Mitigating corruption through fiscal transparency: a panel data approach

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Abstract   Since transparency reduces information asymmetry, we empirically analyze whether fiscal transparency represents a mechanism able to increase the control of corruption. Moreover, we seek to provide evidence that when fiscal transparency is increased and it is associated with a strong legal system, the control of corruption is more effective. Therefore, we analyze determinant aspects of corruption which were not yet explored (or which were little explored) in the literature, whose evidences are particularly necessary because they might bring important practical implications in terms of anti-corruption policy guidelines. Based on a set of 82 countries for the period 2006-2014 and using panel data methodology, we find that more transparent fiscal practices bring beneficial effects in terms of control of corruption. Moreover, we find evidence that when fiscal transparency is associated to a strong legal system (i.e., to a system with strong rule of law, independent and unbiased judiciary, and impartial and effective courts that guarantee law enforcement), control of corruption is increased.

Key words: fiscal transparency; corruption; legal system; rule of law; impartial courts.

Resumo   Uma vez que a transparência reduz a assimetria da informação, analisamos empiricamente se a transparência fiscal representa um mecanismo capaz de aumentar o controle sobre a corrupção. Além disso, buscamos fornecer evidências de que quando a transparência fiscal é elevada e está associada a um sistema jurídico forte, o controle sobre a corrupção é mais efetivo. Assim, analisamos aspectos determinantes da corrupção que ainda não foram explorados (ou que foram pouco explorados) na literatura, cujas evidências são particularmente necessárias porque podem trazer importantes implicações práticas em termos de diretrizes de políticas anticorrupção. Utilizando um conjunto de 82 países para o período 2006-2014 e metodologia de dados de painel, encontramos que práticas fiscais mais transparentes trazem efeitos benéficos em termos de controle da corrupção. Além disso, encontramos evidências de que quando a transparência fiscal está associada a um sistema jurídico forte (ou seja, a um forte estado de direito, poder judiciário independente e tribunais imparciais e efetivos que garantem a aplicação da lei), o controle sobre a corrupção aumenta.

Palavras-chave: transparência fiscal; corrupção; sistema legal; estado de direito; tribunais imparciais.

JEL code: D73, H60, H83, K40

Área 5 - Economia do Setor Público

1. Introduction

Since the mid 1990s, several studies have sought to observe the consequences of corruption on the economy (Shleifer and Vishny, 1993; Mauro, 1995 and 1997; Tanzi and Davoodi, 1997; Campos, Lein, Pradhan, 1999; Al-Marhubi, 2000; Li, Xu and Zou, 2000; Mo, 2001; Gupta, Davoodi and Alonso-Terme, 2002; Svensson, 2005; Reinikka and Svensson, 2004; Aidt, Dutta and Sena, 2008; Mendez and Sepulveda, 2006; Swaleheen, 2012; de Mendonça and Fonseca, 2012; Montes and Paschoal, 2016). Despite some controversial results, in general, the findings suggest that: 1) corruption slows down the pace of business and trade due to inefficiencies and undermines the allocative efficiency in both private and public sectors; 2) corruption undermines human development and economic growth through the deterioration of the quality of public health and education programs; 3) higher corruption is associated with higher inflation, and; 4) high and rising corruption increases income inequality and poverty.[1]

Corruption is an intrinsic phenomenon related to the history of human organizations. Mauro (1997) points out that corruption has always existed and will continue to exist until societies find effective mechanisms to eliminate it. In this sense, there are studies concerned to identifying the determinants of corruption and the mechanisms to reduce it (e.g., Ades and Di Tella, 1997 and 1999; Husted, 1999; Laffont and N'Guessan, 1999; Leite and Weidmann, 1999; Treisman, 2000; Paldam, 2002; Persson et al., 2003; Braun and Di Tella, 2004; Shen and Williamson, 2005; Lederman et al., 2005; You and Khagram, 2005; Sevensson, 2005; Ata and Arvas, 2011; Kotera et al., 2012). The present study contributes to this literature.[2]

In order to address the determinants of corruption, first, one must understand its nature. In this sense, the presentation of a rationale for its existence is important. Based on Jain (2001), when addressing the determinants of corruption, one must consider the following aspects: discretionary public power, rent-seeking behavior, and the legal system. Following Jain (2001) and Seldadyo (2008), we also argue that, to some extent, corruption exists due to private rent-seeking behavior using the discretionary public power that contravenes the legal system. Therefore, anti-corruption policies must be related, to some extent, to strengthening the legal system and reducing the discretionary actions of the government. It is on the basis of this idea that transparency emerges as a mechanism designed to reduce discretionary actions, and thus corruption.

When addressing central banks, Geraats (2002) points out that central bank transparency emerges as a commitment technology aimed at reducing discretionary actions once it reduces information asymmetry. This argument does not need to be exclusively related to central banks practices, and it can be used in other spheres – such as, for instance, in fiscal sphere. Thus, since transparency helps reducing information asymmetry, and based on Tanzi's (1998) argument, which stresses that good practices of fiscal transparency can reduce corruption, the present paper aims at analyzing the effect of fiscal transparency on corruption. Specifically, we seek to provide empirical evidence that fiscal transparency represents a mechanism able to increase the control of corruption (and, thus, capable of reducing corruption perception). Moreover, we also seek to provide evidence that when fiscal transparency is increased and it is associated with a strong legal system (i.e., to a system with strong rule of law, independent and unbiased judiciary, and impartial and effective courts that guarantee law enforcement), the control of corruption is more effective. Therefore, we empirically analyze some determinant aspects of corruption which were not yet explored (or which were little explored) in the

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[1] A summary of empirical studies on the impact of corruption on the economy is presented in Akçay (2006).
[2] Although there are gaps in the literature addressing the effects of corruption on the performance of economies, the present study is not intended to explore this sort of approach.

literature, whose evidences are particularly necessary because they might bring important practical implications in terms of anti-corruption policy guidelines.

The literature that empirically analyzes the relationship between fiscal transparency and corruption is still scarce. These studies are mostly based on cross-country analysis (e.g., Hameed, 2005; Kaufmann and Bellver, 2005; Bastida and Benito, 2007; Lindstedt and Naurin, 2010; Hubbard, 2007).[3] Besides, empirical studies investigating the effects of the legal system on corruption are also very limited (e.g., Buscaglia, 2001). Hence, our study differs from the existing studies and contributes to the literature on the determinants of corruption in several aspects – such as, for instance, the relations being analyzed, the indicators used in the estimations, the sample of countries and its length of time, and the methods used.

The theoretical and empirical studies addressing the determinants of corruption suggests economic, political, institutional, and legal aspects as major causes of corruption (e.g., Aidt, 2003; Seldadyo, 2008). In this sense, the empirical model that we use is supported by the theoretical and empirical literature on the determinants of corruption, and the control variables that we use in the estimates contemplate the main dimensions of the underlying causes for the existence of corruption described above: the economic dimension, the institutional dimension and the legal dimension.

