WHEN DOES GOVERNMENT DECENTRALIZATION AFFECT CORRUPTION?

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ABSTRACT

Are countries with more decentralized fiscal and spending powers characterized by a lower level of corruption? Do changes in the degree of decentralization of such powers affect the level of corruption? This paper innovates on the previous literature, that relies mainly on cross section of countries, by analyzing a pool of a sample of 24 countries for the time interval 1995-2005. The answers are positive on both counts. The results appear robust to changes of the estimation techniques, of indicators of fiscal decentralization and of controlling factors.

JEL code: H11, H53, H77

Keywords: decentralization, corruption, common pool, fiscal autonomy

1. *Introduction*

Are countries with more decentralized fiscal and spending powers characterized by a lower level of corruption? Do changes in the degree of decentralization of such powers affect the level of corruption? The empirical literature on the determinants of corruption and on the relationship between government decentralization and corruption has addressed the first question in part and in a rather unsatisfactory way. The second question has received very little attention, if at all. The goal of this paper is to mark an improvement on both counts.

Empirical studies of the determinants of corruption, including the degree of government administrative and fiscal decentralization, are generally based on cross country regressions (Fan, Lin, Treisman, 2009; Arikan, 2004; Bjedov, Madies, Schnyder, 2010; Treisman, 2007, 2000; Bardhan and Mokherjee, 2005; Kunicová and Rose-Ackermann, 2005; Fjeldstad, 2003; Fisman and Gatti, 2002; De Mello and Barenstein, 2001; Huther and Shah, 1998), , if not on case studies (Jin et al., 2005; Zhuravskaja, 2000; Montinola et al. 1995). For a variety of reasons, including data limitations, the time series dimension of the two link between decentralization and corruption has never been examined so far[9]. Cross section regressions rely on the implicit assumption that countries are on their steady state equilibria for both the level of corruption and the vertical distribution of government competencies. This is far from reality: many countries, within and outside the OECD group, are undergoing important processes of decentralization of their power to tax and spend, some of them precisely to improve accountability and reduce corruption in the public sector (OECD, 2010; Eskeland, Rodden and Litvack, 2003; Rodden, 2005; Stegarescu, 2005). Furthermore , various indices of corruption, notably Transparency International's CPI denote cardinal and ordinal changes of the countries' degrees of corruption during the time interval they cover, i.e., from 1995

[9] Enikolopov and Zuravskaya (2007) consider a pooled regression of public goods provision and a cross country analysis on an indicator of corruption. It is not clear to what extent the two dependent variables capture the same phenomenon.

onwards. Hence, averaging out data about decentralization and corruption into a single observation for each country not only involves a loss of information, but also distorts the analysis. The availability of time series for both the indicators of corruption and of government decentralization makes it now possible to examine the dynamics of the link between the two.

The consideration of the time series dimension also allows answering to the second question, namely, whether countries that have in fact decentralized the government functions have also experienced changes in their degree of corruption. The recent empirical literature on the nexus between decentralization and government growth has evidenced that the immediate effects of a decentralization reform can be quite different from their long run, equilibrium ones (Rodden, 2005; Ashworth, Galli and Padovano, 2011, 2010). In the short run, decentralizing the power to tax and spend to lower government levels may involve greater institutional uncertainty, overlaps of government functions and higher information costs that might lead to higher spending, contrary to what the Leviathan hypothesis predicts (Brennan and Buchanan, 1980). In time, however, the fine tuning of the reform, a higher flux of information and the processes of tax and yardstick competition between jurisdictions might indeed prune down the growth of government. A similar dynamics might also characterize the relationship between government decentralization and corruption; in such a case, the effects after one year might be quantitatively and qualitatively different from those at three, five or more years. Discovering the dynamics of the relationship holds important consequences also for policy reform.

Another contribution that the literature on decentralization and corruption can draw from that on the growth of government is the idea that decentralization may improve the agency problems that generate both government overspending and corruption, provided that it is conducted simultaneously on the revenue and the spending side of the budget (Ashworth,

Galli and Padovano, 2010; Rodden, 2005). The most recent contributions on the subject consider each side of the budget alternatively[9]. Concentrating only on one side while neglecting the other biases the analysis of the impact of decentralization on corruption. If the theoretical presupposition is that overgrazing in taxation breeds corruption (Keen and Kotsogiannis, 2002; Berkowitz and Li, 2000), the larger the size of the common pool, the higher should be the level of corruption. Grant financing of local expenditures in a highly centralized country, where local spending is a small percentage of GDP or of total revenues, has consequences for corruption altogether different than grant financing in a highly decentralized country, where most of government spending is decided locally. While it is indeed relevant to verify the effects of alternative ways to finance subnational government spending, it is also important to consider, at the same time, the degree of decentralization of government spending.

We bring evidence to bear on these two questions by examining a sample of 24 countries for the 1995-2007 time interval. The empirical models are specified to include the contributions derived from the literature on decentralization and corruption and from that on decentralization and public sector size. To anticipate the results, the analysis finds that countries with more decentralized fiscal and spending powers are also characterized by a lower levels of corruption. Consideration of the time series dimension of the data reveals that it is fiscal, rather than administrative decentralization to play the most important role. Furthermore, changes in the degree of fiscal decentralization affect the level of corruption over a three year lag. In the OECD subsample the effect is driven mainly by the reduction of soft budget constraints in lower levels of government, whereas in the non OECD countries

[9] Fan, Lin, Treisman (2009) consider alternatively the share of subnational revenues over GDP and the share of subnational public employees as a proxy for spending. Fisman and Gatti (2002) look only at the share of subnational expenditures over total expenditures.

the most relevant driving force appears to be improvement in the education of the population.

The rest of the paper is organized as follows. Section 2 provides a survey of the literature on decentralization and corruption and on the relevant contributions that can be derived from the closely related literature on decentralization and government size. In section 3 we illustrate the empirical strategy and the specification of the model. The results of the estimates of the relationship between decentralization of the powers to tax and spend and corruption, the first question posed in the introduction, are discussed in section 4. Section 5 presents the results of the estimates of the effects of changes in fiscal decentralization on the level of corruption. The concluding remarks are in section 6.

2. *Literature review*

The study of the link between government decentralization and corruption has been the subject of a relatively recent, but rapidly expanding literature. Most theoretical and empirical contributions deal with the following question: is decentralization a useful institutional reform to reduce corruption, or might corruption increase as political power shifts downward? The idea that centralization brings about high levels of rent-seeking, corruption and lack of accountability of government officials has in fact motivated trends toward greater decentralization that characterize many OECD and non OECD countries since the 1990s (OECD, 2010). Yet, whether this rationale is theoretically legitimate and factually correct remains still a matter of debate.

Two are the main strands of thought on the link between decentralization and corruption. One emerges from the 'second generation' literature on federalism, which focuses on the incentives and accountability of government officials, rather than on the heterogeneity of the

local preferences. Breton (1996), Weingast (1995), Bardhan and Mookherjee (2005) argue that decentralized systems may guarantee more accountable and 'honest' governments as a result of inter-jurisdictional competition, be it of the resource-flow type *à la* Tiebout (1956) or of the spillover type such as yardstick competition (Besley and Case, 1995; Brueckner, 2003). When bureaucrats compete to offer identical or substitute benefits to private agents, the 'price' of the service is drawn down to zero. The second line of thought, based on the idea that there exist many imperfections in the local provision of services which may prevent the realization of benefits from decentralization, argues that decentralized systems may increase corruption (◎ HYPERLINK "http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V76-459HP80-2&_user=2814622&_coverDate=03%2F31%2F2002&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1596911029&_rerunOrigin=google&_acct=C000058858&_version=1&_urlVersion=0&_userid=2814622&md5=ee92561394b5a7549bc8f7b49969e1fe&searchtype=a" \l "bib29"◎Prud'homme, 1995; ◎◎ HYPERLINK "http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V76-459HP80-2&_user=2814622&_coverDate=03%2F31%2F2002&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1596911029&_rerunOrigin=google&_acct=C000058858&_version=1&_urlVersion=0&_userid=2814622&md5=ee92561394b5a7549bc8f7b49969e1fe&searchtype=a" \l "bib35"◎Tanzi, 1996)◎. This because the relationship between citizens and government officials is closer and more frequent, the potential briber needs to affect only a limited segment of the government or local bureaucrats may be poorly trained and inefficient. On a similar line of reasoning, Franzese (2001) suggests that greater decentralization multiplies the governmental units that each citizen must control; this worsens the agency relationship between citizen and elected officials and increases the room for corruption.

