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BUDGETARY TRANSPARENCY, E-GOVERNMENT AND CORRUPTION: NEW EVIDENCE FROM PANEL DATA APPROACH

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Abstract
The effect of transparency indicators on corruption such as budget transparency, e-government, and regulation quality has received considerable attention in recent years. This paper gives some new evidence on this issue using an indicator of open budget index, e-government index and, regulatory quality as transparency indicators. From this perspective, this paper estimates the impact of regulatory quality, e-government index and, open budget index on corruption using unbalanced panel data analysis for selected 48 countries over the period of 2004 to 2015. The results of the analysis reveal that regulatory quality, budget transparency, and e-government indexes have positive and statistically significant effect on corruption.

Key words: *Corruption, E-Government, Open Budget Index, Panel Data Analysis.*

JEL Classification: *D73, H11, H60, C33*

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I. INTRODUCTION

Corruption has become one of the most important issues causing output loss in economical fields faced by states, individuals, bureaucratic actors, and businesses. In this sense; corruption has lots of economic costs such as economic growth, inefficient usage of resources along with political, social, demographic and cultural costs. In the literature, these costs are theoretically and empirically investigated by taking several factors into consideration. Reviewing the theory and the literature; e-government which provides quick access to public services, budget transparency which helps to present information about budgeting process clearly and accurately, and regulatory quality that enables public sector to intervene effectively are commonly thought to have reducing effect on corruption. Reducing effects of these factors on corruption are significant for activities of public and private sector in developed and developing countries in terms of productivity and output.

Corruption is viewed as one of the biggest obstacles in increasing worldwide economic growth and raising the quality of individuals' lives. This study focused on variables e-government, budget transparency and regulatory quality that are thought to have reducing effects on corruption. By developing and testing experimental models investigating the correlation between the changes of using e-government in various countries and changes in corruption levels, the correlation between information and communication technologies focused e-government, budget transparency, regulatory quality and corruption.

With this aim, this paper estimates the impact of regulatory quality, e-government index and, open budget index on corruption for selected 48 countries covering the period between 2004 and 2015 using unbalanced panel data analysis. The rest of paper is organized as follows: Section II discusses the theoretical framework of these relationships. Section III presents the brief literature review. Data and model are presented in Section IV. Section V specifies the econometric methodology and empirical findings. Finally, section VI concludes the study.

II. THEORETICAL FRAMEWORK: CORRUPTION, E-GOVERNMENT, BUDGETARY TRANSPARENCY AND REGULATORY QUALITY

Corruption is one of the primary problems of today's world. According to the Corruption Perceptions Index in which 168 countries were evaluated in the year of 2015; there are only two countries (Denmark and Finland) evaluated as "very clean" (scoring over 90) and two thirds of the countries have scores below 50. According to the report, more than six billion people in the world live in countries with serious corruption problems (Transparency International, 2015). Studies in the literature generally classify the factors effecting corruption level in a country into four general categories. These are; economic factors, political and governmental factors, demographic factors and cultural factors. Gross national product per capita and economic growth rate as a level of economic development affect the level of corruption. Political regime type, democracy level, the size of public sector, superiority of legal rules, freedom of expression and accountability, political stability and lack of violence, efficiency of the government, regulatory quality, and the development level of e-government are political and governmental factors affecting the level of corruption. Gender, urbanization level, education level and population density are demographic factors affecting the level of corruption. Religion is the main cultural factor affecting the level of corruption (Zhao and Xu, 2015, pp. 413-414).

E-government, viewed as one of the decreasing factor for corruption are defined as "using the internet and web site applications more in order to share public services and public information with individuals" (Shim and Eom, 2008,p. 299), "digital connecting process between the government and its citizens in order to access information and services provided by public institutions", "the process which increases accountability and transparency in order to decrease corruption and connection between the citizens and corrupted public employees" (Andersen, 2009, p.201). E-government has become a term that includes all usage of information technologies managed by government and within the information technology framework it includes all management processes of operations between government and government (G2G), government and business (G2B), and government and citizens (G2C) (Torres, Lourdes et al, 2006, pp. 277-278). E-government application are claimed to increase transparency and decrease corruption by strengthening reform oriented executives and encouraging good governance. One of the most significant theories that presents economic analysis of corruption and the relation between e-government and corruption is principal (government) - agent (public employee) theory (Zhao and Xu, 2015, p. 411).This theory was first used to explain the manager-employer relationship in private sector and then used to analyze the politician-bureaucrat relationship. Theory explains both the impulses that cause corruption and the measures to prevent it from happening (Güvel and Ata, 2009, pp.169-173).

