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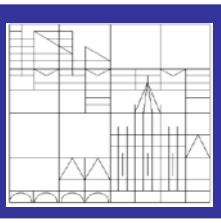

Corruption, Public Procurement, and the Budget Composition: Theory and Evidence from OECD Countries

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Corruption, public procurement, and the budget composition: Theory and evidence from OECD countries

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Abstract

This paper examines the relationship between corruption and the composition of public expenditures. First, I derive a theoretical model that links the degree of corruption in a country – to be understood as the prevailing culture of corruption – to distortions in the budget composition. The transmission channel is a rent-seeking contest where firms from different sectors pay bribes to politicians and bureaucrats to influence public procurement decisions, which give rise to endogenous rents. I then test the implications of the theoretical model with a dataset covering 29 OECD countries over the 1996-2009 period. Consistent with theoretical predictions, the relative share of expenditures on categories that involve public procurement, high-technology goods, and non-competitive markets (health and environmental protection including waste management) increases with corruption. This distortion occurs at the expense of spending categories that do not involve public procurement (social protection and recreation, culture and religion).

Keywords: Corruption; rent-seeking; public procurement; budget composition

JEL classification: D72, D73, H11, H50

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1 Introduction

The literature provides robust evidence that corruption is detrimental to a country's economic development. More specifically, empirical investigations suggest that an increase in corruption by one standard deviation is associated with an 0.8 to 1.0 percentage point decline in GDP growth (Mauro, 1995; Pellegrini and Gerlagh, 2004).[1] More recent studies suggest that the relationship between corruption and economic growth can be observed at the micro-level (Beekman et al., 2013) and that it is non-linear (Aidt et al., 2008; Méndez and Sepúlveda, 2006; Méon and Sekkat, 2005) and of a causal nature (Swaleheen, 2011).[2] The negative corruption-growth link relies on the following transmission channels: investments, trade openness, and political stability.

First, corruption reduces expected returns on investments through an increase in uncertainty and the creation of additional costs. Higher levels of risk associated with returns on investments are due to the difficulty of enforcing bribes (Boycko et al., 1996) and the fact that bribery introduces the risk of being detected. Corruption also diminishes returns on investments (even when ignoring the risk involved) because it acts as a tax. For instance, when an entrepreneur intends to start a business in a developing country, he may have to bribe a bureaucrat in order to obtain a mandatory business license.

Second, policy-makers are likely to create more barriers to trade than is socially optimal since trade restrictions can be a substantial source of rents (Krueger, 1974). For instance, a domestic monopolist has an incentive to pay bribes in order to be protected against foreign competition. Since free trade and international competition increase economic efficiency (Krugman and Obstfeld, 2006), such restrictions cause an impairment of economic growth (Pellegrini and Gerlagh, 2004).

[1] Note that in the case of Mauro (1995) this effect is only robust when using a broader measure for corruption that also includes the subjectively perceived prevalence of red tape and the efficiency and integrity of the judicial system.

[2] In contrast, Huntington (1968) and Leff (1964) assert that corruption has a positive impact on economic development. However, these contributions ignore that bureaucratic inefficiency can be endogenous.

Third, the perception that corrupted practices are pervasive in the public sector fuels political discontent and causes instability and violence. Empirical studies (Aisen and Veiga, 2013; Jong-A-Pin, 2009) point out that such a climate of political instability can be a serious obstacle to economic activity.

A fourth channel, which is relatively neglected in the existing literature, is corruption's distortionary effect on the allocation of public spending.[3] Given the growth in public expenditures during the past few decades, this transmission channel has most likely gained importance and therefore deserves more attention. The rationale behind a corruption-related distortion of the public budget is that bribe-maximizing politicians and/or bureaucrats prefer to shift resources to areas with the best opportunities to be bribed. More specifically, they have an incentive to increase the share of public expenditures that is spent on high-technology goods produced in oligopolistic markets (Mauro, 1998). This ensures that bribery is difficult to detect as prices are hardly comparable for innovative products and allows politicians and/or bureaucrats to collect more generous bribes since large profits are at stake.

In line with the fourth transmission channel, Gupta et al. (2001) provide evidence for a positive relationship between corruption and military spending, while Mauro (1998) presents cross-sectional evidence for a negative relationship between corruption and education expenditures. The neglect of unobserved heterogeneity in Mauro's cross-country analysis may explain why he does not find a positive association of corruption with defense expenditures in contrast to Gupta et al. (2001). Another shortcoming is that both studies mostly rely on data from developing countries, which makes it difficult to draw conclusions for the developed world.

This paper goes beyond the existing literature on the relationship between corruption and the composition of government spending in the following respects: it is (i) the first to focus on the OECD countries for which fiscal data is more comparable across countries and more comprehensive (i.e. covering a total of ten spending categories) and

[3]For a summary of the evidence for a link between corruption and public finances see Hillman (2004).

(ii) the first to undertake the analysis within the context of a two-way fixed effects panel model (29 OECD countries from 1996 to 2009).[4,5,6] Even though the focus on a specific group of countries reduces the heterogeneity in the dataset, the cross-country variation in Transparency International's Corruption Perceptions Index (CPI) in the sample is quite large ranging from 0.42 (average for Denmark) to 6.05 (average for Poland).[7]

The paper also benefits from a theoretical model which shows how corruption may influence the allocation of public funds. It first derives how a distortion in public spending arises in the context of a two-stage rent-seeking model with endogenous rent-setting that captures both "political corruption" and "bureaucratic corruption". The model illustrates how the number of firms in an industry (representing the degree of competition) and transaction costs (representing the difficulty of concealing bribery) affect the allocation of public expenditures, while the corruption culture affects the share of the public budget that a politician makes available as the contest prize. To my knowledge, the distortion of public spending due to corruption has so far not been addressed in any existing rent-seeking model in the literature.

The empirical analysis suggests that an increase in the level of corruption is associated with more spending on health and environmental protection, while the shares of expenditures on social protection and recreation, culture and religion are negatively correlated with corruption. These findings are consistent with the implications of the theoretical model as the waste management (as part of environmental protection) and the health sector are characterized by public procurement, high-technology, and oligopolistic market structures, while this is not true for social protection and recreation, culture and religion.

[4]GFS data by the IMF on worldwide public expenditures is criticized for its lack of cross-country comparability (Mauro, 1998).

[5]Australia, Chile, Estonia, Mexico, and Turkey are not included in my sample of OECD countries due to missing data.