Regarding the variable that captures fiscal transparency, we use the "Open Budget Index" (OBI) obtained from the International Budget Partnership (IBP). We use this index due to its wide country coverage, public availability and acceptance in the literature (Peat et al., 2015; Arbatli and Escolano, 2015). In addition, this measure of fiscal transparency is closely related to the definition of fiscal transparency provided by Kopits and Craig (1998), which is adopted in our research.[4] On the other hand, regarding the variables that we use to capture the legal system, we use the indicator of "Rule of Law" (RULE_LAW) obtained from the Worldwide Governance Indicators (WGI), as well as the variables of "Impartial Courts" (ICOU) and "Integrity of the Legal System" (ILS) obtained from the Economic Freedom of the World database provided by the Fraser Institute.

In relation to the dependent variable (corruption), we use two indicators: the Control of Corruption Perception Indicator (CORRUP) obtained from *The Worldwide Governance Indicators* database (World Bank) and, the Corruption Perception Index (CPI) obtained from *Transparency International*. The two indicators are widely used in the literature and accepted as variables capable of capturing society's perception in relation to corruption (Akçay, 2006; Seldadyo, 2008; Montes and Paschoal, 2016).

The analysis uses a set of 82 countries (14 developed countries and 68 developing countries) covering the period between 2006 and 2014. First, the relationship between fiscal transparency and corruption is investigated based on the total sample of 82 countries (full sample). Then, in order to analyze this relationship in the set of developing countries, the

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[3] It is important to emphasize that the scarce existing literature is composed of working papers and discussion papers, with few studies published so far. In turn, the literature that addresses the relationship between fiscal transparency and corruption based on single-country analysis is also scarce (e.g., Olken, 2007; Reinikka and Svensson, 2011). Although these studies based on single-country analysis are important, we will not address such studies because they fail to characterize the type of analysis presented in our study.

[4] According to Kopits and Craig (1998, p.1): "*Fiscal Transparency is defined (...) as openness toward the public at large about government structure and functions, fiscal policy intentions, public sector accounts, and projections. It involves ready access to reliable, comprehensive, timely, understandable, and internationally comparable information on government activities - whether undertaken inside or outside the government sector - so that the electorate and financial markets can accurately assess the government's financial position and the true costs and benefits of government activities, including their present and future economic and social implications*".

estimates are made for the sample of 68 developing countries. The estimations are based on panel data methodology.

The results show that more transparent fiscal practices bring beneficial effects in terms of control of corruption and, thus, reduce the perception of corruption. Moreover, the study finds evidence that when fiscal transparency is associated with a strong legal system, there is an increase in control over corruption and also a lower perception of its occurrence. Therefore, the study brings findings that may help policymakers in terms of anti-corruption policy proposals.

2. Literature Review

Corruption is a phenomenon capable of affecting all sectors of society and reaching areas of extreme importance such as education and health, as well as being able to increase inequality and poverty, and reduce economic growth (Akçay, 2006). According to Aidt (2009), corruption is harmful to societies and should be seen as an obstacle to sustainable economic development.

Some studies point out that corruption is directly linked to the public sector, and can be defined as the abuse of public power for private purposes (e.g., Rose-Ackerman, 1996; Tanzi, 1998; Treisman, 2000; Aidt, 2003; Ata and Arvas, 2011; Akça et al., 2012). According to these studies, corruption brings serious social and economic problems, increasing poverty and income inequality, and reducing economic growth and investments in key areas.

Due to the effects caused by corruption, there are studies concerned with identifying the determinants of corruption and the mechanisms that can reduce it (e.g., Ades and Di Tella, 1997 and 1999; Husted, 1999; Laffont and N'Guessan, 1999; Leite and Weidmann, 1999; Treisman, 2000; Paldam, 2002; Persson et al., 2003; Braun and Di Tella, 2004; Shen and Williamson, 2005; Lederman et al., 2005; You and Khagram, 2005; Sevensson, 2005; Serra, 2006; Ata and Arvas, 2011; Kotera et al., 2012). As suggested by Ali and Isse (2002), when the determinants of corruption are identified, societies become capable of taking appropriate measures to combat it and thereby to contain its harmful effects.

In relation to the economic determinants, there are studies suggesting that strong institutions and economic growth and development are important to reduce corruption. Treisman (2000) instruments per capita income with geography to find a negative effect of growth on corruption in a cross-country study. Aidt et al., (2008) find that economic growth is effective to reduce corruption as long as the institutions are strong. The literature relating institutions and growth suggests that economic growth improves the quality of political and economic institutions (Acemoglu et al., 2005; Rigobon and Rodrik, 2005). Nguyen (2016) confirms this hypothesis suggesting that a firm's growth reduces corruption. In turn, Akça et al. (2012), based on panel data analysis for 97 countries, find controversial relations for the effect of growth on corruption when compare low-income countries with high-income countries.

Still in relation to the economic determinants, Getz and Volkema (2001) suggest that the greater the economic adversity in a country, the higher the level of corruption. In turn, economic adversity exists when individuals do not have the means to purchase the necessities of life. Following Getz and Volkema (2001), we argue that this situation can result, for instance, from high inflation, high public indebtedness, and low economic growth, factors that are often interrelated. Regarding the effects of inflation on corruption, some empirical studies show a causal link from inflation to corruption (Getz and Volkema, 2001; Braun and Di Tella, 2004). Based on simple OLS regression on cross-sectional data of 163 countries in 1997, the study of Getz and Volkema (2001) show that consumer price index has a positive and significant effect on Corruption. Braun and Di Tella (2004) use instrumental variables method

to address the endogeneity problem in the inflation-corruption nexus, based on a sample of 75 countries over the period 1982 to 1994. The authors provide evidence that inflation variability is positively correlated with corruption. Based on panel data analysis for 97 countries and separating the countries in three different income-level groups, Akça et al. (2012) find evidence that inflation has a statistically significant and positive effect on corruption in all the three groups of countries analyzed. Aiming to explain the mixed causality nexus between corruption and inflation, Sassi and Gasmi (2017) apply a panel vector autoregression model on a sample of 180 countries over the period 1996–2014, and two measures of corruption (the control of corruption obtained from the World Bank and the corruption perception index (CPI) elaborated by Transparency International). The findings suggest the relationship between corruption and inflation is bidirectional. The analysis of impulse responses functions provides evidence that the relationship between inflation and corruption is not unidirectional and the causality is bilateral, i.e., corruption is simultaneously a cause and a consequence of inflation.

In turn, Kotera et al., (2012) suggest that an increase in government size reduces corruption if democracy is strong enough, and, in contrast, increases corruption if the democracy level is too low. Tanzi (1998) argues that corruption is related to the actions of governments and that their causes need to be tackled with structural changes. Tanzi (1998) suggests that the solution to the problem of corruption may not be as simple as just reducing the size of the state. Rather, the way the state operates and carries out its functions is far more important that the size of public sector activity.

Some studies point to the importance of rule of law and stronger law enforcement in controlling corruption. Elbahnasawy and Revier (2012) suggest that the arsenal of anticorruption policies should include stronger and more visible law enforcement (stronger rule of law), greater scope for citizens to participate in selecting their government, more freedom of expression and free media. The study of de Mendonça and Fonseca (2012) find evidence, based on cross-country analysis, that countries with increased levels of rule of law present better control of corruption.