Other significant applications that will decrease corruption in public management and contribute to good governance are fiscal transparency and regulatory quality. Fiscal transparency is defined as "presenting government structure and functions, fiscal policy objectives and public sector accounts in an open and accurate way with ready access to reliable, comprehensive, punctual, understandable and internationally comparable information about government activities" (Kopits and Craig, 1998, p.1). Fiscal transparency intends to provide efficiency in public fiscal management, inspection, rule of law, accountability, reducing administrative procedures, quick access to financial information and presenting financial information in an understandable way. Regulatory Quality, which is one of the Worldwide Governance Indicators described by the World Bank, includes sub-dimensions; government interventions, efficiency in tax applications, convenience for foreign investors to start business, and unfair competitive practices. It is commonly expected that good governance practices in public sector will be effective in the fight against corruption, develop democratic processes, and increase transparency and accountability by encouraging participation.

III. LITERATURE REVIEW

There are several studies try investigating the determinants of corruption with various macroeconomic, fiscal, political, demographic and, cultural variables such as economic growth, fiscal transparency, political stability, absence of violence, government effectiveness, rule of law, bureaucratic quality, urbanization level, population density, and religion. However, relatively less study has been carried out to determine the relationship between regulatory quality, e-government index, open budget index, and corruption.

Most of the studies examined the relationship between e-government and corruption provide evidence that e-government help reducing corruption level (Shim and Eom, 2008; Andersen, 2009; Mistry and Jalal, 2012; Proskuryakova, Liliana et al, 2013; Elabhnasawy, 2014; Lupu and Lazar, 2015; Zhao and Xu, 2015). For instance; Zhao and Xu (2015) analyzed the effect of e-government and other factors on the corruption with the data from 80 countries for five selected years (2003-2010). They found that the development of e-government is correlated with lower levels of perceived corruption. Moreover, the researchers such as Seongcheol, Kim et al

(2009) and Cho and Choi (2004) have found similar results in the same direction by using case studies.

There exist many empirical studies investigating the relationship between effectiveness of governance and corruption. Regulatory quality is the one of the main measures of effectiveness of governance. It can be stated that the quality of government regulations hampers economic activities and it affects the level of corruption by rent-seeking behavior (Zhao and Xu, 2015, p.413). While these studies mostly showed that regulatory quality have affected the corruption positively (Billger and Goel, 2009; Michael, Jetter et al, 2015). Kotera, Go et al (2010) showed the negative relationship between these variables. Moreover, Zhao and Xu (2015) found no significant relationship between regulatory quality and corruption.

Fiscal transparency is among the most significant factors affecting the corruption. In the literature, open budget index is often used to measure the effect of fiscal transparency on corruption. Most of the studies showed that open budget index affected the level of corruption positively (Sedmihradska and Haas, 2012; Cimpoeru, 2015a; Cimpoeru, 2015b; Hague and Neanidis, 2009).

As it is seen from the selected literature, it can be said that there is positive correlation between e-government, regulatory quality, open budget index and corruption. Therefore, it can be stated that these factors help lower corruption levels.

IV. DATA AND MODEL

In this study, the impact of regulatory quality, e-government index and, open budget index on corruption are examined for 48 countries covering the period between 2004 and 2015. Data accessibility was decisive in determination of sample and period[9].

In order to test whether e-government, regulatory quality and budget transparency index are effective or not on corruption for mentioned countries, models shown in Table 1 are created in regard to the empirical and theoretical literature. In the models; while the regulatory quality is taken as control variable, e-government index and open budget index are taken as explanatory variables by taking the empirical literature into account.

Table 1. Regression Models

Model 1: $CPI_{it} = \beta_0 + \beta_1 RQ_{it} + \beta_2 EGOV_{it} + \varepsilon_{it}$
Model 2: $CPI_{it} = \beta_0 + \beta_1 RQ_{it} + \beta_2 OBI_{it} + \varepsilon_{it}$

In equations, CPI represents the Corruption Perceptions Index, RQ represents the regulatory quality, EGOV represents the e-government development index, and OBI represents the open budget index. The data for the analysis are obtained from Transparency International, United Nations Public Administration Network, International Budget Partnership and World Bank. "Stata 12" software was used in the econometric analysis.