[6]Delavallade (2006) also includes several expenditure categories in her analysis, but focuses on a set of developing countries over the 1996 - 2001 period.

[7]The CPI scale (0-10) has been inverted so that a higher value indicates a higher level of corruption.

The analysis proceeds as follows: Section 2 discusses the role that non-competitive market structures and high-technology play for corruption in the public sector. Section 3 formalizes this intuition by means of a two-stage rent-seeking model with endogenous rent-setting. Section 4 describes the dataset and the empirical strategy. Section 5 reports the results for the baseline estimations and five robustness checks. Section 6 concludes.

2 Market structure, technology, and corruption in public procurement

Governments spend their resources in various ways such as the direct provision of services (e.g. education and fire protection) and the redistribution of income across members of society. The following discussion focuses on expenditures that arise when politicians or bureaucrats commission private sector firms to provide the government (and ultimately citizens) with specific goods or services. Examples for public procurement can be found in the health and military sector as well as with regard to waste management. The objective is to gain an intuitive understanding as to what factors influence the direction of the distortions in the budget composition when the government and the private sector interact in such a setting.

In her seminal contribution, Krueger (1974) points out that the existence of rents induces rent-seeking behavior.[8] Hence, one way to assess where bribes are most likely paid in the public sector is to analyze which types of public expenditures promise rents to politicians and/or bureaucrats. Going one step further, I analyze which types of public expenditures promise the *highest* rents to politicians and/or bureaucrats.

One factor that is related to the size of the rent, which the public official can expect, is the market structure that potential bribers are facing (Rose-Ackerman, 1975). Since the payoffs from being awarded a public contract are much higher in a non-competitive

[8]Note that rent-seeking and corruption are related but not entirely congruent concepts. Lambsdorff (2002) provides an overview of the literature that uses rent-seeking models to describe corruption.

than in a competitive setting, a bribe-maximizing politician has an incentive to shift as much as possible of the public resources available to him to types of expenditures which are spent in non-competitive markets (Mauro, 1998). Of course, there is a limit as to how large this distortion gets as the politician wants to keep the probability of detection reasonably low. The impact of the market structure on rent-seeking activities can also be extended to the international sphere given the evidence that corruption prevails in countries where firms are less exposed to foreign competition (Ades and Di Tella, 1999).

Due to high entry barriers one can well imagine that the above argument related to non-competitive market structures applies especially to high-technology markets. Yet, there is also another reason why public officials prefer to shift resources to types of expenditure that are technology-intensive. The necessity of secrecy for an illegal act such as bribery implies that corrupt politicians prefer to collect bribes on goods whose exact value cannot be ascertained such as high-technology goods that are not too widely distributed (Mauro, 1998; Shleifer and Vishny, 1993). The fact that this is especially true for defense expenditures due to national security reasons is pointed out by Hines (1995). He provides evidence that international trade in military aircraft is particularly prone to corruption.

The bribe that an agent from the private sector is willing to pay in order to succeed in a public invitation to tender is likely to increase proportionally with the profits that the briber earns with the involved public project. This line of reasoning implies that corruption induces a shift of public resources to expenditure types that are allocated to large projects (Bardhan, 1997). Since the size of a project increases with the prices of the products bought, this argument is again related to oligopolistic market structures and the fact that high-technology products require large R&D investments. The finding that public resources are shifted to investments in the building and creation of projects and away from operation and maintenance lends some support to this hypothesis (Tanzi and Davoodi, 2000).

To conclude, the above considerations suggest that two main factors affect the direction of distortions in the public budget: the extent of market concentration in specific industries and the difficulty of concealing bribery related to the comparability of prices. The following section integrates these considerations in a two-stage rent-seeking model. To do so, I divide the private sector into different industries that may be commissioned by the government to provide a good or a service, which in turn translates into expenditures in distinct categories.

3 A two-stage bribing contest with endogenous rent-setting

3.1 General framework

This section theoretically analyzes allocation decisions in a public procurement context using a two-stage rent-seeking framework. The objective is to illustrate mechanisms that explain how corruption leads to a distortion in the allocation of public expenditures.[9]

Rent size is endogenously determined in line with Appelbaum and Katz (1987).[10] The considerations from section 2 are integrated into this model by means of two exogenous variables: the number of firms $n_j \geq 2$ (representing the degree of competition) and the effectiveness of rent-seeking efforts β_j (inversely related to the transaction costs involved in keeping bribery secret) across two industries $j = A, B$.[11]

The model includes a third exogenous variable which influences the extent to which asymmetries in n and β give rise to budget distortions: the culture of corruption τ

[9] According to Congleton et al. (2008), rent-seeking contests take place when there is a contestable rent at stake, when resources can be used to influence distributional outcomes, and when individuals rationally decide to invest in contesting pre-existing resources rather than taking up productive activity. One aspect that differs in my model is the extent of dissipation given that the rent-seeking "efforts" in my model represent income transfers, i.e. bribe payments, that are only partially wasted through the existence of transaction costs in hiding bribes.

[10] For an earlier application of two-stage modeling of rent-seeking activity see Katz and Tokatlidu (1996).

[11] The parameter β_j relates for instance to the analysis by Stein (2002) on the implications of an asymmetry in the ability to convert expenditures into meaningful efforts.

(a larger value for this parameter indicates that corruption is more common). This parameter is introduced in section 3.3 where I will discuss the politician's bribe income as a function of τ. The underlying intuition is that the ingrained corruption culture in a country has an influence on the psychological costs of accepting a bribe. This may reflect a guilty conscience, the likelihood of detection and potential sanctions.

The model rests on the assumption that a politician has discretion over the allocation of a budget $G > 0$. Even though G itself is fixed, the politician can determine what share $(1-\gamma)$ of the public budget G is made available to the rent-seeking contest and therefore, he is a rent-setter.