In turn, some studies analyze the importance of society's freedom of expression in the fight against corruption. These studies indicate that a free press has the power to reduce corruption (e.g., Ahrend, 2002; Brunetti and Weder, 2003; Chowdhury, 2004; Freille et al., 2007). In turn, Frechette (2006) points out that greater political freedom tends to reduce corruption. Lederman et al., (2005) indicate the importance of political institutions and the press in the fight against corruption, and point out that different levels of press freedom are associated with different levels of control of corruption. Chowdhury (2004) and Freille et al. (2007) suggest that lower levels of corruption are associated with higher levels of press freedom. Elbahnasawy and Revier (2012), using the WGI index for voice and accountability, find evidence that countries presenting higher levels of voice and accountability also present lower levels of perceived corruption in all regressions. Elbahnasawy and Revier (2012) argue that a potential approach to curbing corruption may include the development of greater opportunities for citizens to participate in selecting their government, more freedom of expression, and freer media. In short, most studies point out that society's freedom of expression brings benefits in terms of reducing corruption.

With respect to the effects of transparency, Islam (2006) suggests that the quality of a country's governance is associated with available information on government economic data, indicating that more transparent governments tend to govern better. Concerning the effects of transparency on corruption, the literature suggests that higher levels of transparency of government agencies tend to reduce corruption. According to Adsera et al., (2003), a society with better informed citizens is able to limit political corruption and to reduce government mismanagement. For Lindsted and Naurin (2006), more transparency can reduce corruption,

but as long as additional reforms that enable society to deal with such information are adopted.

Studies that address the consequences of fiscal transparency on the economy suggest the existence of effects over different factors (e.g., greater economic stability, lower budget deficits, higher government effectiveness and lower public debt). According to Kopits and Craig (1998), governments with higher levels of fiscal transparency have shown better economic performance, which is a good reason to push governments to increase fiscal transparency. Fukuda-Parr et al. (2011) stress that countries with high levels of budget transparency tend to better meet the economic and social aspirations of their citizens, to be more democratic, and also to achieve better human development outcomes. Regarding the study of Alt and Lassen (2006b), the results indicate that higher levels of fiscal transparency are associated with lower public debt and lower budget deficits.

Andreula et al. (2009) point out that increased levels of fiscal transparency are important to strengthen institutions. Alt and Lassen (2006a) suggest that countries with low fiscal transparency tend to have more persistent electoral cycles (reelections or perpetuations of the same political groups), a fact that is not so common in countries with high fiscal transparency. For Blume and Voigt (2013), more transparent budgets are related to increased government effectiveness, to better fiscal policies and to lower levels of corruption.

Concerning the effects of fiscal transparency on financial markets, Bernoth and Wolff (2008) argue that countries with higher levels of fiscal transparency have lower risk premia in financial markets, indicating that markets penalize less transparent fiscal reports. According to Hameed (2011), countries with greater budgetary transparency have higher credit ratings. In addition, more transparent countries are less susceptible to changes in their market spreads. According to Tilly (2012), after the subprime crisis, the relationship between fiscal transparency and investors' perception was considerably strengthened.[5]

With regards to the studies that empirically analyze the relationship between fiscal transparency and corruption, the literature is still scarce. However, the few existing studies suggest an inverse relation between fiscal transparency and corruption. According to Bastida and Benito (2007) fiscal transparency and corruption are negatively correlated. Bastida and Benito (2007) do not make estimates; they only analyze the correlation between the variables and observe other descriptive statistics. Haque and Neanidis (2009), based on cross-country analysis, find evidence that an increase in fiscal transparency can reduce corruption.

Although the empirical literature on the determinants of corruption is vast, it is still incipient and lacks rigor in the analysis of the effects of fiscal transparency and also on the effects of the legal system. In this sense, the present study seeks to contribute to the literature through a more robust and reliable analysis of the effects of fiscal transparency and the legal system on corruption.

3. Empirical analysis

3.1 Data and methodology

The main goals of the study are to estimate the effect of fiscal transparency on corruption, and the effects of the rule of law and law enforcement on corruption. For this, we use a set of 82 countries (14 developed economies and 68 developing economies)[6] grouped in

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[5] Specifically, Tilly (2012) concludes that, in the pre-crisis period, transparency had little or no significant impact on investors' perceptions. But since the beginning of the crisis in 2008, it has changed, and markets have exhibited greater sensitivity to fiscal performance.

[6] Table A.1 in the appendix shows all countries that are in the samples. The classification as developed and developing countries follows the International Monetary Fund (World Economic Outlook – WEO).

two samples: the first sample is formed by all the 82 countries (full sample), and the second sample is formed by 68 developing economies. Since developed countries have better scores in terms of fiscal transparency and corruption, the idea of analyzing developing countries is to check whether these countries improve the control of corruption when they enhance fiscal transparency and promote structural changes through improvements in the legal system. The period under analysis is from 2006 to 2014 with annual frequency (The choice of the period and countries are due to data availability – particularly due to data for fiscal transparency (the Open Budget Index) which begins in 2006.

In relation to our dependent variable, as a proxy for corruption, we use the Control of Corruption Perception Indicator (named CORRUP) – obtained from the World Bank WGI data base (The Worldwide Governance Indicators). The Control of Corruption Perception Indicator (CORRUP) varies between -2.5 and 2.5, in which the greater the indicator the greater is the control of corruption. In addition to this indicator, in order to verify the robustness of the results, we repeat the estimates using another proxy for corruption, the Corruption Perception Index (CPI) obtained from International Transparency. The higher the CPI, the lower the perception in relation to corruption. The correlations between CORRUP and CPI for the years of 2006 and 2014 are 0.97 and 0.99, respectively.

In turn, fiscal transparency has received increasing attention from different international organizations in recent years. For the International Budget Partnership (IBP) – an international partnership that analyzes government budgets in order to improve their effectiveness and reduce poverty – fiscal transparency is central and should be translated into greater access of the society to information about different types of expenditures, and how tax revenues and other public resources are used by governments. In this sense, the IBP launched the "Open Budget Initiative" through the Open Budget Survey – a comprehensive analysis and survey that assesses whether governments give the public access to budget information and opportunities to participate in the budget process at the national level. From this initiative, in order to measure the global commitment of the countries surveyed with transparency and to allow cross-country comparisons, the IBP created – based on the research – the Open Budget Index (OBI).

In relation to the Open Budget Index (OBI), de Renzio and Masud (2011) point out that the index is effective and governments around the world are increasingly interested in their scores, and that civil society groups had been using their recommendations to pressure governments to improve the transparency related to budgetary decisions. According to Seifert et al. (2013), the OBI contributes in an exclusive and independent manner, providing objective data regarding the transparency related to budgetary procedures of a number of countries over time. For Seifert et al. (2013), this independent process guarantees the reliability of the presented data. Therefore, as a proxy for fiscal transparency (named TRANSP), we use the open budget index (OBI). The index ranges from 0 to 100, where 100 is the maximum of fiscal transparency, and zero represents total opacity.

