and, to a less extend free and fair elections. However, it increases executive, judicial and legislative corruption trough undesirable effects on civil liberties and state fragility.

This second findings partially confirm the third hypothesis that stipulate that, parts of the effects of social media on corruption dynamics are desirably mediated through civil society participation and democracy but undesirably mediated through, civil liberties, free and fair elections and fragility of the state.

The results of this research obviously leave room for some policy implications. First, it is apparent from the study that social media is fundamental in eliciting corruption. The analysis of the indirect effects highlights the value of monitoring certain variables that are worthwhile in

reducing the level of corruption**,** especially the presence of a dynamic civil society and democracy. It is therefore necessary to integrate the contribution of civil society and democracy that increase the effectiveness of social media in fighting corruption. Second, the findings have also shown that the relevance of social media in fighting corruption is contingent on both the type of population using the social media as well as the type of corruption that the corresponding social media aims to address. These contingencies should be considered when formulating and implementing policies through which social media can be fought.

The findings in this study evidently leave room for further research, especially as it concerns the assessment of country-specific cases in order to derive more country-specific policy implications. Moreover, considering how social media affects sustainable development goals (SDGs) in the light of the United Nations' 2030 agenda is worthwhile.

6. Declaration

Statements:

Hereby, the authors declare that all information in this paper is accurate. They solemnly declare that all the information furnished in this document is free of errors to the best of their knowledge.

Conflicts of interest/Competing interests:
The authors declare that there are no competing interests.

Funding:

No funding has been received for this paper

Authors' contributions:

Sylvain B. Ngassam: Topic formulation, problem statement, literature review, methodology and comments

Simplice A. Asongu: Methodology, Data analysis, comments of results and conclusion

Gildas T. Ngueleweu: Database preparation, Topic formulation, literature review

Data availability: Data are available upon request.

References

Acha-Anyi, A., Acha-Anyi, P. N., Asongu, S. A., & Tchamyou, V. S. (2020). Social media for health promotion: A visual analysis of "TB proof" South Africa's Facebook page. *Technology in Society*, 63, 101386.

Asongu, S., & Nwachukwu, J. (2015). The incremental effect of education on corruption: evidence of synergy from lifelong learning. Economics Bulletin 35: 2288–308.

Asongu, S., & Nwachukwu, J. (2016). Revolution empirics: predicting the Arab Spring. Empirical Economics, 51(2), 439-482.

Asongu, S., & Odhiambo, N. (2019). Governance and social media in African countries: an empirical investigation. Telecommunications Policy, 43(5), 411-425.

Asongu, S. A., & Odhiambo, N. M. (2019). Social media and inclusive human development in Africa. *Information Development*, 37(2), 307-325.

Avom, D., Nkengfack, H., Kaffo Fotio, H., & Totouom, A. (2020). ICT and environmental quality in Sub-Saharan Africa: Effects and transmission channels, *Technological Forecasting & Social Change*. 155, June 2020, 120028

Bernroider, E. W., Harindranath, G., & Kamel, S. (2022). From connective actions in social movements to offline collective actions: an individual level perspective. Information Technology & People, 35(8), 205-230.

Camaj, L. (2012). The media's role in fighting corruption: Media effects on governmental accountability. *The International Journal of Press/Politics*, 18(1),21–42.doi:10.1177/1940161212462741

Chong, A., Ana L. De La O, Karlan, D. & Wantchekon, L. (2015). Does Corruption Information Inspire the Fight or Quash the Hope? A Field Experiment in Mexico on Voter Turnout, Choice, and Party Identification. *Journal of Politics* 77 (1): 55–71.

Chowdhury, S. K. (2004). The effect of democracy and press freedom on corruption: an empirical test. *Economics Letters*, 85(1), 93-101.

Diamond, L. (2010). Liberation technology. *Journal of Democracy* 21.3, 69-83.29

Dridi, M. (2014). Corruption and education: Empirical evidence. *International Journal of Economics and Financial Issues* 4: 476.

Dyck, A., Volchkova, N., & Zingales L. (2008). The Corporate Governance Role of the Media: Evidence from Russia. *Journal of Finance* 63 (3): 1093–1135.

Elbahnasawy, N. G., & Revier, C. F. (2012). The determinants of corruption: Cross-country-panel-data analysis. *The Developing Economies*, *50*(4), 311-333.

Enikolopov, R., Petrova, M., & Sonin, K. (2018). Social media and corruption. *Am. Econ. J. Appl. Econ*. 10:150–74

Fergusson, L., Vargas, J.F., & Vela., M. A. **(**2013). Sunlight Disinfects? Free Media in Weak Democracies.http://siteresources.worldbank.org/INTPOVRES/Resources/JuanVargas_Paper_25Sept13_Draft_March2013.pdf.