If the politician announces (before the contest starts) that he will allocate a large share of the public budget G to the rent-seeking contest, he is likely to lose the election and to receive neither any of the bribe income R_1 (will be defined at the end of section 3.3) nor his salary in office y. Instead, he earns an alternative compensation $V < y$.[12]

On the other hand, if the politician announces that a small share of G will be allocated to the contest, he is more likely to win the election. However, the size of the politician's bribe income, that he only receives if he takes office, depends positively on the share of the public budget that is allocated to the contest. Therefore, the politician is in summary weighing up the benefit of a higher probability of winning the election against the benefit of receiving more bribe income when in office.[13]

There are two industries denoted as $j = A, B$ that consist of n_j symmetric firms. In the first stage of the contest, these firms pay bribes x_{ij} to the politician in order to win

[12]At first sight, one is tempted to believe that the politician earns a lower wage when in office than when he works in the private sector. However, for several reasons I make the opposite assumption. First, one could interpret y and V as utility levels and argue that politicians gain an "ego-rent" from holding office. Second, one has to take into account that successful electoral candidates are offered more lucrative employment opportunities after their political career than candidates that never hold an office (see for example Eggers and Hainmueller (2009) and Fisman et al. (2012) for empirical evidence on the positive effect of holding office on post-career earnings of politicians). Hence, y and V can be interpreted as the present value of the candidate's lifetime utility in the two scenarios. Moreover, while in comparison Appelbaum and Katz (1987) require $y + R_1 > V$ to hold, this is automatically fulfilled with $y > V$.

[13]Ursprung (1990) relies on a similar theoretical framework to analyze how underdissipation arises with contested rents that have a public good character. The main difference to the model at hand is that he uses explicit electoral competition in a two-candidate setting in order to endogenize the prize of the contest.

the rent $S = (1 - \gamma)G$. Given that the rent is divisible, each industry wins an expected share of the rent S which represents a *public good* at the beginning of the second stage.

The second stage constitutes a separate contest since the recipient of the bribe is now a different person (a bureaucrat) assumed to be independent from the politician, which implies that the first-stage bribes are sunk.[14] In this intra-industry bribing contest, the expected share of the rent S represents a *private good*. Expenditures by each firm in the second round are denoted by y_{ij}.

The idea that corruption occurs at multiple levels has previously been put forward especially by Shleifer and Vishny (1998), who have in this context coined the term 'the grabbing hand'. A detailed classification of the theoretical literature on corruption can be found in Aidt (2003), where it is argued that "Only by taking seriously the possibility of self-interest at all levels of government as advocated by *The Grabbing Hand* can real progress be made in developing a satisfactory positive theory of corruption" (p.F649), which clearly supports my modeling approach.

In sections 3.2 to 3.4, this model is solved recursively given that the individual firms anticipate in the first stage that they will have to engage in a second-round contest.

3.2 Bureaucratic corruption: Bribing contest between firms

In the second stage, the firms in industries A and B compete for their individual share of the rent $P_j S$ (where P_j is the rent share that industry j has captured in the first-stage contest) by paying bribes y_{ij} to a bureaucrat who has complete discretion over the allocation of his fixed budget. His decision is based entirely on the relative amount of

[14] An alternative approach is to use an exogenous sharing rule as in Nitzan (1991). Yet, my objective is to explicitly allow for a second stage in line with the notion of the 'grabbing hand' (Shleifer and Vishny, 1998).

bribes that he receives. Following Tullock (1980), the share of the industry-specific rent that firm i wins is represented by:

$$p_{ij} = \begin{cases} \frac{y_{ij}}{y_j} & \text{if } \max\left\{y_{1j}, ..., y_{n_j j}\right\} > 0 \\ \frac{1}{n_j} & \text{else.} \end{cases} \tag{1}$$

Consequently, firm $i = 1, ..., n_j$ in industry $j = A, B$ solves:

$$\text{Max} \quad \pi_{ij} = p_{ij} P_j S - y_{ij}. \tag{2}$$

Assuming a Cournot-Nash equilibrium, an interior solution and symmetric firms within each industry, the size of the bribe that an individual firm pays to the bureaucrat and the sum of bribes paid by an entire industry can be expressed as follows:

$${y_{ij}}^* = \frac{n_j - 1}{{n_j}^2} P_j S, \qquad {y_j}^* = \frac{n_j - 1}{n_j} P_j S. \tag{3}$$

These equations reveal that the optimal bribe paid by an individual firm decreases with the number of firms since each firm expects to win a smaller rent share. Yet, the sum of bribes paid by an industry increases with the number of firms. Plugging the expression for the optimal bribe into equation (2), the expected profit of an individual firm is:[15]

$${\pi_{ij}}^* = \frac{1}{{n_j}^2} P_j S. \tag{4}$$

Note that the existence of a second-stage contest gives rise to a waste of resources. If the individual firms abstain from bribing the bureaucrat, each firm would receive an expected profit of ${\pi_{ij}}^* = \frac{1}{n_j} P_j S$. However, the firms are likely to mistrust each other and have no reason to believe that the other firms will abstain from bribing the bureaucrat.

[15] Obviously, the share of the rent that an individual firm obtains (i.e. the value of the project(s) that the firm has been assigned to) does not represent pure profits. However, in order to keep the model tractable I have abstained from introducing an additional parameter that captures the profit margin.

In the case where $n_A < n_B$, equation (4) predicts that the expected profit for firms in industry A is higher than for firms in industry B, i.e. ${\pi_{iA}}^* > {\pi_{iB}}^*$.[16] If the valuation of firms in industry B for entering the second-round contest is comparatively lower, this is likely to have an influence on the first-stage bidding behavior of this industry. This will be analyzed in the next section.

3.3 Political corruption: Bribing contest between industries

In the first stage of the contest, the politician decides what share of S to allocate to each of the two industries depending on the relative size of the bribes that he receives from the two industries. When industry j collectively expends x_j, the politician receives $\beta_j x_j$ with $0 < \beta_j \leq 1$.[17] The parameter β_j is introduced in order to reflect the fact that the transaction costs involved in keeping the bribe payment secret may differ between the two industries. The larger β_j is, the lower are the transaction costs. In conclusion, the share of the rent S that the firms in industry $j = A, B$ obtain is represented by:

$$P_j = \begin{cases} \frac{\beta_j x_j}{\beta_j x_j + \beta_{-j} x_{-j}} & \text{if } \max\{x_j, x_{-j}\} > 0 \\ \frac{1}{2} & \text{else .} \end{cases} \tag{5}$$

Even though the politician allocates S according to the relative size of the aggregate bribes in each industry, each firm decides individually on the size of the bribe x_{ij} that is paid to the politician. The profit that an individual firm can expect when entering the second round of the contest is represented by ${\pi_{ij}}^*$ (see section 3.2). Based on these considerations, each of the n_j symmetric firms in industry $j = A, B$ solves the following maximization problem:

$$\text{Max} \quad \Pi_{ij} = {\pi_{ij}}^* - x_{ij}. \tag{6}$$

[16] Note that the difference in expected profits between the two industries grows disproportionately with the difference in group sizes n_A and n_B due to the squared term in the denominator.