Following Wehner and de Renzio (2013), countries can be divided into five groups based on their overall index scores, distinguishing governments that disclose extensive (81–100; Group 1), significant (61–80; Group 2), some (41–60; Group 3), minimal (21–40; Group 4), and scant or no information on the budget (0–20; Group 5). Considering the full sample of countries, figure 1 shows the graph with this groups and reveals the countries that presented improvement in fiscal transparency in terms of changing from one group to another over time. The graph uses darker colors to denote groups of more opaque countries, and as the regions become lighter this means more transparency.

Figure 1 – Improvement of fiscal transparency
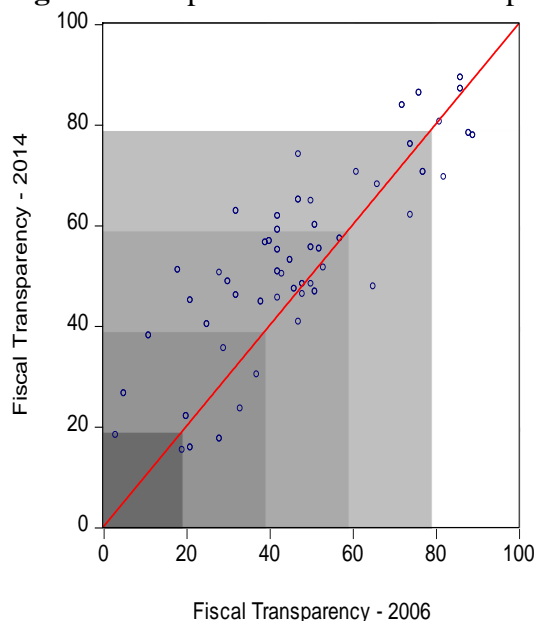
The results reveal the following changes: from Group 5 to Group 4 (Angola and Burkina Faso); from Group 4 to Group 3 (Albania, Nicaragua, Honduras, Ecuador, Azerbaijan, El Salvador, Mongolia, Bangladesh and Uganda); from Group 3 to Group 2 (Philipinnes, Malawi, Mexico, Bulgaria and Russian Federation); from Group 2 to Group 1 (Norway and Sweden). These results are contrary to the hypothesis raised and assumed by Blume and Voigt (2013) that the OBI is time-invariant, and "*the index itself seems to be fairly stable over time*" (Blume and Voigt, 2013, pp. 241). One can observe that several countries made efforts to improve fiscal transparency over time, justifying in this sense an analysis that also considers the effect of this variable over time.

Regarding the legal-institutional dimension, we use the "Rule of Law" indicator (RULE_LAW) obtained from the World Bank WGI data base. This indicator is widely used in studies addressing the determinants of corruption (e.g., Elbahnasawy and Revier, 2012; de Mendonça and Fonseca, 2012). The Rule of Law indicator has values between -2.5 (lowest level of rule of law) and 2.5 (highest level of rule of law). We also use the indicators of "Impartial Courts" (ICOU) and "Integrity of the Legal System" (ILS) obtained from the Economic Freedom of the World database provided by the Fraser Institute. Both indicators (ICOU and ILS) present values in a 0-10 scale that is increasing in the degree to which they are consistent with law enforcement. The idea of using these variables is due to the legal system being essential for the efficient allocation of resources; and because rule of law, an independent and unbiased judiciary, and impartial and effective enforcement of the law are considered key aspects of a legal system. Besides, in order to capture the effect of political rights, civil liberty, press freedom and freedom of speech on corruption, we use the indicator of "Voice and Accountability" (VOIC_ACC) obtained from the World Bank WGI data base.

Regarding the control variables that constitute the economic dimension, we follow the theoretical and empirical literature presented above in section 2. Thus, we use: the GDP growth rate (GROWTH), which is the annual percentage growth rate of GDP at market prices based on constant local currency − aggregates are based on constant 2005 U.S. dollars − obtained from World Bank Data; the inflation rate (INFLATION), which is the inflation of consumer price index obtained from World Bank Data, and; the debt to GDP ratio, which is the ratio between a country's government debt and its gross domestic product (GDP), obtained

from the International Monetary Fund. Table A.2 (Appendix) presents the descriptive statistics of all variables.

In order to provide preliminary evidence on the relationship between fiscal transparency and corruption, scatter plot with regression lines for the year 2006 and for the year 2014 are presented. Figure 2 shows these correlations for the full sample, and Figure 3 for the sample of developing countries.

The graphs in figure 2 show positive correlations between fiscal transparency and the variables used as proxy for corruption (CPI and CORRUP) for 2006. The same positive correlations are observed for 2014. Once both corruption indicators assume that higher values represent better performance in terms of corruption control and perception, thus, countries that are more transparent in their fiscal reports tend to have lower levels of corruption.

Figure 2 - Correlations and scatter plot with regression lines (full sample)
2006

correl: 0.69   correl: 0.72

2014

correl: 0.61   correl: 0.60
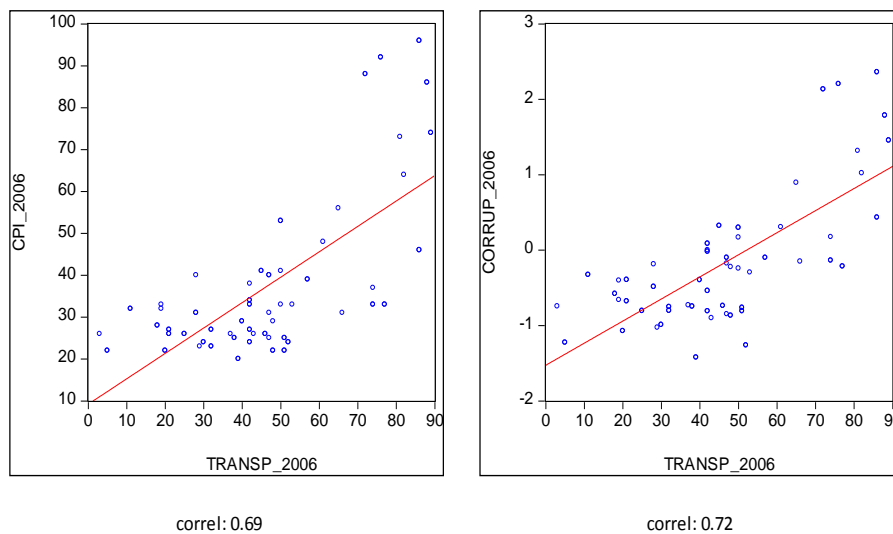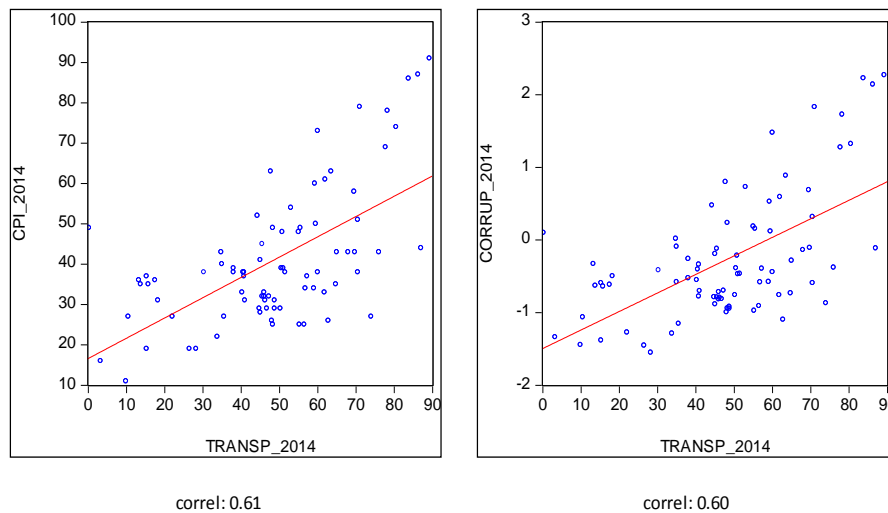
Based on Figure 3, one can observe, for the year of 2006, positive correlations between fiscal transparency and the variables used as proxy for corruption. Besides, the same positive correlations are observed for the year 2014. Hence, developing countries that present more transparency in their fiscal reports tend to have lower levels of corruption.