Corruption Perceptions Index (CPI)

With the help of corruption perceptions index, the perception levels of corruption in countries are presented. The index is calculated by International Transparency Agency every year by taking weighted means of indexes by different organizations into consideration. Index is valued between 0 and 100. The higher the index value is, the higher the perception level of corruption is (very clean) and the lower the index value is, the lower the perception level of corruption is (high corruption). Evaluating the corruption perception level of countries has been done by International Transparency Agency since 1995. Last calculation was done in 2015 for 168 countries with the data obtained from 12 different sources (Transparency International, 2015).

E-Government Development Index (EGDI)

E-Government Development Index is a combined index published by United Nations Public Administration Network (UNPAN) measuring tendencies and capacities of governments about using information and communication technologies for offering public services. This index (EGDI) was first published in 2003 and continued publishing in 2004, 2005, 2008, 2010, 2012 and 2014. The index includes weighted averages of Online Service Index, Telecommunication Infrastructure Index and Human Capital Index. Index values between the score 0 and 1. In the evaluation of e-government capacity; EGDI>0.75 means "very high", EGDI is between 0.75-0.50 means "high, EGDI is between 0.50-0.25 means "medium" and EGDI<0.25 means "low" levels. In the final index, published in 2014, EGDI data for 193 countries were published (United Nations, 2016).

[9] The countries included in the sample are: Albania, Algeria, Angola, Argentina, Azerbaijan, Bosnia and Herzegovina, Brazil, Bulgaria, Chile, China, Costa Rica, Croatia, Czech Republic, Dominican Republic, France, Germany, Italy, Jordan, Kazakhstan, Kyrgyzstan, Lebanon, Malaysia, Mali, Mexico, New Zealand, Norway, Peru, Poland, Portugal, Republic of Korea, Romania, Russia, Saudi Arabia, Senegal, Serbia, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Thailand, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, USA, Venezuela.

Open Budget Index (OBI)

Open Budget Survey, conducted to measure the budget transparency, is a survey study based on objective evaluations rather than perceptions carried out by local specialists in order to give information (Jan, Seifert et al, 2013, p.90). With the help of Open Budget Survey conducted by International Budget Partnership (IBP), budget transparency levels, budget participation levels, accountability, and budget oversight levels of countries are measured. Index is published bi-yearly in 2006, 2008, 2010, 2012 and finally in September 2015. In 2006, 59 countries; in 2008, 85 countries; in 2010, 94 countries and in 2012, 100 countries were included in the survey study. The final study published in September 2015 includes 102 countries. In Open Budget Survey, each country gets a score between 0 and 100 under different categories. In scoring, higher scores mean higher levels in budget transparency (International Budget Partnership, 2015).

Regulatory Quality (RQ)

The World Bank has been publishing Worldwide Governance Indicators for six dimensions of governance since 1996. The final study covers the period of 1996-2015 for over 200 countries .The World Bank's Worldwide Governance Indicators includes six dimensions. These are: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. The results of governance indicators are reported in two ways: ranging from (-2.5) to (+2.5) and in values between o and 100. In scorings, higher points (scores closer to +2.5 or 100) corresponds better governance practices (Daniel, Kaufmann et al, 2010, p.4). For the regulatory quality indicator, values between (-2.5) and (+2.5) are used in this study.

V. METHODOLOGY AND EMPIRICAL FINDINGS

In this study, the impact of regulatory quality, e-government index and, open budget index on corruption was analyzed using unbalanced panel data analysis. Initially, since the data are unbalanced, variables are tested with ADF PP and ADF DF unit root tests to find out whether they are stationary or not. CPI and RQ variables are found to be are stationary in levels. Besides, other variables could not be tested because of missing data in panel and time dimensions.

In the models, Breusch and Pagan Lagrange Multiplier test is used to find out whether random effects model or pooled model is suitable and auto-correlation presence is tested with reliable adjusted Lagrance Multiplier test (ALM Test).