These rather contrasting theoretical predictions call for empirical analysis to solve the conundrum. The empirical literature on the issue consists basically in cross-country regressions and case-studies. Huther and Shah (1998), De Mello and Barenstein (2001), Fisman and Gatti (2002), and Arikan (2004) find that a larger subnational share of public expenditures is associated with lower perceived corruption. Enikolopov and Zhuravskaya (2007) find, instead, that a larger subnational revenue share is associated with lower perceived corruption in developing countries with older and fewer parties in government. Looking at political rather than fiscal indicators, Goldsmith (1999), Treisman (2002), and Kunicová and Rose-Ackerman (2005) report that a federal structure is associated with higher perceived corruption. More recently, however, Fan, Lin and Treisman (2009) suggest that neither the (negative) expenditure decentralization effect nor the (positive) federalism effects are robust. The fiscal decentralization effect appears weakened after controlling for national characteristics, and the federal effect disappeared as the number of countries in the sample increases. These strikingly dissimilar results may also be due to the different type of indicator of corruption that Fan, Lin and Treisman (2009) use, based on reported experiences rather than subjective perceptions. Treisman (2002) and Arikan (2004) have also examined whether smaller local government units are associated with less corruption because of more intense inter-jurisdictional competition, but obtained inconclusive results. Finally, examining the effect of the vertical structure of states, Treisman (2002) found that a larger number of administrative tiers is correlated with higher perceived corruption, in line with the idea of Franzese (2001), but the fact that subnational governments were appointed or elected did not have a clear effect.

So far, the empirical literature does not allow to unanimously assign a positive or negative sign to the partial derivative of corruption with respect to decentralization. The mix of results depends not only on the variety of samples and estimation techniques, but also, and we would say primarily, on the different definitions of decentralization and corruption that

the various studies adopt. These two issues must be evaluated beforehand, to avoid the risk that the review of the various empirical contributions compares the incomparable.

Transparency International's annual corruption perception index (CPI) – and similar subjective measures provided by the World Bank – has been mostly used in the empirical studies of corruption. The use of a corruption perception index is justified because the actual level of corruption in a country is difficult to observe. Certain potential measures of corruption, such as the number of prosecuted corruption-related cases in a country, may be rather noisy measures. For example, a low arrest rate for bribery may indicate a low prevalence of corruption or, else, widespread corruption with no prevention efforts. Treisman (2007) and Fan, Lin and Treisman (2009) instead rely on data coming from the "World Business Environment Survey" or WBES, that reports responses of businessmen and citizens in particular countries about their own (or close associates') concrete experiences with corrupt officials; data are available for a cross country of 80 countries for the years 1999-2000 (one observation per biennium). They prefer these data because they are based on reported experiences, rather than, as it is the case for the CPI, on the aggregated perceptions of businessmen or country experts, which may be driven by prejudices, word of mouth and the like. On the other hand, the WBES data may be affected by self or biased selection: not all businessman who were asked a bribe to obtain a contract may wish to report that. It is hard to decide which of the two approaches provides the most reliable data. Fortunately, in the context of our sample, which, as we shall see, is determined by data limitations of the measures of fiscal decentralization, the choice of the CPI is quite straightforward. The correlation between the two indices, for the countries and years where they overlap, is very high (r = 0, 73, significant at the 5% level), so the availability of a time series dimension for the CPI, lacking in the WBES data, dictates our choice.

The concept of decentralization is also disputed and needs to be clarified (Dafflon and Madiès, 2008). Fiscal federalism focuses on many different aspects that pertain to subcentral governments, like: 1) the autonomy to decide expenditures on local services; 2) the autonomy to set and collect taxes; 3) the share represented by grants received from higher level governments in the total revenues of the subcentral government; 3) the number government levels that characterize the country's public sector; 4) other dimensions of political decentralization such as the creation of checks and balances between different governments either via horizontal competition, or across different vertical levels (Treisman, 2002). Both common pool (Ostrom, 1990; Rodden, 2003) and public choice models (Brennan and Buchanan, 1980) argue that the effects of a move towards greater decentralization are conditional on the choice of the financial instruments, i.e., dimensions 1)-3), and chiefly grants versus the ability to raise taxes at the decentralized level (the so-called "own taxes"). Rodden (2003) finds that expenditure decentralization without corresponding local tax powers will neither engender the beneficial effects of tax competition, nor will it strengthen the agency relationship between local citizens and their representatives. The effect will in fact be quite the opposite, because decentralizing only expenditures breaks the link between taxes and benefits and turns the public sector's resources into a common pool that competing local governments will overgraze. To distinguish the effects of decentralization of both expenditures and revenues, empirical analysis must consider, in the same model, the indicators of the degree of expenditure autonomy, of tax autonomy and of dependency on transfers from the central government (Ashworth, Galli, Padovano, 2010).

The dynamics of the relationship is another aspect raised by the literature on the nexus between federalism and the size of government, which may prove relevant also for the relation between decentralization and corruption. In the short run, the movement towards greater decentralization may create an institutional hybrid that enhances, rather than reduce, problems of electoral control of the government and corruption (Scharpf, 1988; Rodden and

Rose-Ackermann, 1997; Bardhan and Mookherjee, 2000). Only when the countries reach their long run equilibria can decentralization be associated to lower corruption.

With respect to these latter two points, the empirical literature on decentralization and corruption has been rather cavalier, if not neglectful. International cross-country studies such as Goldsmith (1999), Kunicova (2002), Kunicova and Rose-Ackerman (2005) have equated decentralization to the fact that the country has a federal structure or not. Fisman and Gatti (2002) have also looked at the share of the general government's budget that is spent locally. Fan, Lin and Treisman (2009) have improved on this situation by considering various dimensions of fiscal and government decentralization, including the number of government units, the share of local taxes and of transfers to subcentral governments. Yet all these fiscal indicators of decentralization are entered separately in the regression model and are averaged out, to fit into the cross sectional dimension of the indicator of corruption. This is highly unsatisfactory because averaging out the time dimension of measures of fiscal decentralization involves a loss of information[9]. It is no accident that in cross sectional studies, such as Fan, Lin and Treisman (2009), measures of administrative decentralization, such as the number of government units and the like, appear to be more strongly correlated with corruption, because they are therefore rather stable through time. But these measures are inherently imprecise, as the same institutional structure can support a large variety of degrees of fiscal decentralization (Eskeland, Rodden and Littvack, 2003; OECD, 2010). Finally, all these studies consider measures of tax and expenditures decentralization alternatively. This is highly problematic, because grant financing of local expenditures in a highly centralized country, where local spending is a small percentage of GDP or of total revenues, has consequences for corruption altogether different than in a highly decentralized country,

[9] Another shortcoming, already mentioned in the introduction, is the implicit and incorrect assumption that the mean value of decentralization reflects an equilibrium value. Many countries around the world are instead going through deep processes of decentralization and of restructuring of the vertical organization of their public sectors, some of them precisely in the attempt to fight corruption.

where most of government spending is decided locally. As Ashworth, Galli and Padovano (2010) show, it is important to simultaneously control for both tax and expenditure decentralization in order to have a correct representation of the effects, on corruption as well as on other phenomena, of the decentralization process.