[17] I have abstained from introducing a parameter to capture transaction costs in section 3.2 since there is no intra-industry heterogeneity in this respect. Therefore, any such parameter would drop out of the contest success function presented in equation (1).

The first-order condition for this optimization problem can be written as follows:

$$\beta_j \beta_{-j} \sum_{i=1}^{n_{-j}} x_{i-j} S - \left(\beta_j \sum_{i=1}^{n_j} x_{ij} + \beta_{-j} \sum_{i=1}^{n_{-j}} x_{i-j} \right)^2 {n_j}^2 = 0. \tag{7}$$

Taking into account the symmetry of firms within the two industries, we obtain:

$$n_{-j} \beta_j \beta_{-j} x_{i-j} S - (n_j \beta_j x_{ij} + n_{-j} \beta_{-j} x_{i-j})^2 {n_j}^2 = 0. \tag{8}$$

As a next step, I combine equation (8) with the equivalent first-order condition for the optimization problem of industry $-j$. This yields the following expression for the relationship between the total expenditures of the two industries in equilibrium:

$${x_j}^* = {x_{-j}}^* \frac{{n_{-j}}^2}{{n_j}^2}. \tag{9}$$

Finally, I combine equations (8) and (9) to rewrite the equilibrium expenditures by industry j as a function of the number of firms in each industry, the transaction costs in making a bribe payment, and total rent size:

$${x_j}^* = \frac{\beta_j \beta_{-j}}{{n_{-j}}^2 (\beta_{-j} \frac{{n_j}^2}{{n_{-j}}^2} + \beta_j)^2} S. \tag{10}$$

On the basis of equation (10), it is straightforward to derive the politician's total bribe income $R_1 = \tau(\beta_j {x_j}^* + \beta_{-j} {x_{-j}}^*)$. The intuition behind the τ parameter ($0 < \tau \leq 1$) is that when corruption is less common in a country, the politician suffers from higher psychological costs when accepting a bribe. This may reflect a guilty conscience, the likelihood of detection and potential sanctions. Bribe income is then:

$$R_1 = \left(\frac{\beta_j}{{n_{-j}}^2 (\beta_{-j} \frac{{n_j}^2}{{n_{-j}}^2} + \beta_j)^2} + \frac{\beta_{-j}}{{n_j}^2 (\beta_j \frac{{n_{-j}}^2}{{n_j}^2} + \beta_{-j})^2} \right) \tau \beta_j \beta_{-j} S. \tag{11}$$

Equation (11) suggests that the larger the rent S is, the more bribe income is collected by the politician. However, the influence of the number of firms and the size of transaction costs is less obvious at this point (see section 3.4 for such comparative statics analyses).

3.4 Endogenous rent-setting

Following Appelbaum and Katz (1987), the politician is at the same time a rent-seeker and a rent-setter. Therefore, the size of the rent is determined endogenously. More specifically, the politician is torn between two objectives. He seeks to be elected and earn a high salary y, but on the other hand he also wants to collect a high bribe income R_1.

Both of these objectives depend on what share $(1-\gamma)$ (with $0 \leq \gamma \leq 1$) of the total budget G he makes available to the rent-seeking contest ($S = (1-\gamma)G$). When γ is large, the rent S is small and following equation (11) the politician's bribe income will be low. On the other hand, a large γ increases the probability g that the politician wins the election and receives a high salary. In summary, the risk-neutral politician faces the following objective function:

$$\text{Max} \quad E[U] = g(\gamma)(y + R_1) + (1 - g(\gamma))V. \tag{12}$$

In order to allow for an explicit solution for equation (12), I assume $g(\gamma) = \gamma$. The maximization of equation (12) yields the following expression for the equilibrium share of the budget G that is not allocated to the rent-seeking contest:

$$\gamma^* = \frac{1}{2} + \frac{y - V}{2\tau\kappa G} \quad \text{with} \quad \kappa = \left(\frac{\beta_j}{n_{-j}{}^2(\beta_{-j}\frac{n_j{}^2}{n_{-j}^2} + \beta_j)^2} + \frac{\beta_{-j}}{n_j{}^2(\beta_j\frac{n_{-j}{}^2}{n_j{}^2} + \beta_{-j})^2} \right) \beta_j\beta_{-j}. \tag{13}$$

Equation (13) shows that the politician makes less than half of the total budget G available as a rent for the bribing contest under the assumption that $y > V$ holds. In addition, since $\gamma^* \leq 1$ has to be fulfilled, we know that $G \geq \frac{y-V}{\tau\kappa}$. Hence, the total budget has

to be large enough or conversely the salary gain from being elected into office should be moderate.

3.5 Empirical predictions

The main result of the model (in terms of testable predictions) consists of two parts. The first part explains how the corruption culture τ determines the extent of potential distortions in the budget composition which is captured by $(1-\gamma^*)$.[18] Based on equation (13), the politician's decision how much of the public budget to make available for the rent-seeking contest depends on τ as follows :

$$\frac{\partial \gamma^*}{\partial \tau} < 0. \tag{14}$$

Equation (14) shows that the overall potential budget distortion increases when corruption is more common. The mechanism behind this relationship is that the psychological cost of corruption decreases in a corrupt environment. Conversely, if τ approaches zero, the bribe income R_1 also approaches zero (see equation (11)) and the politician will choose a value for γ that is close to one since $y > V$ holds (see equation (12)).

The second main result of the model illustrates how the industry-specific degrees of competition and levels of transaction costs for keeping corruption secret affect the *direction* of the distortions in the budget. This question relates back to the derivations in section 3.3, in particular the contest-success function for the first-stage contest which describes the share of the rent that an industry gains (see equation (5)). By solving equation (9) for x^*_{-j} and plugging this into equation (5) one obtains:

$$P^*_j = \frac{\beta_j}{\beta_j + \beta_{-j}\frac{n_j^2}{n_{-j}^2}}. \tag{15}$$

[18]Note that since we do not know how the share of the budget that is allocated as a prize in the rent-seeking contest $(1-\gamma^*)$ would be spent otherwise, we cannot say for sure that a distortion (i.e. deviation from the socially optimal benchmark) occurs even though it is very likely. Therefore, I speak of *potential* distortions.