Table 2. Breusch-Pagan Lagrange Multiplier (LM) Test Results

MODEL 1	
H0 : Var (u) = 0 Chi2 (1) = 121.27 (Prob. > chi2 = 0.0000)	Random Effects, two sided: LM (Var(u)=0) = 121.27 prob.>chi2(1) = 0.000 ALM (Var (u)=0) = 159.46 prob.>chi2(1) = 0.000 Random Effects, one sided: LM (Var(u)=0) = 11.01 prob.>N(0,1) = 0.000 ALM (Var (u)=0) = 12.63 prob.>N(0,1) = 0.000
MODEL 2	
H0 : Var (u) = 0 Chi2 (1) = 105.66 (Prob. > chi2 = 0.0000)	Random Effects, two sided: LM (Var(u)=0) = 105.66 prob.>chi2(1) = 0.000 ALM (Var (u)=0) = 242.39prob.>chi2(1) = 0.000 Random Effects, one sided: LM (Var(u)=0) = 10.28 prob.>N(0,1) = 0.000 ALM (Var (u)=0) = 15.57 prob.>N(0,1) = 0.000

In Table 2, both tests results are reported; with the possibility of auto-correlation and with no auto-correlation. According to the results, with the rejection of null hypothesis, individual effects (panel effect) efficiently exist against random effects. After determining that the models have individual effects, it should be determined whether these effects are fixed or random. To this end, Hausman (1978) Specification Test is applied. Hausman test tests null hypothesis suggesting that random effect is suitable.

Table 3. Hausman Specification Test Results

MODEL 1			
Variables	Fixed Effects	Random Effects	Difference
RQ	-.9753243	-1,585625	.6103008
EGOV	-1,613279	-2,092227	.4789481
Ho: Differences in coefficients not systematic. (RE estimator is consistent) Chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 3.62 Prob. >chi2 = 0.1632			
MODEL 2			
Variables	Fixed Effects	Random Effects	Difference
RQ	-.5298116	-1,775094	1,245283
OBI	-.5472099	-.9674978	.4202879
Ho: Differences in coefficients not systematic. (RE estimator is consistent) Chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 10.81 Prob. >chi2 = 0.0045			

As can be seen from the tables, random effects estimator is consistent and efficient in Model 1 and not efficient in Model 2. Random effects estimator is estimated in Model 2 by considering that F statistical value for fixed effect estimator in the model is insignificant and random effects estimator is more suitable both according to the theory and the data set.

Regression estimates in panel data analysis are based on certain assumptions. One of the most significant assumptions is that estimators do not have autocorrelation and heteroscedasticity problems. Failing to prove one or more assumptions causes efficiency loss in estimated parameters and incorrect estimations of standard errors. Following the selection of random effects model for the models, suitable tests for this estimation are selected. From this point; heteroscedasticity in the models is tested with Levene and Brown-Forsythe Tests, auto-correlation presence is tested with Bhargava, Franzini and Narendranathan Durbin-Watsan Test, Baltagi-Wu Locally Best Invariant Test, Lagrange Multiplier Test (LM) and Adjusted-Lagrange Multiplier Test (ALM).

Table 4. Levene, Brown and Forsythe Heteroscedasticity Test Results

MODEL 1		
W0 = 2.8450977	df (47,240)	Pr > F = 0,00000010
W50 = 1.0240366	df (47,240)	Pr > F = 0,43802895
W10 = 2.8450977	df (47,240)	Pr > F = 0,00000010
MODEL 2		
W0 = 2.3817818	df (47,110)	Pr > F = 0,00010662
W50 = 1.0094035	df (47,110)	Pr > F = 0,47173699
W10 = 2.3817818	df (47,110)	Pr > F = 0,00010662

In Table 4, statistics of Levene, Brown and Forsythe test are summarized. According to the results; the null hypothesis of homoscedasticity is rejected and it is determined that there is a heteroscedasticity problem in the models.