In this ensuing analysis we try to introduce the contributions of the literature on decentralization and government size to improve our understanding of the link between fiscal decentralization and corruption.

3. Empirics

3.1. Empirical strategy. To answer to the two questions posed at the beginning, namely: Are countries with more decentralized fiscal and spending powers characterized by a lower level of corruption? Do changes in the degree of decentralization of such powers affect the level of corruption? we estimate two variants of the same empirical model. For the first question, indicators of corruption and fiscal decentralization must considered in levels, together with the (mostly time-invariant) vector of controls of the other determinants of corruption. For the second question, instead, which is directly related to variations in the degrees of decentralization and corruption, the same indicators must be considered in rates of change. Moreover the lag structure of the relationship must be progressively increased, to analyze how much time it takes for processes of decentralization to produce equilibrium changes in the level of corruption.

The structure and quality of the data is another conditioning factor for the empirical strategy. Data about corruption have not the same reliability as those on, say, GDP; they are

based on surveys, are not subject to periodical revisions and are collected with annual and sometimes biannual frequency. Also the indicators of fiscal decentralization, as we shall see in the next section, raise some concerns, as they possibly overestimate the sub-central governments' actual autonomy in fiscal decisions. Moreover, the theoretical literature does not offer a model of the dynamics of the correlation between decentralization and corruption. These problems are well known in this literature and are by no means unique to the present analysis. We choose to deal with them upfront, by looking for robust structural correlations among the phenomena under scrutiny; in other words, the analysis will verify whether the results are sensitive to changes in the specification of the regression model, of the series available to proxy a single theoretical variable and of the estimation techniques adopted.

3.2. Data and model specification. The empirical analysis employs a panel of 24 countries between 1995 and 2007. Data availability for measures of fiscal decentralization determines the size of the cross section, while the CPI series set the boundaries of the time interval. Overall we have 312 observations per variable, which ensures enough degrees of freedom to achieve efficient estimates. The countries considered are Australia, Austria. Belgium, Bolivia, Canada, Chile, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Luxemburg, Netherlands, Norway, Romania, South Africa, Spain, Sweden, Switzerland, Thailand, United Kingdom and United States. The majority of them are developed countries, but more about one third of them are either developing or non-OECD countries. An interesting feature of the panel is that it features a considerable variety of institutional systems, geographic locations and degrees of fiscal decentralization, which spam through (nominally) federal and centralized countries. The time dimension should be long enough for a process of decentralization (or, conversely, centralization) to attain its long run, equilibrium effects on the level of corruption.

Our baseline estimating equation combines the contributions from the literatures on decentralization with those corruption and decentralization and public sector size. Equation 1 lists the variables in their levels, i.e., the specification used to answer the first question.

$$CPI_{it} = a_0 + a_1 GRANTS_{it} + a_2 OWNREV_{it} + a_3 \boldsymbol{DECENTRALIZATION}_{it} + a_4 EXP_{it} + a_5 GDPPC_{it} + a_6 EDU_{it} + a_7 POP_{it} + a_8 OPEN_{it} + a_9 FUEL_{it} + a_{10} \boldsymbol{POLITICS}_{it} + a_{11} \boldsymbol{CULTURE}_{it} + a_{12} EF_{it} + u_{it} \quad (1)$$

where i denotes the country and t the year. On the other hand, in order to analyze the effects of changes of the degree of fiscal decentralization on the level of corruption, we consider the dynamic variant of equation (1):

$$dCPI_{it} = a_0 + a_1 d\Lambda GRANTS_{it} + a_2 d\Lambda OWNREV_{it} + a_3 \boldsymbol{DECENTRALIZATION}_{it} + a_4 EXP_{it} + a_5 GDPPC_{it} + a_6 EDU_{it} + a_7 POP_{it} + a_8 OPEN_{it} + a_9 FUEL_{it} + a_{10} \boldsymbol{POLITICS}_{it} + a_{11} \boldsymbol{CULTURE}_{it} + a_{12} EF_{it} + u_{it} \quad (2)$$

where Λ denotes the lag structure and d is the difference operator. The variables can be described as follows:

1) *CPI* is the corruption perception index provided by the Transparency International from 1995 to 2007. The ranking of the CPI goes from 0 (most corrupt) to 10 (least corrupt). We keep the index decreasing in the level of corruption, an ordering that must be kept in mind when interpreting the signs of the estimated coefficients.

2) *GRANTS* are revenues raised by the central government and transferred to sub-national governments (state-regional and local governments) over total revenues. Data come from GFS (various years). According to the common pool theory, the expected sign on this variable is negative.

3) *OWNREV* is revenue raised and retained by state, regional and local level (mainly local taxes, user fees and interest income) over total revenues, from the GFS (various years). These data fail to distinguish between tax revenues that are legislated and collected locally from those that accrue to the sub-national governments through revenue-sharing schemes. This covariate may thus overestimate actual tax autonomy. A positive sign on *OWNREV* is expected.

4) **DECENTRALIZATION** is a vector of dummy variables that capture the degree of decentralization of public expenditures or, alternatively, of revenues, when we control for the effects of fiscal decentralization on the spending side of the budget. To construct the dummies we divide the percentage of total spending supplied (alternatively, of total revenues collected) by sub-central government levels in quartiles, ranging from very highly decentralized (highest quartile), to highly centralized spending (lowest quartile), with two middle categories reflecting medium decentralized and highly centralized. The variable equals 1 when the observation falls within that quartile and 0 otherwise. The qualitative structure of the variable minimizes collinearity with other continuous fiscal covariates. The introduction of this variable is novel but important. The basic premise of our analysis has effectively two themes: to what extent the spending is localized and how any local spending is financed using grants or own taxes. Having *GRANTS* and *OWNREV* alone does not capture entirely fiscal decentralization without adjusting for the underlying preferences for the government level at which spending is carried out. Furthermore, because there is no guarantee that *GRANTS* and *OWNREV* sum to unity, examining the type of expenditure preferences is a way of taking account of any missing revenues. While we expect a positive sign on the highly decentralized countries (highest quartile) and a negative one on the low decentralized dummy, the whole range of signs on the intermediate dummies is *a priori* undetermined.

5) *TOTEXP* is the total public expenditure as a percentage of the GDP. The benefits of corruption come from bureaucrats and politicians being able to allocate public resources to private individuals. Thus, the larger the public sector, the greater will be the possibilities for corrupt endeavours (Tanzi, 1994; Glaeser and Shleifer, 2003; Adsera et al., 2003). It is true that corruption may exploit non fiscal tools, such as regulations and the distribution of rents, but there is generally a direct correlation between size of the public sector and number of regulations. Lacking continuous data about regulations or size of the bureaucracy, we concentrate on the amount of public spending. Considered alongside *GRANTS* and *OWNREV*, this variable has also the advantage of controlling to what extent the country's budget is balanced. A negative sign on this variable is expected.

5) *GDPPC* is per capita GDP in U.S. dollars measured at purchasing power parity and taken from Penn World Tables mark 6.2 (hereafter, PWT). According to the Lipset hypothesis (1960), voters with higher income are expected to be both more willing and capable to monitor public employees and to take action when the latter violate the law. A positive sign is expected.

6) *SCHOOL* is the secondary school enrollment for male and female population, from the Barro-Lee dataset. Again, the Lipset hypothesis (1960) states that education is a way to lead individuals towards a higher value of staying politically involved and develop a channel towards closer monitoring (Glaser et al., 2004). A positive sign is expected.