Figure 3 - Correlations and scatter plot with regression lines (developing countries)

2006
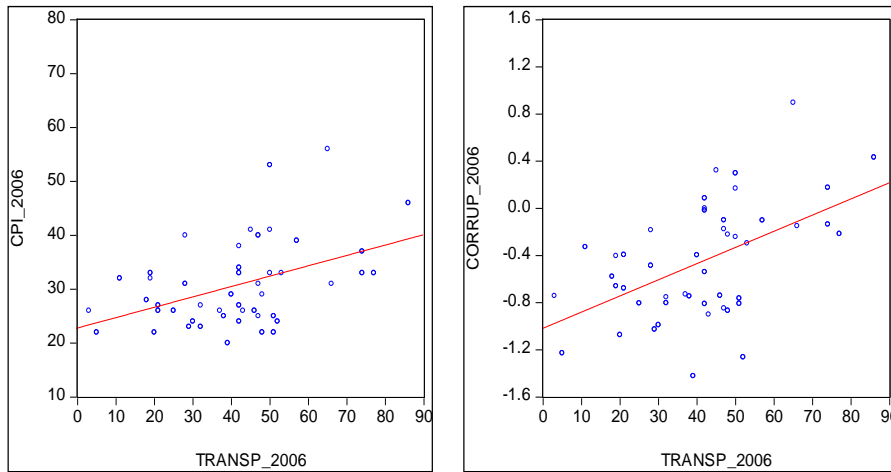
correl: 0.44   correl: 0.52

2014
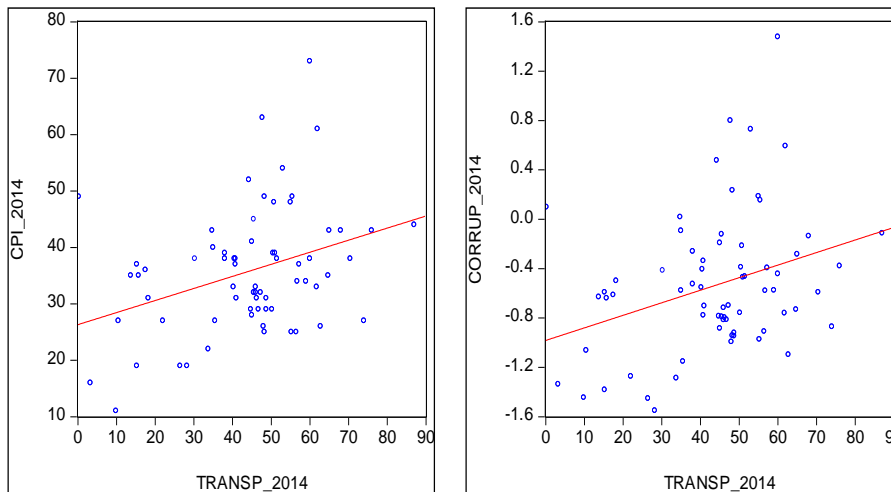
correl: 0.35   correl: 0.32

        In order to estimate the effect of fiscal transparency on corruption, as well as the effect of economic, institutional and legal variables, we estimate three sets of equations. In all equations, we use the variable CORRUP as the dependent variable. In addition, in all equations the effect of fiscal transparency is captured individually, as well as in an interactive way with the variable of rule of law. The idea of using the joint effect is to check what happens to the control of corruption indicator when there is a simultaneous increase in the rule of law and a higher level of fiscal transparency.

        The first model (equation 1) seeks to capture the effects of the economic dimension (represented by the vector of variables X_E), as well as the effect of the variable TRANSP and the combined effect of the rule of law and fiscal transparency (RULE_LAW*TRANSP). Therefore, the first equation is given by:

(1) $CORRUP_{i,t} = \alpha_0 + \alpha_1 X_{E_{i,t}} + \alpha_2 transp_{i,t} + \alpha_3\, rule\_law * transp_{i,t} + \varepsilon_{i,t}$,

where the subscript $i=1,2,...,82$ is the country; $t=1,2,...,9$ is the period (from 2006 to 2014), and $\varepsilon_{i,t}$ is the disturbance. In addition, the vector of variables X_e is formed by: GROWTH,

INFLATION and DEBT_GDP.[7]

The second model (equation 2) seeks to capture the effects of the legal-institutional dimension (represented by the vector of variables X_L), as well as the effect of the variable TRANSP and the combined effect of the rule of law and fiscal transparency (RULE_LAW*TRANSP). Thus, the second equation is:

(2) $CORRUP_{i,t} = \beta_0 + \beta_1 X_{L_{i,t}} + \beta_4 \, transp_{i,t} + \beta_5 \, rule\_law * transp_{i,t} + \mu_{i,t}$,

where $\mu_{i,t}$ is the disturbance, and the vector of variables X_j is formed by: VOIC_ACC, ICOU and ILS.

The third model (equation 3) estimates the effects of both dimensions (X_E, X_L), as well as the effect of the variable TRANSP and the combined effect of the rule of law and fiscal transparency (RULE_LAW*TRANSP). Thus, the third equation is:

(3) $CORRUP_{i,t} = \phi_0 + \phi_1 X_{E_{i,t}} + \phi_2 X_{L_{i,t}} + \phi_7 \, transp_{i,t} + \phi_8 \, rule\_law * transp_{i,t} + \delta_{i,t}$,

where $\delta_{i,t}$ is the disturbance.

The study uses panel data analysis. Besides usual OLS method for panel data analysis, we make use of dynamic panel data framework (D-GMM and S-GMM). As pointed out by Arellano and Bond (1991), an advantage of using the dynamic panel data method (GMM) is that it eliminates the non-observed effects on the regressions and the estimates are reliable even in the case of omitted variables. In particular, the use of instrumental variables allows the estimation of parameters more consistently, even in the case of endogeneity in explanatory variables and the occurrence of measurement errors (Bond et al., 2001).