A first finding based on equation (15) is that when $\beta_j = \beta_{-j}$ and $n_j = n_{-j}$ hold, the rent $(1-\gamma^*)G$ is equally distributed over the two industries. Yet, when there are asymmetries in n and β it is likely that one industry is awarded a larger share of the rent. The following relationships can be derived:

$$\frac{\partial P_j^*}{\partial \beta_j} > 0, \quad \frac{\partial P_j^*}{\partial \beta_{-j}} < 0, \quad \frac{\partial P_j^*}{\partial n_j} < 0 \quad \text{and} \quad \frac{\partial P_j^*}{\partial n_{-j}} > 0. \tag{16}$$

It follows from equation (16) that higher transaction costs $(1 - \beta_j)$ associated with concealing corruption induce the politician to allocate a smaller rent share to industry j. Moreover, the politician allocates a larger share of the rent to an industry that is non-competitive (small n_j). If industry A has a small n_A and a large β_A while industry B has a large n_B and a small β_B, industry A will receive a much larger share of the rent.

To summarize, the theoretical analysis predicts that there is a relationship between the culture of corruption and shares of public expenditures since the distortion potential is higher when corruption is more common. The question which expenditure shares are correlated with corruption can be derived from equation (16). Since industry-specific measures of n and β across OECD countries are not available, I will use anecdotal evidence about characteristics of different industries and the degree to which expenditure shares are related to public procurement to reconcile the empirical findings in the following sections with the predictions of the theoretical model described above.

Based on equation (13), a number of additional relationships can be derived which given the available data cannot be tested but which are nonetheless of interest:

$$\frac{\partial \gamma^*}{\partial y} > 0, \quad \frac{\partial \gamma^*}{\partial V} < 0, \quad \text{and} \quad \frac{\partial \gamma^*}{\partial G} < 0. \tag{17}$$

Equation (17) suggests that the politician's motivation to abstain from making public resources available for the rent-seeking contest depends positively on the size of his salary y when in office and negatively on his alternative wage V. This corresponds with the existing evidence in the empirical (Van Rijckeghem and Weder, 2001) and experimental

literature (Schulze and Frank, 2003) for a negative relationship between the wage level in the public sector (compared to the wage level in the private sector) and the corruptibility of public officials.[19] Finally, the larger the overall budget G is, the higher is the potential bribe income of the politician and the more public resources will he make available as a contest prize. This aspect is noteworthy when considering the growth in public sector size over the past few decades which would suggest an increase in corruption-related distortions of the budget composition over time.

4 Data and model specification

4.1 Data description

4.1.1 Description of the variables

The dependent variable in the estimations is one of ten expenditure types as a share of total public expenditures from the OECD National Accounts database (see table 2 in appendix A for a list of items included in the ten categories). Even though the *absolute* amount of public resources spent on purposes that are not related to public procurement (such as social protection) may not be affected by corruption in the way described in sections 2 and 3, I include these expenditure types in the regression analysis since it is still possible that the *relative* shares are affected.

Corruption is the main explanatory variable measured by the Corruption Perceptions Index (CPI) from Transparency International. This data is of a subjective nature since the CPI relies on surveys among international business people, risk analysts, local residents and expatriates.

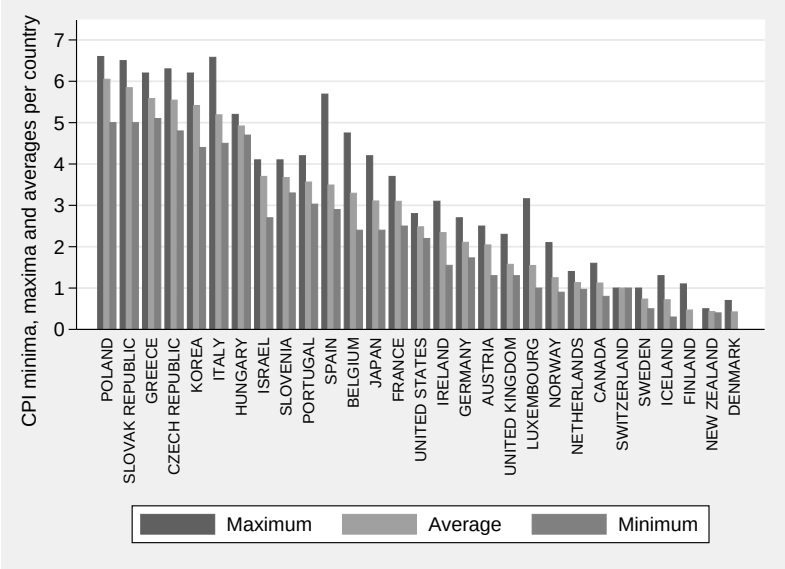
Figure 1 illustrates country averages from 1996 to 2009 suggesting that corruption is lowest in Scandinavia, whereas the most corrupt countries are mainly located in Eastern Europe and the Mediterranean region. The CPI averages exhibit a high cross-country

[19]Note that more recent evidence by Schulze et al. (2013) points to a reversal of this negative relationship into a positive relationship at very high levels of public sector wages.

variation with values ranging from less than 1 until up to 6 on a scale from 0 to 10. Figure 1 also illustrates the minimum and maximum level of perceived corruption for each country between 1996 and 2009. It can be concluded that all countries except for Switzerland exhibit variation over time in the CPI.

This variation is not concentrated in a particular geographic area: the largest variation in terms of the difference between minimum and maximum values per country can be observed for Spain (2.79), Belgium (2.35), Luxembourg (2.16), Italy (2.08), Japan (1.8), and Korea (1.8). An alternative way to define the largest within-country variation is the number of year-on-year changes in the CPI that differ by at least two standard deviations from the average year-on-year changes per country. In that case, the Netherlands, Norway, and Sweden have the largest variation with two such cases followed by Denmark, Greece, Hungary, Italy, and Luxembourg where one large year-on-year change occurs over the sample period.

Figure 1: Corruption minima, maxima and averages per country, 1996 - 2009



Notes: There is no bar for the minimum value of corruption for Finland and Denmark since the minimum value is 0. The data source is Transparency International.

While I am aware of the shortcomings of subjective indicators, using the CPI is justified. First, data on the number of corruption-related prosecutions may be rather noisy with

regard to an illegal act such as corruption and may mostly capture the extent and effectiveness of anti-corruption law enforcement. Second, even though the different surveys that are used in order to construct the CPI rely on different methodologies and interview different people, they correlate strongly with each other (Lambsdorff, 2004a). This is not a trivial finding given that one might expect foreign experts to have different perceptions of the incidence of corruption in a country than residents and local businessmen.