7) *POP*, the country population, in millions of units, from the Penn World Tables, acts as a control for country size. If large countries exploit economies of scale in the provision of public services (Alesina and Wacziarg 1997), and therefore have a low ratio of public service outlets per population, individuals might revert to bribes "to get ahead of the queue". At the same time, larger countries might adopt more decentralized fiscal systems to better cater to the diverse preferences of their citizens. Again, for a given level of decentralization, a larger

population implies a lower degree of satisfaction of individual preferences for public services, with greater incentives to resort to malfeasance. We expect that more populated countries are also more corrupt.

8) *OPEN* is the sum of exports and imports over GDP in percentage terms, from PWT. This variable tests the prediction that increasing trade interdependence improves the competitiveness and productivity of the economy, which should leave less room for corrupt practices. A positive sign is expected.

9) *FUEL* is the percentage of mineral fuels in manufacturing exports (WDI, World Bank, 2007). Ades and Di Tella (1999) found that high endowments of natural resources, inasmuch as they constitute a rent, increase corruption.

10) The vector **POLITICS** is composed of the following variables: *DEMOCRACY* is a multivariate qualitative variable that ranges from -10 to +10. These values are the sum of the country scores for democracy and autocracy for every year, with data drawn from the Polity IV database. Autocratic systems are characterized by the monopolization of power in the hands of a small elite, with few or no constraints to prevent it from exercising its own interest. Thus, a high level of corruption should prevail in the autocratic regimes. In contrast, democratic systems are characterized by diffuse authority, where the executive branches of government are balanced by an elected parliament and an independent judiciary, and where elections allow an alternation in power which should deter corruption. As alternatives, we use the Freedom House indexes of political rights (*PR*) and of civil liberties (*CL*), both also scaled from 0 to 10, where a higher score indicates a higher level of political rights and freedom. *SYSTEM* is a multivariate dummy that takes the value of 0 when the government is presidential, 1 when presidents or prime ministers are elected by the assembly and 2 when the system is parliamentary. The values are from the World Bank Database of Political Institutions (hereafter, DPI). The aim of this variable is to control for the effects of institutions

on corruption. Persson and Tabellini (1999) and Persson et al. (2003) suggest the existence of a systematic link between corruption and political systems. Presidential systems are more accountable because voters seek consensus among individuals rather than among parties, which should restrict rent extraction. Then majoritarian elections are more effective in deterring political rents since the outcome of an election is generally more sensitive to the incumbent's performance. The sign on this variable is also expected to be positive. *VETO* refers to the literature that links divided governments in presidential systems and fragmented governing coalitions in parliamentary systems to "wars of attrition" and budget deficits (Alesina and Drazen, 1991; Tsebelis, 2002). Political fragmentation generates stalemates in decisions, retard efficiency-enhancing economic reforms and thus creates more room for corruption.

11) The vector **CULTURE** consists of a set of variables that capture the effectiveness of a legal system which is rooted not only in the formulations of the laws but also in the 'legal culture', that is the expectations and practices that inform the way they are enforced. Different conceptions of the social role of law may imply dissimilar perceptions of the gravity of corruption. Besides losing their jobs, corrupt officials face a social stigma that highly depends on the prevailing moral norms and cultural expectations (Treisman, 2000). These variables are *BRIT*, i.e. a dummy variable that takes the value 1 if the country is a former British colony, 0 otherwise, from Fan, Lin and Treisman (2009); *PROT*, the percentage of protestants in the population, from Barro and McClearly (2005); and *LEG*, a dummy variable that takes the value 1 if the country is characterized by a common law legal system, 0 otherwise, again from Fan, Lin and Treisman (2009). With respect to all these variables we expect a negative sign.

12) Another set of studies on the determinants of corruption has focused on the effect of ethnic fragmentation on corruption (Mauro, 1995; Fearon and Laitin, 1996; Alesina et al.,

2002). If an area is worn out by ethnic divisions and leaders tend to allocate resources towards groups of their own ethnicity, then members of one ethnic group might continue to support a leader of their own group, even if he is known to be corrupt. To account for this effect, we use the variable ETF, which is the average of the five indices of ethnic fractionalization provided by LaPorta, Shleifer and Vishny (2003).

Finally, to verify the robustness of the estimated correlations, we have controlled for different specifications of fiscal decentralization. First, as we have seen, GFS data report the vertical distribution of own tax revenues, but do not identify the locus where tax decisions are actually made. A country can appear to be more decentralized than it actually is, insofar as subcentral governments can levy a considerable amount of tax revenues using tax instruments that the central government in fact mandates and regulates. To overcome this problem, Stegarescu (2005) has collected data on subcentral tax autonomy for 18 OECD countries until 2001, by merging GFS data on own revenues with OECD classification of the tax autonomy of subcentral governments. Specifically, we consider the Stegarescu's aggregate RD1, which include own non-tax and capital revenue and autonomous own taxes of sub-central governments that the OECD classifies up to the degree of autonomy *d1*, i.e., the subcentral government has some autonomy in deciding the base and/or the rate. Other non-autonomous revenues, such as revenue sharing schemes, are therefore excluded. We use this indicator *RA* as an alternative to GFS data, although for more limited and more homogeneous cross section and sample period. For the results on fiscal decentralization to be robust, the estimates coefficient for *RA* should be the same as for *OWNREV*. We have also controlled whether expenditure decentralization, holding the vertical distribution of the power to tax constant, similarly affects the level of corruption. To this end we have used two variables from the GFS dataset, namely *CGEXP* and *SGEXP*, which represent the share of total expenditures that pertain to the central and to the subcentral government levels. Inasmuch as expenditure decentralization betters the satisfaction of individual preferences for public

goods and services and improves the agency relationship between citizens and their administrators, corrupt practices should be less pervasive; we then expect a positive sign on *SGEXP* and a negative on *CGEXP*. When we use this specification we control for revenue decentralization by means of dummies drawn from the classification in quartiles of the variable *OWNREV*. Finally, we have also considered the variable *TIER*, i.e., the number of government levels that characterize the country's public sector. This variable captures the degree of administrative, rather than fiscal, decentralization of a country and plays an important explanatory role in the cross section analysis of drawn from Fan, Lin and Treisman (2009). We use it to check whether it is administrative rather than fiscal decentralization that affects most the level of corruption. Even more importantly, this variable allows us to verify whether adding the time dimension actually increases the explanatory power of the analysis over the previous contributions, that relied on cross section models. Table 1 reports the descriptive statistics for all variables and Table 2 the table of the correlations among the covariates.

Table 1 and 2 about here

4. Estimates of the relationship between decentralization and corruption

Table 3 reports the results of the various estimates of Equation (1), where all the variables are inserted in levels.

Table 3 about here

Model 1 proposes the estimates for the entire sample, via pooled EGLS with cross section weighted coefficients, to allow for cross sectional heteroskedasticity, and clustered standard errors, to avoid the risk of inflating the significance of the estimates in the absence of fixed

effects. These cannot be introduced because most of the variables of the vectors ***POLITICS*** and ***CULTURE*** are time invariant. The results strongly support the view that the method of financing local expenditures matters for corruption: if decentralization is carried out on both sides of the budget, i.e., by increasing also the amount of taxes that are spent locally, corruption is low. Grants financing has the opposite effect, but it is not statistically significant in this specification. Importantly, controlling for the level of expenditure decentralization is also relevant, since corruption is low only if expenditure decentralization is carried out at a level well above the sample average, i.e., the 60%-80% and 80%-100% quartiles – and the latter even more than the former. Coming to the controlling factors, the dimension of the public sector is statistically insignificant, because of its collinearity with *GRANTS* and *OWNREV*; neither GDP per capita appears significant, possibly because what really drives the Lipset hypothesis is the level of education, that shows the expected positive sign; in particular, education was introduced at its initial value, to account for the very long lag with which it produces its effects. *POP* has the expected positive, "jump the queue" effect on corruption and openness to international trade is negatively correlated, although only at the 10% level. Also the presence of natural resources, at the beginning of sample value to better capture their characteristic of being an endowment, the degree of ethnic fractionalization, the share of protestant believers in the population, the degree of democracy of the country and the adoption of a presidential government system have the predicted signs, are significant and robust to changes of the covariates. The same cannot be said about British colonial legacy, the fact that the legal system is common law and the number of legislative veto players active in the country. All these variables are highly time invariant and tend to capture correlated phenomena, so multicollinearity conditions the precision of their estimates.