Ferraz, C., & Finan, F. **(**2008).Exposing Corrupt Politicians: The Effects of Brazil's Publicly Released Audits on Electoral Outcomes. *Quarterly Journal of Economics* 123 (2): 703–45.

Fisman, R.J., & Gatti, R. (2002), Decentralization and Corruption: Evidence across Countries. *Journal of Public Economics* 83: 325-345.

Fomba, Kamga, B., Talla, Fokam, D.N.D., & Tii Nchofoung, N. (2022). Social media and political instability: some empirical evidence. *Economics Bulletin*, Vol. 41 No. 2 pp. 720-73.

Frechette, G.R. (2001). A Panel Data Analysis of the Time-Varying Determinants of Corruption. *Paper presented at the EPCS* 2001.54

Freedom House. (2015). *Freedom of the press*. Retrieved from https://freedomhouse.org/report-types/freedom-press

Greene, W. H. (2002). The behavior of the fixed effects estimator in nonlinear models. NYU *Working Paper* No. EC-02-05, New York.

Hunt, J., & Laszlo, S. (2012). Is bribery really regressive? Bribery's costs, benefits, and mechanisms. *World Development* 40: 355–72.

Jetter, M., & Parmeter, C.F. (2018). Sorting through global corruption determinants: Institutions and education matter–Not culture. *World Development* 109: 279–94.

Jha, C.K., & Sarangi, S. (2017). Does social media reduce corruption? *Information Economics and Policy* 39: 60–71.

Kaffenberger, M. (2012). *The Effect of Educational Attainment on Corruption Participation in Sub-Saharan Africa*. Ph.D. dissertation, Vanderbilt University, Nashville, TN, USA.

Kalenborn, C., & Lessmann, C. (2013). The impact of democracy and press freedom on corruption: Conditionality matters. *Journal of Policy Modeling, 35*(6), 857–886. doi:10.1016/j.jpolmod.2013.02.009

Keneck-Massil, J., Nomo-Beyala, C., & Owoundi, F.(2021). The corruption and income inequality puzzle: Does political power distribution matter? *Economic Modelling* 103 105610.

Kietzmann, J.H., Hermkens, K., McCarthy, I.P., & Silvestre, B.S. (2011). Social Media? Get serious! Understanding the Functional Building Blocks of Social Media. *Business Horizons* **54**(3) : 241-251.

Kim, D. H., & Ellison, N. B. (2022). From observation on social media to offline political participation: The social media affordances approach. New Media & Society, 24(12), 2614-2634.

Kolstad, I., & Wiig, A. (2009). What determines Chinese outward FDI? *Journal of World Business*, in press.

Kunicova, J., & Ackerman S.R. (2005). Electoral Rules and Constitutional Structures as Constraints on Corruption, *British Journal of Political Science* 35 (4): 573-606.

Lederman, D., Norman V. L., & Soares, R.R. (2005). Accountability and corruption: Political institutions matter. *Economics & Politics* 17.1, 1-35.

Lee, C. S., Merizalde, J., Colautti, J. D., An, J., & Kwak, H. (2022). Storm the capitol: linking offline political speech and online Twitter extra-representational participation on QAnon and the January 6 insurrection. Frontiers in Sociology, 7, 876070.

Lo, I. P. Y. (2022). (Dis) Engagement with queer counter publics: Exploring intimate and family lives in online and offline spaces in China. The British Journal of Sociology, 73(1), 139-153.

Malesky, L.A., & Peters, C. (2012). Defining appropriate professional behavior for faculty and University students on social networking websites. *Higher Education*, 63, 135-151.

Mauro, P, (1995). Corruption and Growth. *The Quarterly Journal of Economics,* 1103, pp.681-712

Merloni, F. (2018). *Corruption and Public Administration: The Italian Case in a Comparative Perspective*. New York: Routledge.

Nam, T. (2012). Freedom of information legislation and its impact on press freedom: A cross-national study. *Government Information Quarterly*, *29*(4), 521–531. doi:10.1016/j.giq.2012.03.003

Nickell, S. (1981). Biases in dynamic models with fixed effects. Econometrica: *Journal of the Econometric Society*, 1417-1426.

Norris, S. (2004). *Analyzing multimodal interaction: A methodological framework. London*: Routledge.

Nur-tegin Kanybek, W., & Czap, H.J. (2012). Corruption: Democracy, autocracy, and political stability. *Economic analysis & policy*, 42 No. 1, March

Omgba, L.D. (2009). On the duration of political power in Africa: the role of oil rents. *Comp. Polit. Stud*. 42 (3), 416–436.

Oreopoulos, P., & Salvanes, K.G. (2009). How Large Are Returns to Schooling? Hint: Money Isn't Everything. NBER Working Paper No. 15339. Cambridge: National Bureau of Economic Research.