Third, Kaufmann et al. (2004) investigate the potential for biases in perceptions more specifically and report no significant ideological biases in corruption ratings. Finally, it has been argued that the CPI allows for year-to-year comparisons even if the sources used are not the same in each year. This is due to the fact that the effect of changes in the sources on the CPI estimate is rather small (Lambsdorff, 2004b).

As the time-series variation in the CPI is nevertheless contaminated by the variation in the underlying sources, I use the ICRG corruption index in a robustness check. This measure is provided by the private risk-rating agency Political Risk Services that publishes the International Country Risk Guide (ICRG). The advantage of this corruption measure is that it is not a composite indicator, which makes year-to-year comparisons more reliable.

Since demographic factors are likely to affect the composition of the public budget, I include the age-dependency ratio in the estimations. In addition, the regressions control for population density since the provision of public goods should be cheaper in more densely populated areas due to economies of scale. The data for both population-related variables is taken from the World Bank's World Development Indicators. The estimations also take into account the interest rate on government bonds (OECD National Accounts database) as a catch-all measure for the fiscal situation, government stability, and political risks in a certain country.

I include the log of real GDP per capita in the regressions due to Wagner's Law which states that the public sector grows as a society becomes wealthier based on two arguments. Firstly, as states grow wealthier they also grow more complex, increasing

the need for public regulatory action. Secondly and more importantly, certain publicly provided goods such as education are luxury goods only provided when society reaches a certain level of wealth. In addition, I control for the unemployment rate given that the relative importance of social protection expenditures in the public budget is likely to increase with high levels of unemployment.

One robustness check takes into account three political factors from the Database of Political Institutions (DPI) by Beck et al. (2001). First of all, I expect that left-wing governments allocate public resources in a different way than centrist and right-wing governments, which has been investigated in numerous empirical studies (see for instance Baskaran (2011), Bräuninger (2005), Hessami and Uebelmesser (2013) Van Dalen and Swank (1996)). The second political variable is the number of years left in the current term given the evidence for political cycles in public expenditures in line with the theoretical prediction by Nordhaus (1975). Finally, I include a measure of government fragmentation as the number of parties in a government coalition and their relative sizes are likely to affect how the budget is allocated.[20] Summary statistics and detailed definitions for all variables are provided in tables 3 and 4 in appendix A.

4.1.2 Bivariate relationships

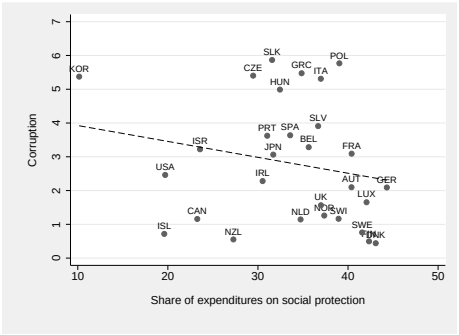
Simple correlations provide a first impression of the relationships between expenditure shares and corruption. Figure 2 includes ten scatterplots labeled from (a) to (j), where each dot in the scatterplots represents average expenditures for one of the ten expenditure categories for a particular country between 1996 to 2009. Each dot is labeled with an abbreviation of the country name.

The negative correlation between corruption and education expenditures in subfigure (c) and the positive correlation between corruption and defense expenditures in subfigure (d) confirm the results in previous studies (Gupta et al. (2001), Mauro (1998)), even though the dispersion around the regression line is very high.

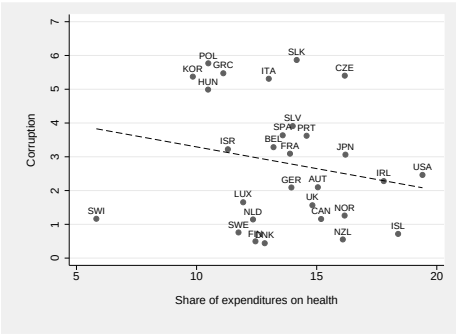
[20]For evidence on the link between government fragmentation and fiscal policy see for example Baskaran (2013) and Volkerink and de Haan (2001).