The exploitation of the time series dimension of our sample carries potential problems of endogeneity between some covariates and the degree of corruption. In particular, it is possible that corruption affects per capita income, total government expenditures, the

exploitation of natural resources and the level of education. To account for that, model 2 presents the estimates of equation (1) via pooled IV-two stages EGLS, again with cross section weights and clustered standard errors. As it is current practice in the literature, we use the lagged value of the potential endogenous regressors as instruments; we have however departed from this practice in the case of *FUEL* and *SCHOOL*, which are likely to have a dynamically slow impact on the dependent variable. These variables have been instrumented with the second and third lagged value, the longer excursion that the time dimension of the dataset allows. Under IV estimation, the results specifically related with the correlation between decentralization and corruption appear even more consistent with the theoretical predictions; *OWNREV* keeps its negative estimated coefficient, while *GRANT* appears positively correlated with corruption and becomes statistically significant. Also the size of the public sector becomes statistically significant, supporting the view that a more public spending generally multiplies the opportunities for malfeasance. Once more, this result is conditional on the government level where public spending is carried out, because expenditure decentralization, provided that it is accompanied by tax decentralization, confirms to be an effective constraint on corruption. The other controls maintain their signs and statistical significance; only the estimated coefficient of per capita GDP, once instrumented, becomes positive and acquires significance, at the cost of subtracting it to education – but both covariates were insisting on the Lipset hypothesis.

As a further control of the robustness of the correlation between fiscal decentralization and corruption, we have examined this relationship by looking at it…from the other side of the budget; in other words, we have introduced the share of expenditures supplied by the central government and the subcentral governments as continuous variables, while controlling for tax decentralization by means of the usual dummies that identify the quartiles of medium, high and very high decentralization of own revenues. The results, reported in Model 3, confirm that local spending, controlling for tax decentralization, is correlated with

low corruption, while the opposite is true for central government spending. The likely explanations for this effect are the better satisfaction of individual preferences and the improvements of the agency relationship with elected officials that decentralization brings about. These results are conditional on effective tax decentralization, as shown by the own revenue decentralization dummies, which are all positive and become significant at the quintile between 60% and 80% of the interval, where most of the decentralized countries are clustered. In this specification it would have been ideal controlling for the size of the public sector by the share of tax revenues over GDP; as GFS has yet not published such data for the entire sample under investigation, we had to resort to the share of total expenditure. This, being collinear with *SGEXP* and *CGEXP*, has the correct sign but it is not significant. All the other variables basically confirm the signs and levels of significance already found in the previous models.

The GFS data create concerns about the accuracy with which they proxy actual tax autonomy via *OWNREV*. The alternative indicator provided by Stegarescu (2005) covers only 18 OECD countries for the 1999-2001 period. This much more limited sample does not allow to use lagged values of potentially endogenous covariates as instruments because of its limited time dimension; we thus resorted to an EGLS estimator like in model 2, which provided results qualitatively in line with the IV estimates. Furthermore, to preserve the degrees of freedom model 4 thus estimates a more parsimonious specification of equation (1) using the *RA* variable in place of *OWNREV*. Model 4 again confirms the pattern of relationships between fiscal decentralization and corruption: grant-financing of decentralization are correlated with corrupt practices, while tax financing autonomously decided by subcentral governments is associated with low levels of corruption. Expenditure decentralization confirms to be also correlated with low levels of corruption, but in this specification, where the sample of countries is more homogeneous and the definition of tax autonomy more precise, the effect of expenditure decentralization becomes predominant. The

significance of the control variables reflects the greater homogeneity of the OECD sample: the number of veto players, the government system and the protestant work ethic show the expected signs; other covariates, related to the colonial past, the enjoyment of civil and political rights and the degree of democracy did not attain any significance level, even when considered in isolation; they were excluded from Model 4.

Finally, we have inserted a proxy for administrative decentralization, *TIERS*, used in Fan, Lin and Treisman (2009) where it carried probably the highest explanatory power among the decentralization variables. Its consideration alongside our indicators of fiscal decentralization allow to verify which of the two processes of decentralization, i.e., administrative and financial, are mostly correlated with corruption. It is also a test of whether the consideration of the time series dimension actually augments our understanding of the link between decentralization and corruption. Model 5 reports the results of the IV estimates, that basically replicate the specification of model 2 with the addition of *TIERS.* While this variable is not significant, *OWNREV* maintain its sign and significance. *GRANT* remains positive but loses significance, possibly because countries with many government levels also rely heavily on grants. The expenditure decentralization dummies are all highly significant. The other controls basically remain unchanged. These results indicate that the neglect of the time series dimension in the data does not only produce a loss of information, but also leads to incorrect results. Model 5 also shows that it is fiscal decentralization that matters in the relationship with corruption, rather than political and administrative decentralization.

All in all, this series of estimates allows us to answer "yes" to the first question, namely, countries with more decentralized fiscal and spending powers are also characterized by a lower levels of corruption. Interestingly, when the time series dimension of the data is considered, as in the present study, fiscal decentralization appears to play the most important explanatory role with respect to corruption. With that in mind, we now further exploit the

time series dimension to try to answer to the second question, namely: do changes in the degree of decentralization of such powers affect the level of corruption?

5. Estimates of the relationship between changes in decentralization and corruption

The choice of the difference operator d and of the lag structure Λ is the key in the estimates of equation (2). In the absence of a theory describing the dynamics of the relationship between decentralization and corruption, we proceed in two steps. First, we average out the continuous variables over three years, and the lag structure of 1. This seems to us a reasonable time frame for a decentralization reform to produce its effects on corruption and, at the same time, it leaves a time dimension sufficient for pooled regression analysis (4 time intervals). It is also the same dynamic structure adopted in studies of the effects of decentralization reforms on the changes in the composition of government spending (Kappeler and Välillä, 2008). Under this specification, the 2006-2007 average change in the degree of perceived corruption for country i is regressed on the average change in the indicators of fiscal decentralization of the period 2002-2004, and so on. The analysis aims at uncovering whether changes in the degree of decentralization have produced any change in the country's level of corruption after three years[8]. Secondly, we verify whether the results thus obtained are stable and can be considered as equilibria. To this end, we increase the lag structure to five years; by doing so, we examine whether the correlation found in three years persists over a longer time span. If it is the case, the correlation is stable and identify an equilibrium condition. The relatively short time series makes it impossible to distinguish short run from long run correlations by means of panel cointegration analysis or vector

[8] We have also tried a specification in first differences, i.e., with a one year lag, but, predictably, the results were not very satisfactory. Evidently, one year is too short a period for decentralization reforms to affect the level of corruption. The results, not reported in the paper, are available upon request.

correction models. The dummy controls generally show little if any variability, and are entered in levels. Since the choice of this lag structure removes any potential problem of endogeneity, we estimate all models via pooled EGLS, always with cross section weighted coefficients and clustered standard errors. Table 4 reports the results for the three years lag.

Table 4 about here

Model 5 can be considered the baseline model, as it includes all countries and the largest number of covariates. The main result is that changes in *GRANTS* are not significant, while variations in *OWNREV* do reduce corruption, always keeping the level of expenditure decentralization constant. Reforms that reduce situations of common pool and make subcentral governments bear the financial and political costs of their expenditure decisions appear the most effective tool to reduce corruption. The other continuous variables keep the expected signs but, predictably, most of the variables entered in levels and the time invariant covariates loose statistical significance in this dynamic specification. The level of democracy carries the highest explanatory power among the controls.