Oser, J., Grinson, A., Boulianne, S., & Halperin, E. (2022). How political efficacy relates to online and offline political participation: A multilevel meta-analysis. Political Communication, 39(5), 607-633.

Picón, C. (2012). *Red Neuronal Artificial (MLP) Aplicada al Estudio de la Corrupción: Un análisis comparativo con otros modelos econométricos a la luz de la teoría*. Editorial Académica Española LAP LAMBERT Academic Publishing GmbH& Co.

Qin, B., Strömberg, D., & Yanhui Wu. **(**2016). The Political Economy of Social Media in China. Unpublished.

Ruess, C., Hoffmann, C. P., Boulianne, S., & Heger, K. (2023). Online political participation: the evolution of a concept. Information, Communication & Society, 26(8), 1495-1512.

Saleh, N. (2012). Egypt's digital activism and the Dictators Dilemma: An evaluation. *Telecommunications Policy* 36.6, 476{483.

Shirky, C. (2008). *Here comes everybody: The power of organizing without organizations*. New York, NY: Penguin Group.

Smith, A., Schlozman, K. L., Verba, S., & Brady, H. (2009). The demographics of online and offline political participation. The Internet and Civic Engagement. *Pew Research Center*

https://www.pewresearch.org/internet/2009/09/01/the-demographics-of-online-and-offline-political-participation/ (Accessed: 16/07/2023).

Snyder, J.M.Jr., & Strömberg. D. (2010).Press Coverage and Political accountability. *Journal of Political Economy* 118 (2): 355–408. Stattin, H., Amnå, E., & Russo, S. (2023). Setting societal engagement goals during adolescence amplifies the impacts of political interest on political activities during young adulthood. International Journal of Behavioral Development, 47(2), 135-145.

Starke,C., Naab,T.K., & Scherer. (2016). Free to expose corruption: The impact of media freedom, internet access, and governmental online service delivery on corruption. *International journal of communication* 10(2016), 4702–4722 1932–8036/20160005

Stattin, H., Amnå, E., & Russo, S. (2023). Setting societal engagement goals during adolescence amplifies the impacts of political interest on political activities during young adulthood. International Journal of Behavioral Development, 47(2), 135-145.

Suphachalasai, S. (2005). *Bureaucratic corruption and mass media.* Research Paper No. 05, Environmental Economy and Policy. Cambridge, UK: University of Cambridge.

Theocharis, Y., Boulianne, S., Koc-Michalska, K., & Bimber, B. (2023). Platform affordances and political participation: how social media reshape political engagement. West European Politics, 46(4), 788-811.

Toros, S., & Toros, E. (2022). Social media use and political participation: the Turkish case. Turkish Studies, 23(3), 450-473.

Treisman, D. (2000). The Causes of Corruption: A Cross-National Study. *Journal of Public Economics* 76: 399-457.

Truex, R. (2011). Corruption, attitudes, and education: Survey evidence from Nepal. *World Development* 39: 1133–42.

Uslaner, E.M., & Rothstein. B. (2016). The historical roots of corruption: State building, economic inequality, and mass education. Comparative Politics 48: 227–48.

Yogo, U.T., & Mallaye, D., (2015). Health aid and health improvement in Sub-Saharan Africa: accounting for the heterogeneity between stable states and post-conflict states. *Journal of International Development* 27, 1178–1196.

Zhao J.R., & Chen, Q.J.G. (2010). Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis. *Journal of Consumer Research* 37, 197–206.

Zhuravskaya, E., Petrova, M., & Enikolopov, R. (2020). Political effects of the internet and social media. *Annual Review of Economics*, 12, 415-438.

Appendix

Table Appendix 1: Description of variables and sources

Variables	Codes	**Proxy**	**Source**
Legislature corrupt activities	Legcor	It Captures the extent to which members of the legislature abuse their position for financial gain, including accepting bribes or facilitating the gain of government contracts for firms owned by the	V-Dem data base (2020)