Table 5. Auto-correlation test results

MODEL 1	
Modified Bhargava et al. Durbin Watson = 1.2717599	Serial Correlation: LM (lambda=0) = 1.48 Pr>chi2(1) = 0,2244 ALM (lambda=0) = 39.67 Pr>chi2(1) = 0,000

Baltagi – Wu LBI = 2.2717599	Joint Test: LM (Var(u)=0), lambda=0) = 160.94 Pr>chi2 (2) = 0,000
MODEL 2	
	Serial Correlation: LM (lambda=0) = 0.00 Pr>chi2(1) = 1,000 ALM (lambda=0) = 136.73 Pr>chi2(1) = 0,000
	Joint Test: LM (Var(u)=0), lambda=0) = 242.39 Pr>chi2 (2) = 0,000

As can be seen from the table; despite the results of Durbin Watson test and LBI test statistics which determine there is no auto-correlation in Model 1, ALM test results shows there is auto-correlation in the model. Since there is not enough observation in Model 2, Durbin Watson and LBI test results could not be tested. However, ALM and LM test results show the presence of first degree autocorrelation in the random effect model.

Since there are heteroscedasticity and auto-correlation problem in the models created to show the effect of RQ, EGOV and OBI on the corruption (CPI); along with random effects estimator, estimators that are robust to heteroscedasticity and auto-correlation problems are also estimated. These estimations are summarized in Table 6.

Table 6. Panel Regression Results

Dependent Variable: CPI (INVERSED CPI)					
Variables	**RE (MODEL 1)**	**RE_ROBUST (MODEL 1)**	**RE_AR1 (MODEL 1)**	**RE (MODEL 2)**	**RE_ROBUST (MODEL 2)**
C	7,2313 (18.73)***	7,2313 (21.23)***	7,2401 (17.01)***	6,5718 (23.35)***	6,5718 (23.31)***
RQ	-1,5856 (-.907)***	-1,5856 (-7.47)***	-1,6418 (-8.90)***	-1,7750 (-9.10)***	-1,7750 (-7.72)***
EGOV	-2,0922 (-2.95)***	-2,0922 (-3.23)***	-2,0835 (-2.62)***		
OBI				-0,9674 (-9.10)*	-0,9674 (-2.01)*
R^2	0,6698	0,6698	0,6699	0,7708	0,7708
Wald Chi2 (Prob.)	184,33 (0.0000)	136,61 (0.0000)	200,80 (0.0000)	156,98 (0.0000)	130,44 (0.0000)
Obs.	288	288	288	158	158
Notes: The t-statistics are in parentheses. ***, **, * represent %1, %5 and %10 significant level respectively.					

The results of the random effect models and the robust random effect models are reported in Table 6. Two different models were estimated to analyze the impact of these variables on corruption. Model 1 was created to examine the effect of e-government index (EGOV) on the corruption (CPI). Model 2 aimed to examine the direction of the relationship between open budget index (OBI) and corruption.

Corruption Perception Index measures the perceived level of public sector corruption on a scale of 0 (highly corrupt) to 10 (very clean). We reversed this index in to 0 (very clean) to 10 (highly corrupt) in order to prevent confusion in interpretation of the coefficient signs of the results.

According to the results; all explanatory variables have the expected sign and statistically significant. As expected, the control variable Regulatory Quality (RQ) has a positive and statistically significant effect on corruption in all models. All versions of Model 1 show the relationship between the e-government index (EGOV) and corruption levels (CPI). In these models, there is a positive (CPI inversed) and statistically significant relationship between EGOV and CPI. According to the results of the versions of Model 2, there is a positive (CPI inversed) and statistically significant relationship between Open Budget Index (OBI) and the corruption levels (CPI) also. These results indicate that e-government, regulatory quality and open budget indexes help lower corruption levels.

VI. CONCLUSION

This paper investigates the relationship between the regulatory quality, the e-government index, the open budget index, and the corruption using unbalanced panel data analysis for 48 countries covering the period 2004 and 2015. Firstly, the effect of regulatory quality on corruption was positive and statistically significant as expected. From this point; considering the relevant country set and the period, it can be clearly stated that regulatory quality is positively effective with the help of unfair competitive practices, government interventions and tax efficiency. Secondly, e-government and open budget indexes have affected the level of corruption positively as expected as well. Considering the country set and the period; it is empirically determined that e-government as a factor facilitating the access to public services and budget transparency ensuring transparency in public fiscal practices are positively effective on the corruption. These results are advisory for developed and developing countries in terms of decisions to reduce corruption, increase transparency and facilitate access to public activities.

The findings of this study provide new evidences on the effect of regulatory quality, e-government index and, open budget index on corruption. These results indicate that e-government, regulatory quality and open budget indexes help lower corruption levels and the results are consistent with the literature.

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