The empirical model used in this study is subject to the above-mentioned problems. In short, not all explanatory variables of the model are known and measurable. In addition, the growth rate of real GDP can be influenced by corruption, which, in turn, suggests a simultaneity problem.

The model proposed by Arellano and Bond (1991) consists of the estimation of first-difference GMM panel data as a way of eliminating non-observed effects. However, Alonso-Borrego and Arellano (1999), and Blundell and Bond (1998) showed that the first-difference GMM has a bias (for large and small samples) and low accuracy. Moreover, the use of lags can generate weak instruments (Staiger and Stock, 1997). As a way of mitigating the weakness problem in the D-GMM, Arellano and Bover (1995) and Blundell and Bond (1998) suggest the inclusion of moment conditions. Hence, S-GMM combines regression equations in differences and in levels into one system and uses lagged differences and lagged levels as instruments.

Although D-GMM and S-GMM estimation approaches are suitable for a small number of time periods (t) and a large number of individuals (i), in the case of small samples, when the instruments are too many, they tend to over-fit the instrumented variables creating a bias in the results (Roodman, 2009). Therefore, with the objective of avoiding the use of an excessive number of instruments in the regressions and thus lose the power of tests, we report the number of instruments (as suggested by Roodman, 2009) through the number of instruments/number of cross-sections ratio, which must be less than 1 in each regression. Moreover, in order to confirm the validity of the instruments in the models, the test of over-

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[7] The estimates also tested the variables "government size", "trade openness", "financial openness", "GDP per capita", "unemployment", "budget balance", "inequality (Gini index)", and "democracy". However, the estimated coefficients for these variables did not present statistical significance in the estimates and, therefore, we have decided to remove these controls from the analysis and have more parsimonious specifications.

identifying restrictions (J-test) was used as suggested by Arellano (2003). In addition, tests of first-order (AR1) and second-order (AR2) serial correlation were performed.

3.2 Estimates and results

Table 1 presents the estimates of the three equations for the full sample, and table 2 presents the estimates of the three equations using the sample of developing countries. The estimates reveal positive and statistically significant coefficients for the combined effect of the variables rule of law and fiscal transparency (RULE_LAW * TRANSP). This result is obtained for the three equations through the three methods and in both samples. Therefore, the results presented in tables 1 and 2 indicate that when fiscal transparency is associated with strong legal institutions there is an increase in control of corruption.

Regarding the individual effect of fiscal transparency on CORRUP, the estimated coefficients using the full sample and the sample of developing countries are all positive. In relation to the full sample, statistical significance is found in estimates through D-GMM and S-GMM. In relation to the sample of developing countries the statistical significance was found in all models estimated by D-GMM and S-GMM and also in equation 1 by the fixed effects estimator. The results indicate that countries committed to increasing fiscal transparency, on average, will present greater control of corruption.

Regarding the variables of the legal-institutional dimension, the positive and statistically significant coefficients obtained in all estimates of the two samples for the variable VOIC_ACC indicate that, as society and the media are more vigilant and there is greater freedom of expression, control of corruption is also greater. In turn, the variables related to the legal system also presented the expected signals. Based on both samples and through all the methods, all estimated coefficients for ICOU are positive and statistically significant. Moreover, for both samples, the estimated coefficients for the integrity of the legal system (ILS) are all positive, but statistical significance is found only through D-GMM and S-GMM estimates. In this sense, the findings indicate that countries with stronger legal institutions have greater control of corruption.

The results for the economic dimension reveal the following findings. In relation to the effect of economic growth, all the estimated coefficients (based on both full sample and sample of developing countries) are positive, and most present statistical significance. Despite some controversial results presented in the literature (e.g., Akça et al., 2012), this result corroborates the findings in the literature on the effect of economic growth on corruption (e.g., Treisman, 2000; Paldam, 2002; Ata and Arva, 2011). In turn, all the estimated coefficients for the effect of inflation have negative signals in both samples, and statistical significance was found in all D-GMM and S-GMM estimates. Thus, the findings for the effect of inflation corroborate the theoretical arguments and the findings presented in the literature. Poole (2007) suggests that countries with high inflation tend to have weak institutions, which reinforces the findings of de Mendonça and Fonseca (2012) that countries with higher inflation rates tend to be more corrupt. However, based on a cross-section analysis, de Mendonça and Fonseca (2012) do not find statistical significance for this relation for the sample of developing countries.

Estimates also point out that countries with higher levels of public debt tend to have less control of corruption. For both samples, all the estimated coefficients are negative. In relation to the full sample, statistical significance is found in all models; and regarding the sample of developing countries, statistical significance is found in all the models estimated through D-GMM and S-GMM, and in equation 1 through fixed effects.

Table 1 - Estimates (dependent variable: CORRUP) - Full sample

Method	EFc			D-GMM			S-GMM		
Regressors:	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)
CONSTANT	-0.2335***	-0.4415***	-0.3295***						
	(0.0442)	(0.0809)	(0.1265)						
CORRUPTION(-1)				0.1704*	0.3615***	0.3164**	0.2297*	0.2294***	0.3211***
				(0.0903)	(0.1176)	(0.1248)	(0.1332)	(0.0777)	(0.0989)
GROWTH	0.0037***		0.0014	0.0026*		0.0025*	0.0048**		0.0035*
	(0.0011)		(0.0012)	(0.0015)		(0.0014)	(0.0023)		(0.0020)
INFLATION	-0.0012		-0.0013	-0.0026**		-0.0022**	-0.0056**		-0.0035*
	(0.0012)		(0.0011)	(0.0012)		(0.0011)	(0.0022)		(0.0019)
DEBT_GDP	-0.0009***		-0.0015**	-0.0032*		-0.0023**	-0.0084***		-0.0041**
	(0.0002)		(0.0007)	(0.0018)		(0.0011)	(0.0019)		(0.0020
VOIC_ACC		0.4062***	0.4269***		0.2733***	0.2600***		0.2826**	0.2939***
		(0.0557)	(0.0878)		(0.0819)	(0.0751)		(0.1181)	(0.1028)
ICOU		0.0454***	0.0386***		0.0327*	0.0514***		0.0422***	0.0534***
		(0.0096)	(0.0135)		(0.0171)	(0.0183)		(0.0144)	(0.0141)
ILS		0.0081	0.0064		0.0360**	0.0411**		0.0405**	0.0364*
		(0.0108)	(0.0186)		(0.0162)	(0.0172)		(0.0205)	(0.0207)
TRANSP	0.0009	9.07E-05	0.0002	0.0022*	0.0076***	0.0032*	0.0050**	0.0026*	0.0028*
	(0.0008)	(0.0006)	(0.0007)	(0.0012)	(0.0028)	(0.0017)	(0.0022)	(0.0015)	(0.0015)
RULE_LAW*TRANSP	0.0042***	0.0025***	0.0026***	0.0055***	0.0065**	0.0071***	0.0123***	0.0060***	0.0081***
	(0.0007)	(0.0006)	(0.0008)	(0.0019)	(0.0028)	(0.0024)	(0.0032)	(0.00196)	(0.0027)
N. obs.	621	629	598	253	340	309	297	299	304
adj. R²	0.98	0.98	0.98						
N.Inst./N. Cross Sec				0.397	0.369	0.414	0.347	0.402	0.385
J-Stat				19.970	19.768	14.404	20.321	22.128	12.421
p-value (J)				0.523	0.536	0.809	0.375	0.513	0.825
AR(1)				-1.887	-1.716	-3.568	-0.231	-0.318	-0.324
p-value				0.059	0.086	0.000	0.000	0.000	0.000
AR(2)				-0.273	0.008	-0.271	-0.095	-0.090	-0.068
p-value				0.784	0.993	0.785	0.209	0.265	0.375