		legislator. Values range from the most corrupt ”0” to the least corrupt ”4”. Scores have been multiplied by -1 to facilitate interpretations of results.	
Judicial decisions index	Judcor	Indicates the frequency with which agents make undocumented extra payments or bribes to speed up or delay the judicial process to obtain favorable decisions. Values range from the most corrupt ”0” to the least corrupt ”4”. Scores have been multiplied by -1 to facilitate interpretations of results.	
Executive corruption index	Execor	Measures either how routinely members of the executive allow favors in return for any inducement or how often they misappropriate public funds for personal use. The Values range from the least ”0” to the most corrupt ”4”.	
Population use of social media for off line political actions	$Socialmedi_t$	It measures the peoples' propensity to use social media to organize offline political action of any kind. The scale of measure is ordinal and then converted to interval by the measurement model. Score varies from 0 (Never used) to 4 (most regularly used)	
Elite use of social media for off line political actions	$Socialmel_{it}$	It measures the elites' propensity to use social media to organize offline political action of any kind. The scale of measure is ordinal and then converted to interval by the measurement model. Score varies from 0 (Never used) to 4 (most regularly used)	
The per capita Gdp	**Gdp**	It is a proxy for the average income of the population measured in thousand USD	
Civil liberties	**Civilib**	It evaluates the extent to which civil rights and liberties are respected. Scores range from 0 (not respected) to 1 (highly respected)	
Level of democracy	Democracy	It is calculated by **P-polity** score from systemic peace and drawn from. The scores range from (-10) least democratic to (+10) most democratic.	
Civil society participation	Csop	Extent to which civil societies are routinely consulted by policymakers. The involvement of people in civil societies. Scores ranges from 0 (low civil society participation to 1 (high civil society participation.	
Index of Fragility	Fragility	It measures the state capacity to manage conflict, to formulate and implement public policies, to deliver basic services to its population. It also measures the resilience of the state in maintaining system coherence, cohesion, and quality of life; responding effectively to challenges and crises, and sustaining progressive development. Score ranges from 0 (less fragile) to 25 (extremely fragile) .	
Free and fair elections	Fairelect	Extend to which national elections are free and fair?	
Alternative indicator of democracy	Democracy 2	It is an alternative measure of the level of democracy calculated by freedom house. The scores range from 0 (autocratic) to 100 (democratic)	Bertelsmann Stiftung data base
The educational level	Education	Is the average number of years of total schooling across all education levels for the population aged 25 years and more. It ranges from 0 lowest to 1 highest	Lee-Lee 2016; Barro-Lee 2018 and UNDP 2018).
Civil society participation	Csop2	It measures the extent to which the political leadership enable the participation of civil society in the political process? Score range from 1 (less participation of civil society) to 10(higher participation of civil society).	Bertelsmann Stiftung data base
The natural resource rent	Rent	Revenues from the natural resources as a percentage of total export earnings,	World Bank's WDI database

Chief executive power duration	Duration	Number of years of chief executive in power	*Data base of Political Institutions*

Table Appendix 2: Effects of social media on corruptions (RE estimation)

	Executive		Judicial		Legislative	
	Coef. (1)	Coef. (2)	Coef. (3)	Coef. (4)	Coef. (5)	Coef. (6)
Civilib		-0.0046		-0.0106		-0.0072
		(0.1363)		(0.0130)		(0.0165)
Democracy		-0.0042*		-0.0201***		-0.0101*
		(0.0018)		(0.0039)		(0.0049)
Fragility		0.000064		0.0227***		0.0174***
		(0.0019)		(0.0041)		(0.0052)
Fairelect		-0.0000		-0.00007		0.0002
		(0.0001)		(0.0002)		(0.0003)
Csop		-0.6767***		-0.3693***		-1.744***
		(0.0539)		(0.1162)		(0.1476)
Socialmed	-0.0531***	-0.0231***	0.0056	0.0503***	-0.1192**	-0.0393
	(0.0091)	(0.0084)	(0.0187)	(0.0184)	(0.0242)	(0.0470)
Gdp	0.0116	-0.0064	-0.1106***	-0.0914*	-0.07690*	-0.0813*
	(0.0163)	(0.0168)	(0.0346)	(0.0375)	(0.0444)	(0.0470)
Rent	0.0001	-0.0000406	0.0006	0.0014	-0.0000	0.0004
	(0.0005)	(0.0004)	(0.0011)	(0.0010)	(0.0014)	(0.0013)
Duration	0.0035***	0.0006	0.0014	-0.0013	0.0072***	0.0004
	(0.0004)	(0.0004)	(0.0009)	(0.0010)	(0.0012)	(0.0012)
Education1	-0.0224***	-0,0051	-0.0975***	-0.0533***	0.0538***	0.0989***
	(0.0070)	(0.0067)	(0.0149)	(0.0148)	(0.0191)	(0.0187)
Cons	0.7241***	1.1827***	-0.4010*	-0.8576***	-1.097***	-0.5574
	(0.1156)	(0.1411)	(0.2505)	(0.3143)	(0.3188)	(0.3932)
Obs	870	794	870	794	870	794
Groups	46	46	46	46	46	46
R-sq	0.0485	0.2147	0.1735	0,2890	0,0708	0.1814
Wald chi2(7)	34.37***	450.38***	141.94***	268.91***	75.67***	338.26***
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: *** 1% level significant; ** 5% level significant; * 10% level significant