Figure 2: Correlation between expenditure shares and corruption

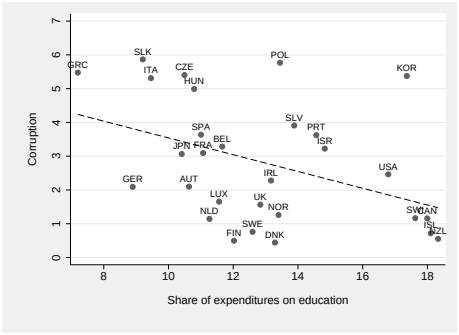
(a) Social protection



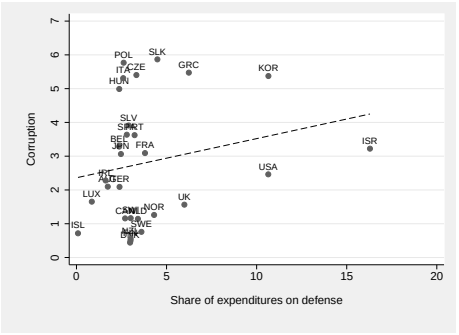
(b) Health



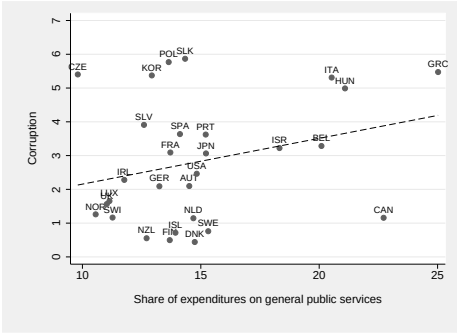
(c) Education



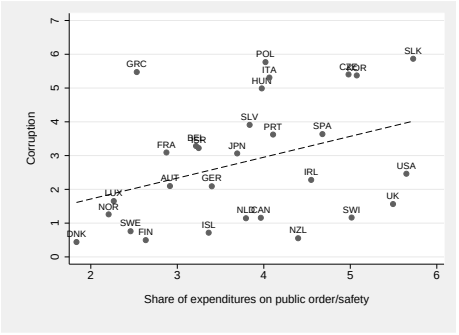
(d) Defense



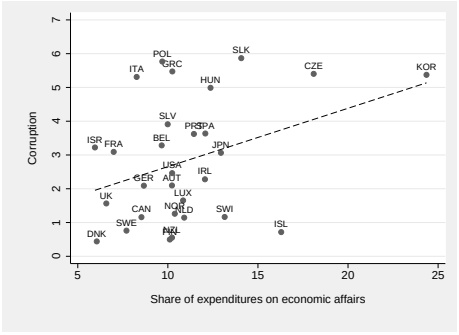
(e) General public services



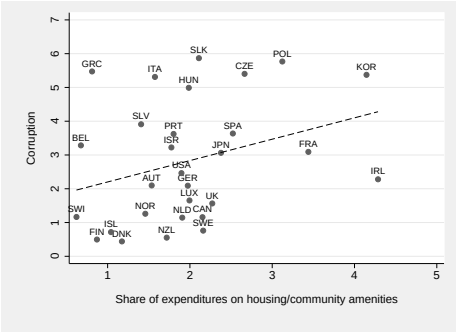
(f) Public order & safety



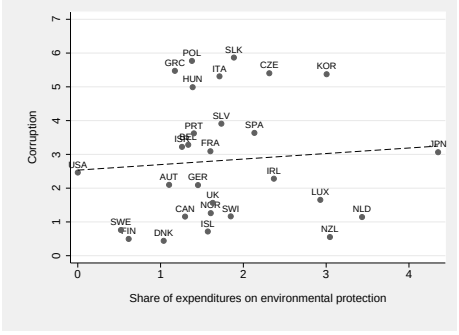
(g) Economic affairs



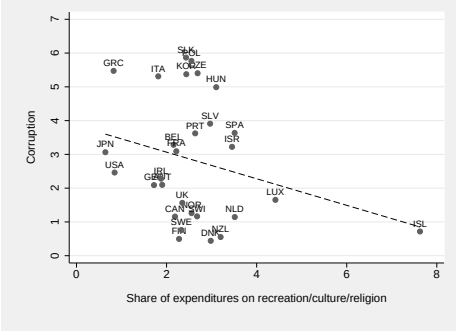
(h) Housing & commun. amenities



(i) Environmental protection



(j) Recreation, culture, religion



The shares of expenditure categories that are not characterized by high-technology, non-competitive markets or public procurement (social protection, recreation, culture and religion) are negatively correlated with corruption as the theoretical analysis in the previous sections suggests. There is a weakly positive relationship between corruption and environmental protection expenditures and housing and community amenities that is also in line with the theory. For health expenditures, there is a negative relationship even though the opposite is expected. Finally, there are some correlations that may be explained through mechanisms beyond my theory. The positive correlation between public order and safety expenditures and corruption may be due to the fact that crime is in general higher in corrupt countries necessitating more expenditures to fight crime.

Summarizing, some of the correlations in figure 2 are in line with the theoretical predictions. Given that the country averages in all ten subfigures are quite dispersed around the regression line, it appears likely that the variation in expenditure shares is also driven by other variables. In the following regression analysis, I will investigate how the results differ when control variables are included and the nature of the data is taken into account through appropriate estimation techniques.

4.2 Empirical strategy

I estimate the following equation for each of the ten expenditure categories:

$$\text{Expshare}_{it} = \alpha_i + \beta \text{Corruption}_{it-1} + \delta X_{it} + \nu_t + \epsilon_{it}, \tag{18}$$

with countries $i = 1, 2, ..., 29$ and time periods $t = 1996, 1997, ..., 2009$. ϵ_{it} represents the normally distributed error term.

The vector X_{it} includes the interest rate on government bonds, the population density, the age-dependency ratio, the log of real GDP per capita, and the unemployment rate. All regressions include time dummies in order to control for common exogenous shocks ν_t and an intercept α_i in order to deal with unobserved heterogeneity. Hypothe-

sis tests are based on standard errors that are robust to heteroscedasticity and that are clustered at the country-level.[21]

There is reason to believe that endogeneity plays a role in the empirical investigation at hand. First, there is the possibility of reverse causality. There are a number of studies that analyze the effect of government size on corruption (Arvate et al., 2010; Goel and Nelson, 1998), while previous studies that focus on the composition of public expenditures provide evidence for the opposite direction of causality (Delavallade, 2006; Gupta et al., 2001; Mauro, 1998), i.e. corruption causes a distortion in the budget composition. In support of this, my model suggests that the *culture of corruption* is the driving force for a distortion in the budget composition. This, however, does not preclude the possibility that corruption in the political arena in turn influences the corruption culture which then again influences politician's willingness to accept bribes. To partially address this issue, the estimations rely on the lag of Transparency International's CPI denoted as $Corruption_{it-1}$.

A second reason for endogeneity is measurement error in corruption indices. By using a second indicator for corruption (ICRG index) in one of the robustness checks that allows for more reliable year-to-year comparisons, I attempt to deal with this issue. Third, as in every other empirical study it is impossible to control for all factors that may influence public spending patterns. I try to reduce this problem by including additional control variables in the robustness checks.

The estimation results for the two-way fixed effects models are presented in section 5.1. The baseline estimations are followed by five robustness checks (section 5.2) that

[21]Since the ten expenditure categories sum up to a total of 100, the regressions are by definition not independent from each other. In fact, when one of the shares decreases, we have the additional information that at least one of the other shares must have increased. The Seemingly Unrelated Regressions (SUR) estimator (Zellner, 1962) makes use of this information and allows for an improvement in efficiency. This is true only when the equations have different control variables and/or a cross-equation zero-parameter restriction is imposed. When the control variables are identical (as in equation (18)) and no restriction is imposed, the SUR estimator yields the same results as the OLS estimator. In my case, the control variables in all ten models are identical. While imposing a restriction may increase efficiency slightly, it comes with the cost that standard estimation packages for SUR in Stata (e.g. sureg) do not allow for clustered standard errors. Given the persistence in my data, I favor the option to use country-clusters and therefore use the OLS estimator.

involve random effects, the inclusion of additional controls, the inclusion of a lagged dependent variable, the measurement of expenditures as a share of GDP as well as the inclusion of government size, and the use of the ICRG corruption measure.

5 Estimation results

5.1 Baseline regressions

The results for the baseline estimations are summarized in table 1, where models 1a to 10a only differ with regard to the dependent variable. The dependent variable is one of the ten expenditure shares where the denominator is total public spending and each of the variables is scaled from 0 to 100.