The analysis of the determinants of changes inherently lends itself to policy advices that can be contingent on the sample chosen. We choose to disaggregate the analysis between OECD and non OECD countries. Model 6 reports the estimates for the OECD sample. Neither the level (reported), nor the evolution of education seems to play a role, possibly because of the already high schooling levels in these countries. Predictably, the level of democracy is not significant, while the number of veto players is, with the expected negative sign, i.e., a positive impact on corruption. On the other hand, in the non-OECD sample, (model 7), changes in the vertical distribution of taxing powers seem to play no role in the reduction of corruption, as they never turn out significant. Expenditure decentralization instead seems to matter more, particularly at high levels of decentralization (between 60% and 100%). This may be evidence that in these countries briberies take place mostly at the central government

level. Furthermore, improvements in education seem to be a more effective policy to combat corruption, inasmuch as they enhance citizens' participation to, and control of the activities of, the public sector. Given the altogether different levels of education in the OECD and non OECD samples, the opposing results on the covariate *SCHOOL* reinforces the overall plausibility of the estimates.

As we did in the estimates of equation (1), in model 8 we control the robustness of the results by looking at the impact on corruption of a process of expenditure decentralization, holding tax decentralization constant. Consistently with what already found in the estimates on the levels, decentralizing expenditures decreases corruption, while their centralization shows a positive correlation, although it fails just short of being significant. The comparison of models 8 and 10, the effects of expenditure decentralization seems to originate entirely from the non OECD sample. This effect is conditional on an effective decentralization of the power to tax. In this respect, the results reported in model 9 and 10 indicate that this is especially relevant in the non OECD countries. Interestingly, in that same sample, also an increase of the total size of public spending is correlated with an increase in corruption. Per capita income growth never reduces corruption, suggesting that, barring other circumstances, what distinguishes corruption in the OECD and non OECD countries is the level of sophistication with which such practices are carried out. This interpretation is corroborated by the evidence that education holds the predicted corruption-limiting effect only in the non-OECD sample. These result call for a closer investigation of the Lipset hypothesis. Finally, the number of veto players facilitates corrupt practices only in the OECD countries, while the reduction in corruption that more democracy brings about is concentrated in the non-OECD sample. All other covariates, especially those with very little time variation, were always highly insignificant and were therefore never reported.

To verify whether these results are stable and identify equilibrium conditions, we increase the lag structure to five years. The reduction of the dimension of the panel requires the use of parsimonious specifications; we have therefore concentrated only on fiscal decentralization viewed from the point of view of taxation (model 11) and expenditure (model 12), without disaggregating between OECD and non OECD samples. Table 5 reports the results.

Table 5 about here

The results of model 11 confirm those found with a three years lag specification, the decreasing effect of corruption associated with the decentralization of the power to tax found after three years remains still there after five years. If anything, the corruption enhancing effects of grant financing becomes more evident in the estimates, as the coefficient on $d(GRANT)$ at Λ=5 becomes statistically significant. Also the other results remain unchanged. The estimates suggest that the negative correlations found in the three years lags is a stable equilibrium condition. As for expenditure decentralization, holding revenue decentralization constant (model 12), the results are also satisfactory and in line with those found setting Λ=3: the five year lag of the covariates *CGEXP* and *SGEXP* have the correct signs and, again, only that on *SGEXP* is statistically significant. Also the perspective from expenditure decentralization confirms that the results identify a stable equilibrium.

All in all, the estimates of equation (2) show that changes in the degree of fiscal decentralization indeed affect the level of corruption. For the OECD countries in particular the greatest gains in terms of reduction of malfeasance appear to derive from the imposition of harder budget constraints in local government, i.e., from a reduction of grant financing of local spending programs and a progressive decentralization of the power to tax. If this condition is met, a further constraint on corrupt practices appears to derive from decentralization of spending programs, possibly because of improvements in the agency relationship between voters and elected officials and/or because of a better satisfaction of

heterogeneous preferences for public goods and services, which reduces the incentives for individuals to "jump the queue". In the non-OECD sample the policy implications become less clear cut, but the same suggestion to decentralize expenditures and taxes seem to emerge. Yet, improvements in the level of education play an especially important role in these countries. These results remain stable when the lag structure is stretched to five years, and can be thus considered as stable equilibria.

6. Conclusion

This paper innovates on the literature about the link between decentralization and corruption because it is the first to examine the time dimension in which this relationship unfurls. The existing literature relies on simple cross section analysis. The consideration of the time series dimension for the countries where it is available yields estimates that are both more informative and methodologically more satisfactory for the empirical analysis. Most of all, the empirical model thus becomes more coherent with observed reality, as it does not require the hypothesis that variables are observed at equilibrium conditions that cross section models engender; this assumption is at odds with the fact that many countries are implementing decentralization reforms ostensibly to reduce corruption.

The empirical analysis has found a robust correlation between high decentralization and low levels of corruption; furthermore, an increase in the degree of fiscal decentralization produces a stable reduction of corruption after three years, as it is found also in a five year lag specification. This result appear to be an equilibrium and therefore can serve as a basis for policy advice. In particular, the estimates indicate that in the OECD countries improvements in the quality of governance can be expected mostly from the reduction of situations of common pool and soft budget constraints in subcentral government levels. In non OECD

countries, instead, improvements in the level of education represent a more decisive force to reduce corruption. In all cases, what matters is the degree of fiscal, rather than administrative, decentralization, another new evidence produced by the consideration of the time series dimension of the data, instead of just the cross section. An expansion of the number of countries for which time series data about fiscal decentralization appears the next step to make to deepen our understanding on the relationship between decentralization and corruption.

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Table 1. Descriptive statistics

	mean	*median*	*st. dev*	*min*	*max*
BRT	0,25	0,00	0,43	0,00	1,00
CATH	0,43	0,37	0,35	0,00	0,92
CGEXP	0,30	0,30	0,10	0,00	0,65
CPI	6,46	7,31	2,49	0,70	10,00
DEM	9,37	10,00	1,08	0,00	10,00
ETFRAC	0,22	0,13	0,21	0,03	0,83
GDPPC	22215,32	23122,55	13478,80	1750,83	88335,05
GRANT	0,14	0,13	0,12	0,00	0,89
HIDECEXP	0,23	0,00	0,43	0,00	1,00
HIDECTAX	0,24	0,00	0,43	0,00	1,00
LEG	0,36	0,00	0,48	0,00	1,00
LOWDECEXP	0,23	0,00	0,41	0,00	1,00
LOWDECTAX	0,23	0,00	0,42	0,00	1,00
MIDDECEXP	0,38	0,00	0,48	0,00	1,00
MIDDECTAX	0,31	0,00	0,46	0,00	1,00
OWNREV	0,19	0,15	0,18	0,00	1,00
POP/1000000	78,79	21,51	195,19	0,42	1129,87
PROT	0,00	0,00	0,00	0,00	0,00
RA	26,26	23,95	18,60	0,11	61,70
SGEXP	0,15	0,15	0,09	0,01	0,75
SYS	1,51	2,00	0,84	0,00	2,00
TIERS	3.64	4	0.83	2	5
TOTEXP	0,42	0,42	0,31	0,00	3,41
VETO	4,43	4,00	1,76	1,00	17,00
VHIDECEXP	0,16	0,00	0,38	0,00	1,00
VHIDECTAX	0,22	0,00	0,41	0,00	1,00