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denote s 0.1. White's heteroskedasticity consistent covariance matrix was applied in regressions. The numbers in parentheses are standard errors. EFc – OLS fixed effects (cross-section). D-GMM – uses two-step of Arellano and Bond (1991) without time period effects. S-GMM – uses two-step of Arellano and Bover (1995) without time period effects. D-GMM estimator - tests for AR (1) and AR (2) check that the average autocovariance in first order and second-order residuals, respectively, is zero. S-GMM estimator - tests for AR (1) and AR (2) check for the presence of first order and second-order serial correlation in the first-difference residuals.

Table 2 - Estimates (dependent variable: CORRUP) - Developing countries

Method	EFc			D-GMM			S-GMM		
Regressors:	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)
CONSTANT	-0.4753***	-0.5998***	-0.5126***						
	(0.0371)	(0.0811)	(0.0899)						
CORRUPTION(-1)				0.2510***	0.2850***	0.3046***	0.2000**	0.1670**	0.2504***
				(0.0610)	(0.0858)	(0.0810)	(0.0860)	(0.0678)	(0.0808)
GROWTH	0.0042***		0.0020*	0.0049***		0.0025*	0.0056***		0.0037***
	(0.0011)		(0.0010)	(0.0017)		(0.0014)	(0.0014)		(0.0012)
INFLATION	-0.0014		-0.0012	-0.0040*		-0.0027*	-0.0039*		-0.0074**
	(0.0012)		(0.0011)	(0.0024)		(0.0015)	(0.0022)		(0.0029)
DEBT_GDP	-0.0005**		-0.0009	-0.0022**		-0.0027*	-0.0027***		-0.0035***
	(0.0002)		(0.0006)	(0.0009)		(0.0014)	(0.00091)		(0.0013)
VOIC_ACC		0.3811***	0.4090***		0.2825***	0.2865***		0.2535***	0.2169***
		(0.0568)	(0.0599)		(0.0502)	(0.1077)		(0.0516)	(0.0618)
ICOU		0.0417***	0.0375***		0.0602***	0.0390***		0.0730***	0.0703***
		(0.0118)	(0.0114)		(0.0195)	(0.0142)		(0.0171)	(0.0139)
ILS		0.0131	0.0086		0.0205*	0.0370**		0.0411*	0.0349*
		(0.0114)	(0.0122)		(0.0105)	(0.0159)		(0.0234)	(0.0197)
TRANSP	0.0016*	0.0004	0.0006	0.0021**	0.0044**	0.0042***	0.0038***	0.0017*	0.0019*
	(0.0009)	(0.0007)	(0.0008)	(0.0009)	(0.0020)	(0.0014)	(0.0011)	(0.0009)	(0.0011)
RULE_LAW*TRANSP	0.0047***	0.0029***	0.0030***	0.0056***	0.0035***	0.0056**	0.0078***	0.0047***	0.0059***
	(0.0009)	(0.0008)	(0.0008)	(0.0011)	(0.0013)	(0.0023)	(0.0010)	(0.0010)	(0.0012)
N. obs.	518	523	495	206	251	259	259	250	259
adj. R²	0.957	0.95	0.961						
N.Inst./N. Cross Sec				0.672	0.500	0.578	0.655	0.563	0.655
J-Stat				34.355	22.406	25.844	34.914	27.165	27.847
p-value (J)				0.403	0.495	0.361	0.331	0.348	0.526
AR(1)				-2.595	-1.933	-3.738	-0.323	-0.284	-0.318
p-value				0.009	0.053	0.000	0.000	0.000	0.000
AR(2)				-0.523	-0.126	-0.803	-0.104	-0.1540	-0.1508
p-value				0.600	0.899	0.421	0.299	0.168	0.151

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denote s 0.1. White's heteroskedasticity consistent covariance matrix was applied in regressions. The numbers in parentheses are standard errors. EFc – OLS fixed effects (cross-section). D-GMM – uses two-step of Arellano and Bond (1991) without time period effects. S-GMM – uses two-step of Arellano and Bover (1995) without time period effects. D-GMM estimator - tests for AR (1) and AR (2) check that the average autocovariance in first order and second-order residuals, respectively, is zero. S-GMM estimator - tests for AR (1) and AR (2) check for the presence of first order and second-order serial correlation in the first-difference residuals.

3.3 Robustness analysis

In order to check the robustness of our main empirical results, we estimate equations 1, 2 and 3 for both samples through S-GMM using as dependent variable the *Corruption Perception Index* (CPI). It is worth noting that an increase in CPI represents a reduction in corruption perception. Thus, the expected signals for the coefficients are the same as for the previous estimates.

Table 3 presents the estimation results when the CPI is used as the dependent variable. Estimates show positive and statistically significant coefficients for the interaction term between rule of law and fiscal transparency (RULE_LAW*TRANSP) in all three equations and in both samples. The findings corroborate the results obtained when the dependent variable was CORRUP. Therefore, estimates show that when fiscal transparency is improved and it is associated with strong legal institutions there is a reduction in corruption perception.

In turn, for both samples, all the estimated coefficients for the individual effect of fiscal transparency on CPI are positive and statistically significant. The findings confirm previous results, indicating that an increase in fiscal transparency reduces corruption perception.

With regard to the findings for the legal-institutional dimension, based on both samples, all estimated coefficients for ILS and ICOU are positive and statistically significant. Therefore, the findings indicate that countries with stronger legal institutions have lower corruption perception. Moreover, the positive coefficients obtained in both samples for VOIC_ACC suggest to the extent that as society and the media are more vigilant and there is greater freedom of expression, corruption perception is also lower.

The estimates for the variables of the economic dimension confirm the findings previously reported. All estimated coefficients present the expected signals and statistical significance.