Table 2. Correlations among independent variables

Correlation	*BRT*	*CATH*	*CEX*	*CL*	*CPI*	*DEM*	*ETH*	*FUEL*	*GDPPC*	*GRANT*
BRT	1,00									
CATH	-0,14	1,00								
CEX	-0,62	0,11	1,00							
CL	-0,09	0,31	0,35	1,00						
CPI	-0,17	-0,70	0,04	-0,42	1,00					
DEM	0,17	-0,21	-0,37	-0,43	0,16	1,00				
ETH	0,18	0,33	-0,41	-0,06	-0,04	-0,07	1,00			
FUEL	-0,09	-0,48	0,47	0,11	0,33	0,02	-0,28	1,00		
GDPPC	0,03	0,15	-0,14	-0,43	0,17	0,17	0,18	-0,28	1,00	
GRANT	0,43	0,01	-0,10	0,14	-0,35	0,13	0,04	0,29	-0,47	1,00
HIDECEXP	-0,24	-0,19	0,06	-0,16	0,26	0,33	-0,17	0,30	-0,35	-0,06
HIDECTAX	-0,26	-0,39	-0,03	-0,19	0,44	0,15	-0,36	-0,14	-0,32	-0,28
LEG	0,88	-0,14	-0,76	-0,17	-0,09	0,20	0,33	-0,21	0,05	0,39
MIDDECEXP	0,18	-0,03	0,42	0,42	-0,11	-0,19	-0,41	0,38	-0,08	-0,07
MIDDECTAX	-0,22	0,55	0,59	0,56	-0,37	-0,34	0,19	0,23	-0,12	0,12
OPEN	-0,20	0,47	0,19	-0,26	-0,12	0,12	0,18	-0,16	0,65	-0,08
OWN	0,11	-0,38	-0,44	-0,19	0,40	-0,12	0,23	-0,29	-0,16	-0,09
POP	0,39	-0,13	-0,28	0,17	-0,11	-0,06	0,08	-0,06	0,04	0,04
PROT	-0,12	-0,90	-0,02	-0,33	0,65	0,27	-0,39	0,46	-0,09	-0,11
RA	-0,15	0,35	-0,15	0,26	-0,20	0,07	0,28	0,00	-0,22	0,14
SCHOOL	0,50	-0,38	-0,52	-0,55	0,11	0,21	0,09	-0,04	0,26	0,09
SGEXP	-0,10	-0,56	-0,23	-0,28	0,53	0,29	0,01	0,07	-0,34	0,05
SYS	-0,39	0,18	0,36	0,17	0,03	-0,07	-0,13	0,08	-0,22	-0,03
TIER	-0,15	0,27	0,30	0,36	-0,43	0,07	-0,23	-0,11	-0,17	0,01
TOTEXP	-0,37	0,13	0,55	0,28	0,08	-0,22	-0,17	0,20	-0,32	0,04
VETO	0,10	0,02	-0,04	-0,29	-0,24	-0,06	-0,28	0,11	0,03	0,27
VHIDECEXP	-0,01	-0,39	-0,32	-0,21	0,37	0,17	0,28	-0,12	-0,12	0,09
VHIDECTAX	0,29	-0,34	-0,61	-0,30	0,31	0,09	0,39	-0,22	0,04	0,04

Correlation	*HIDECEXP*	*HIDECTAX*	*LEG*	*MIDDECEXP*	*MIDDECTAX*	*OPEN*	*OWN*	*POP*	*PROT*
GRANT									
HIDECEXP	1,00								
HIDECTAX	0,54	1,00							
LEG	-0,35	-0,27	1,00						
MIDDECEXP	-0,04	-0,23	0,03	1,00					
MIDDECTAX	-0,07	-0,41	-0,28	0,50	1,00				
OPEN	-0,35	-0,35	-0,21	-0,30	0,15	1,00			
OWN	0,00	0,32	0,21	-0,39	-0,54	-0,52	1,00		
POP	-0,12	-0,24	0,31	0,30	-0,11	-0,44	0,44	1,00	
PROT	0,24	0,46	-0,08	-0,11	-0,51	-0,29	0,19	-0,17	1,00
RA	0,60	0,07	-0,17	-0,22	0,17	-0,15	-0,01	0,00	-0,24
SCHOOL	-0,02	-0,04	0,44	-0,17	-0,47	-0,07	0,25	0,33	0,16
SGEXP	0,22	0,44	-0,01	-0,46	-0,52	-0,41	0,73	0,04	0,48
SYS	0,08	0,23	-0,34	-0,14	0,23	0,29	-0,42	-0,93	0,08
TIER	-0,08	-0,23	-0,17	0,43	0,41	-0,18	-0,19	0,07	-0,24
TOTEXP	-0,12	-0,02	-0,39	0,16	0,29	0,01	0,07	-0,08	-0,12
VETO	-0,13	-0,14	-0,05	-0,26	-0,30	0,29	-0,10	-0,11	0,03
VHIDECEXP	-0,17	0,19	0,10	-0,65	-0,47	-0,13	0,72	0,06	0,33
VHIDECTAX	-0,16	-0,05	0,44	-0,40	-0,56	-0,35	0,88	0,54	0,14

Correlation	*RA*	*SCHOOL*	*SGEXP*	*SYS*	*TIER*	*TOTEXP*	*VETO*	*VHIDECEXP*	*VHIDECTAX*
RA	1,00								
SCHOOL	-0,29	1,00							
SGEXP	-0,09	0,18	1,00						
SYS	0,06	-0,50	-0,05	1,00					
TIER	-0,06	-0,33	-0,10	0,06	1,00				
TOTEXP	-0,14	-0,59	0,23	0,19	0,27	1,00			
VETO	-0,16	0,36	0,02	-0,01	-0,29	0,11	1,00		
VHIDECEXP	-0,19	0,21	0,86	-0,08	-0,19	0,16	0,07	1,00	
VHIDECTAX	-0,06	0,39	0,66	-0,59	-0,18	-0,01	-0,01	0,73	1,00

Table 3. Estimates of Equation (1)

Model	*1*	*2*	*3*	*4*	*5*
Estimation method	*Pooled EGLS*	*Pooled IV-Two stages EGLS*	*Pooled IV-Two stages EGLS*	*Pooled EGLS*	*Pooled IV-Two stages EGLS*
Dependent variable	*CPI*	*CPI*	*CPI*	*CPI*	*CPI*
Sample	*All countries 1997-2007*	*All countries 1997-2007*	*All countries 1997-2007*	*OECD countries 1997-2000*	*All countries 1997-2007*
C	3.62** (2.09)	-45.89** (22.92)	11.67*** (5.03)	0.26 (0.95)	60.21* (36.84)
GRANT	-0.04 (0.09)	-3.64* 2.25)		-12.82*** (2.35)	-0.64 (0.57)
OWN	0.10** (0.05)	30.41*** (9.05)			5.16** (2.64)
RA				0.04*** (0.00)	
CGEXP			-4.06** (2.26)		
SGEXP			21.82*** (6.03)		
TIERS					0.18 (0.37)
TOTEXP	0.03 (0.09)	-5.05*** (1.29)	1.08 (1.28)	1.56 (0.95)	-2.02 (1.46)
MIDDECEXP	0.03 (0.05)	5.75*** (1.41)		1.84*** (0.16)	6.26*** (0.81)
HIDECEXP	0.16*** (0.06)	6.12*** (1.43)		1.43*** (0.15)	6.6*** (0.74)
VHIDECEXP	0.18*** (0.06)	-3.89 (4.54)		1.29*** (0.15)	4.84*** (1.87)
MIDDECTAX			0.1 (0.16)		
HIDECTAX			0.42** (0.28)		
VHIDECTAX			0.17 (0.22)		
GDPPC	-3.11^{-06} (4.73^{-06})	3.42^{-05}*** $(1.1)^{-05}$	9.41^{-06} (2.71^{-05})	9.67^{-05}*** (2.39^{-05})	1.06^{-05} (1.25^{-05})
POP	-0.01*** (0.00)	-0.01 (0.01)	-0.01*** (0.00)	0.37 (0.12)	-0.009** (0.004)
FUEL	-0.01** (0.00)	-0.1** (0.03)	0.05* (0.03)		-0.03** (0.01)
SCHOOL	0.29*** (0.12)	0.09 (0.13)	-0.86 (0.36)		0.15 (0.22)
IMP	0.007* (0.00)	0.11*** (0.01)	0.01 (0.02)		0.04** (0.01)

PR	0.15*** (0.07)	3.31* (1.9)	0.56 (0.46)		-7.71* (4.48)
ETH	-7.74*** (2.54)	16.56*** (7.31)	-10.64*** (3.54)		-3.21** (1.64)
DEM	0.09*** (0.04)	2.23 (1.79)	0.29 (0.19)		-5.48* (3.31)
BRT	0.81 (1.53)	3.38*** (0.65)	-0.39 (1.04)		-1.33 (0.88)
LEG	0.28 (1.91)	3.11** (1.38)	0.85 (1.41)		2.7*** (0.97)
SYS	-0.19*** (0.03)	6.01*** (1.83)		1.12*** (0.09)	-0.24 (0.6)
VETO	0.02 (0.02)	2.43 (3.32)	0.14* (0.08)	0.24*** (0.05)	
PROT	2.89*** (1.1)	11.28*** (2.84)	10.88*** (2.21)	2.07*** (0.38)	3.12*** (0.88)
CL	0.004 (0.12)	0.36 (0.58)			0.15 (0.29)
AR(-1)	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.99	0.92	0.97	0.97	0.78
DW	1.83	1.42	1.95	2.73	1.88
F-statistic	1177.12***	851,73***	1318.02***	104.09***	186.37***
N..	259	144	260	54	259
Instruments		$TOTEXP_{t-1}$, $GDPPC_{t-1}$, $GDPPC_{t-2}$, $FUEL_{t-2}$, $FUEL_{t-3}$, $SCHOOL_{t-2}$, $SCHL_{t-3}$	$TOTEXP_{t-1}$, $GDPPC_{t-1}$, $GDPPC_{t-2}$, $FUEL_{t-2}$, $FUEL_{t-3}$, $SCHOOL_{t-2}$, $SCHL_{t-3}$		$TOTEXP_{t-1}$, $GDPPC_{t-1}$, $GDPPC_{t-2}$, $FUEL_{t-2}$, $FUEL_{t-3}$, $SCHOOL_{t-2}$, $SCHL_{t-3}$

Note: clustered standard errors in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively

Table 4. Estimates of Equation (2), 3 years lag

Model	5	6	7	8	9	10
Estimation method	Pooled EGLS	Pooled EGLS	Pooled EGLS	Pooled EGLS	Pooled EGLS	Pooled EGLS
Lag structure Λ	3	3	3	3	3	3
Dependent variable	*dCPI*	*dCPI*	*dCPI*	*dCPI*	*dCPI*	*dCPI*
Sample	*All countries, 1997-2007*	*OECD countries, 1997-2007*	*Non OECD countries, 1997-2007*	*All countries, 1997-2007*	*OECD countries, 1997-2007*	*Non OECD countries, 1997-2007*
C	-0.29*** (0.08)	0.10 (0.11)	-0.58 (0.69)	-0.24*** (0.09)	-0.13 (0.29)	-0.13 (0.19)
d(GRANT)	0.005 (0.5)	0.04 (0.05)	1.18 (1.00)			
d(OWN)	0.089** (0.04)	0.09** (0.04)	-0.05 (0.3)			
d(SGEXP)				0.72*** (0.16)	-0.078 (0.4)	0.70*** (0.03)
d(CGEXP)				-0.57 (0.4)	-0.77 (0.5)	2.1 (1.36)
TOTEXP	0.006 (0.03)	0.15** (0.08)	-0.03 (0.17)	-0.01 (0.02)	0.17* (0.09	-0.09** (0.034)
MIDDEC	0.03 (0.04)	0.004 (0.06)	-0.06 (0.08)			
HIDEC	0.06 (0.04)	0.03 (0.06)	0.19* (0.1)			
VHIDEC	0.076* (0.04)	0.07 (0.06)	0.47** (0.22)			
MIDDECTAX				-0.010 (0.04)	-0.05 (-0.05)	0.33*** (0.08)
HIDECTAX				-0.031 (0.03)	0.1** (0.05)	0.72*** (0.05)
VHIDECTAX				0.005 (0.03)	0.09* (0.04)	0.46*** (0.05)
GDPPC	-3.58E^{-06}*** (1.35^{-06})	-4.56E^{-06}*** (1.26-06)	-1.86^{-05} (-1.26^{-05})	-2.76^{-06}** (1.34^{-06})	-3.87^{-06}*** (1.22^{-06})	-6.89^{-06}*** (1.58^{-06})
OPEN	0.001** (0.000)	0.001** (0.00)	0.004 (0.004)	0.0006 (0.0005)	0.0002 (0.0007)	
SCHOOL	-0.06 (0.09)	-0.001 (0.01)	0.073 (0.08)	-0.014 (0.009)	0.002 (0.015	0.06*** (0.01)
d(SCHOOL)			0.38*** (0.12)	-0.048 (0.09)	-0.07 (0.07)	0.24 (0.15)
FUEL	-0.01 (-0.009)	0.002* (0.00)	0.004 (0.004)			
VETO	-0.008 (0.008)	-0.021** (0.01)		-0.012 (0.01)	-0.03** (0.01)	
DEM	0.045*** (0.006)			0.052*** (0.008)	0.04 (0.04)	0.06*** (0.00)

Adj. R^2	0.12	0.14	0.15	0.3	0.017	0.76
DW	2.1	1.99	2.09	2.08	2.02	1.88
F-statistic	12.9**	12.5**	15.4**	17.6**	13.01**	11.77***
Cross-sections	24	18	7	24	18	7
N	288	210	35	288	216	35

Note: clustered standard errors in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Table 5. Estimates of Equation (2), 5 years lag

Model	*11*	*12*
Estimation method	*Pooled EGLS*	*Pooled EGLS*
Lag structure Λ	*5*	*5*
Dependent variable	*dCPI*	*dCPI*
Sample	*All countries, 1997-2007*	*OECD countries, 1997-2007*
C	-3.29 (2.5)	6.26 (7.89)
d(GRANT)	-5.24*** (1.79)	
d(OWN)	4.17*** (1.37)	
d(SGEXP)		37.06** (20.96)
d(CGEXP)		-8.69 (17.2)
TOTEXP	3.73*** (1.01)	-0.45** (0.12)
MIDDECEXP	1.26*** (0.21)	
HIDECEXP	0.54** (0.27)	
VHIDECEXP	1.86*** (0.28)	
MIDDECTAX		0.16*** (0.05)
HIDECTAX		0.37*** (0.08)
VHIDECTAX		-0.08*** (0.08)
d(GDPPC)	0.17*** (0.00)	-4.11^{-05}*** 1.17^{-05}
OPEN	0.03*** (0.01)	0.02 (0.00)
POP	-0.01*** (0.00)	0.03*** (0.01)
ETH		-20.75 (13.78)
PROT	1.7*** (0.26)	-16.14 (12.32)
BRT		-6.53 (5.46)
LEG		-3.23 (4.46)
PR	2.55*** (0.94)	

SYS	-0.2 (0.24)	4.69 (3.41)
DEM	0.46 (0.39)	0.23** (0.13)
AR(1)	No	Yes
Adj. R^2	0.95	0.79
DW	1.33	1.86
F-statistic	71.98***	672.45
Cross-sections	24	24
N	72	72