Table 3 - Estimates (dependent variable: CPI) - Full sample and Developing countries

Sample	FULL			DEVELOPING		
Method	S-GMM			S-GMM		
Regressors:	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)
CORRUPTION(-1)	0.3211***	0.3139***	0.3133***	0.5322***	0.4054***	0.5502***
	(0.0410)	(0.0522)	(0.1129)	(0.0474)	(0.0451)	(0.0382)
GROWTH	0.0321***		0.0723**	0.0434***		0.0888***
	(0.0093)		(0.0307)	(0.0166)		(0.0226)
INFLATION	-0.0517**		-0.3049***	-0.0280*		-0.1210**
	(0.0244)		(0.0598)	(0.0162)		(0.0474)
DEBT_GDP	-0.0484***		-0.0738**	-0.0361***		-0.0879**
	(0.0134)		(0.0370)	(0.0113)		(0.0379)
VOIC_ACC		12.6363***	7.3008*		14.2194***	0.6292
		(2.4531)	(4.2569)		(1.6567)	(1.5612)
ICOU		0.8234***	3.9363***		0.4039**	1.1629***
		(0.2910)	(0.9097)		(0.1993)	(0.1947)
ILS		0.9341**	1.1608**		0.6828**	0.2398*
		(0.4062)	(0.4761)		(0.3460)	(0.1446)
TRANSP	0.0539***	0.3503***	0.2288***	0.0536***	0.3454***	0.1061***
	(0.0121)	(0.0496)	(0.0465)	(0.0188)	(0.0418)	(0.0344)
RULE_LAW*TRANSP	0.0187*	0.0719*	0.1242***	0.0376**	0.0755***	0.0336*
	(0.0104)	(0.0425)	(0.0356)	(0.0160)	(0.0286)	(0.0190)
N. obs.	169	276	175	174	231	170
N.Inst./N. Cross Sec	0.781	0.696	0.764	0.822	0.867	0.928
J-Stat	38.2488	45.187	29.603	35.4761	41.920	34.588
p-value (J)	0.4125	0.264	0.486	0.2653	0.387	0.2579
AR(1)	-0.458	-0.446	-0.255	-0.517	-0.354	-0.569
p-value	0.000	0.000	0.021	0.000	0.004	0.000
AR(2)	0.210	-0.009	0.211	0.099	-0.041	-0.083
p-value	0.291	0.947	0.231	0.524	0.806	0.731

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denote s 0.1. White's heteroskedasticity consistent covariance matrix was applied in regressions. The numbers in parentheses are standard errors. S-GMM – uses two-step of Arellano and Bover (1995) without time period effects. S-GMM estimator - tests for AR (1) and AR (2) check for the presence of first order and second-order serial correlation in the first-difference residuals.

4. Conclusions

Despite the wide literature on the determinants of corruption, gaps still exist, especially with respect to studies based on panel data analysis. Most studies addressing the determinants of corruption are based on cross-country analysis. However, since many corrupt countries have been successful in reducing their levels of corruption, and many other countries considered as less corrupt were found to become more corrupt, one can observe that corruption changes over time, suggesting the need for analyzes that consider the effect of the determinants over time.

The literature that addresses the determinants of corruption seeks to identify mechanisms able to mitigate corruption. Several studies identify the quality of government and the quality of the rule of law as fundamental determinants of the level of corruption. In this sense, institutional and judicial reforms can be identified as the main items on the anti-corruption policy agenda. Regarding the institutional changes observed in recent years, governments have been working to increase fiscal transparency in order to reduce information asymmetries. However, studies addressing the effect of fiscal transparency on corruption are still incipient and focused on cross-country analysis. Furthermore, regarding the effects of the legal system, the studies lay emphasis on the effects of the rule of law and neglect several other important aspects related to the legal system.

Therefore, the present study contributes to the literature aiming at filling the following gaps: 1) scarcity of studies addressing the determinants of corruption based on panel data analysis; 2) incipient literature addressing the effect of fiscal transparency on corruption, and; 3) lack of empirical studies addressing other legal aspects, beyond the rule of law, that might affect corruption.

We analyzed, based on panel data methodology for a total of 82 countries in the period 2006-2014, the effect of fiscal transparency on corruption, as well as the effect of the legal system on corruption. Regarding the effects of the legal system, in addition to the "Rule of Law" variable widely used in the literature, we analyzed the effect of the variables related to "Impartial Courts" (ICOU) and "Integrity of the Legal System" (ILS).

The results indicate that increasing fiscal transparency can have beneficial effects in reducing corruption. Thus, we find evidence that fiscal transparency represents a mechanism capable of increasing control of corruption and reducing the perception about corruption. Moreover, the study found that when fiscal transparency is associated with strong legal institutions, there is an increase in control of corruption and also a lower perception of its occurrence.

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Appendix

Table A.1 – List of countries

Countries: Albania; Algeria; Angola; Argentina; Azerbaijan; Bangladesh; Burkina Faso; Bulgaria; Bolivia; Brazil; Botswana; Cameroon; Chile; China; Colombia; Congo Dem. Rep .; Costa Rica; Croatia; Czech Republic; Dominican Republic; Ecuador; Egypt; El Salvador; France; Ghana; Guatemala; Germany; Honduras; Indonesia; India; Iraq; Italy; Jordan; Kenya; Kazakhstan; Lebanon; Liberia; Malaysia; Mali; Malawi; Mexico; Morocco; Mongolia; Mozambique; Namibia; New Zealand; Niger; Nigeria; Nicaragua; Norway; Peru; Papua New Guinea; Pakistan; Philippines; Poland; Portugal; Romania; Russian Federation; Saudi Arabia; Senegal; Serbia; Sierra Leone; Slovak Republic; Slovenia; Spain; Sri Lanka; South Africa; Sweden; Sudan; Thailand; Tunisia; Turkey; Tuvalu; Tanzania; Ukraine; Uganda; United Kingdom; U.S; Venezuela, RB; Vietnam; Yemen Rep .; Zambia.

Developing Countries: Albania; Algeria; Angola; Argentina; Azerbaijan; Bangladesh; Burkina Faso; Bulgaria; Bolivia; Brazil; Botswana; Congo Dem. Rep. Chile; Cameroon; Colombia; Costa Rica; Croatia; Dominican Republic; Ecuador; Egypt; El Salvador; Ghana; Guatemala; Honduras; Indonesia; India; Iraq; Jordan; Kenya; Kazakhstan; Lebanon; Liberia; Malaysia; Mali; Malawi; Mexico; Morocco; Mongolia; Mozambique; Namibia; Niger; Nigeria; Nicaragua; Pakistan; Peru; Papua New Guinea; Philippines; Poland; Romania; Russian Federation; Saudi Arabia; Serbia; Sierra Leone; Sri Lanka; South Africa; Senegal; Sudan, Thailand; Tunisia; Turkey; Tuvalu; Tanzania; Ukraine; Uganda; Venezuela, RB; Vietnam; Yemen Rep .; Zambia.

Table A.2 – Descriptive statistics

	CORRUP	CPI	GROWTH	INFLATION	DEBT_GDP	VOIC_ACC	ICOU	ILS	TRANSP	RULE_LAW
Mean	-0.1716	39.7324	4.0707	6.0281	41.6216	-0.0071	4.2701	5.7216	47.6852	-0.1424
Median	-0.3966	34.0000	4.1524	4.9121	37.0000	-0.0874	4.0298	5.8333	49.5000	-0.3917
Maximum	2.4622	96.0000	34.5000	62.1687	138.4000	1.7595	8.5005	10.0000	93.0000	2.0455
Minimum	-1.4526	17.0000	-15.0884	-2.2480	1.6000	-1.8620	0.6371	1.6667	0.2500	-1.8895
Standard Dev	0.8803	17.8655	3.9918	5.4846	24.4036	0.8066	1.4560	1.9899	22.1166	0.8711
Observations	598	598	598	598	598	598	598	598	598	598