The estimation results suggest that a higher level of corruption is associated with an increase in the share of expenditures on health and environmental protection. The coefficient in the former case is significant at the 10% level, while it is just below the 10% threshold for environmental protection. On the other hand, the relative importance of expenditures on social protection and recreation, culture and religion decreases (significant at the 5% and 10% level, respectively). Interestingly, the regression analysis yields a positive correlation for health expenditures and corruption, while the bivariate correlation was negative in the graphical analysis.

The theoretical model predicts that corruption distorts the composition of public expenditures in favor of sectors with non-competitive industries. In order to establish whether this transmission channel for a corruption-induced distortion of the budget composition is valid, we need to assess the nature of the market structure in industries related to health and environmental protection expenditures.

Table 1: Estimation results with fixed effects, 1996 - 2009

	Model 1a	**Model 2a**	**Model 3a**	**Model 4a**	**Model 5a**	**Model 6a**	**Model 7a**	**Model 8a**	**Model 9a**	**Model 10a**
	Social protection	Health	Education	Defense	General public services	Public order & safety	Economic affairs	Housing & community amenities	Environ-mental protection	Recreation, culture and religion
Corruption (t-1)	-0.573**	0.394*	0.078	-0.038	0.260	0.017	-0.242	0.105	0.073	-0.072*
	(-2.071)	(1.957)	(0.728)	(-0.719)	(0.939)	(0.246)	(-1.496)	(1.030)	(1.528)	(-1.930)
Interest rate on government bonds	-0.125	-0.306***	-0.178**	0.025	-0.105	0.038	0.618***	0.046	0.004	-0.022
	(-0.917)	(-3.886)	(-1.962)	(0.432)	(-0.550)	(0.976)	(3.139)	(1.463)	(0.115)	(-0.739)
Log of real GDP per capita	2.468	4.453	0.727	-4.924**	7.321	-0.469	-9.172***	0.156	-1.049	0.564
	(0.386)	(1.411)	(0.272)	(-2.476)	(1.258)	(-0.279)	(-2.817)	(0.134)	(-1.227)	(0.654)
Unemployment rate	0.422***	-0.238***	-0.089*	-0.059*	0.321***	-0.052**	-0.226***	-0.003	-0.048***	-0.026
	(4.499)	(-2.681)	(-1.870)	(-1.669)	(3.277)	(-2.064)	(-3.063)	(-0.098)	(-3.433)	(-1.535)
Age-dependency ratio	0.337	0.149*	-0.040	-0.067	0.088	0.007	-0.386**	-0.027	-0.081*	0.020
	(1.012)	(1.768)	(-0.473)	(-1.189)	(0.483)	(0.156)	(-2.486)	(-0.818)	(-1.764)	(0.850)
Population density	-0.070	0.016	0.008	-0.037**	-0.044	0.005	0.092***	-0.002	0.015**	0.017***
	(-0.977)	(0.510)	(0.354)	(-2.093)	(-0.987)	(0.416)	(3.215)	(-0.140)	(1.989)	(2.996)
R^2	0.324	0.617	0.268	0.404	0.537	0.139	0.210	0.066	0.251	0.233
Observations	341	341	341	341	341	341	341	341	341	341
Countries	29	29	29	29	29	29	29	29	29	29

[a] The dependent variable is one of the ten expenditure shares where the denominator is total public spending and each of the variables is scaled from 0 to 100.
[b] Hypothesis tests are based on standard errors that are robust to heteroscedasticity and that are clustered at the country-level
[c] t-statistics in parentheses
[d] Stars indicate significance at 10% (*), 5% (**) and 1% (***)
[e] R-squared values are adjusted for country fixed effects
[f] Country and time fixed effects are jointly significant at the 1% level

On a more basic level, we need to first find out what kind of expenditures are summarized under the headlines "health" and "environmental protection". According to the definitions of the expenditure categories (see table 2 in appendix A), the former includes expenditures on medical products and equipment, while the latter includes spending related to waste management and waste water management.

Health equipment such as a magnetic resonance tomograph involves high-technology. Especially, when such medical equipment is new on the market there are very few, if any, competitors that supply public hospitals with these innovative products. For this reason, they are produced in monopolistic or oligopolistic markets (Robone and Zanardi, 2006).

With regard to expenditures on waste (water) management, there is mounting evidence for the role of corruption in this sector. The evidence especially relates to the multi-million dollar construction of waste incineration plants. One example is the Cologne incinerator project in Germany, where allegedly US $13 million were paid in bribes during the construction of a US $500 million waste incineration plant (Transparency International, 2005). A second example is the Naples waste management crisis that peaked in the summer of 2008 (Smoltczyk, 2008). In this case, municipalities awarded expensive waste disposal contracts to shady consortiums controlled by the local Mafia. After fourteen years and a total cost of US $2 billion none of the three waste incinerators were operational and the garbage piled up on the streets of Naples.

In addition, Anbarci et al. (2009) provide evidence for public sector corruption in the water and sanitation sector, which includes waste water management. Two particular anecdotes in this context relate to the largest private multinationals in this sector operating in France: Vivendi Water and Suez-Lyonnaise. In both instances, these oligopolists bribed government officials in order to secure contracts for sizable public projects. High-ranking representatives of both companies were eventually convicted of bribery and sentenced to substantial fines and prison.

Since public spending on social protection merely represents redistributive transfers between different population groups that are unlikely to be influenced by bribe-paying

firms, the relative importance of this expenditure category decreases with corruption. This does not necessarily imply that expenditures in this area are cut, but only that the relative share significantly shrinks. In addition, public spending on recreation, culture and religion decreases as well relative to other expenditure categories, which is in line with the theoretical considerations in sections 2 and 3 as they also provide very few opportunities for bribery.

The magnitudes of the coefficients for corruption in table 1 can be interpreted as follows: a one-unit increase in perceived corruption (on an overall scale from 0 to 10) is ceteris paribus correlated with an increase in expenditures on health and environmental protection by 0.39 and 0.07 percentage points as well as a decrease in expenditures on social protection and recreation, culture and religion by 0.57 and 0.07 percentage points, respectively.[22] For the control variables, it can be stated that the ten expenditure categories are in most cases significantly affected by demographic factors, national income, unemployment and the interest rate, even though there is some variation across the ten models in this respect.

To conclude, even though I discover corruption-associated changes in the relative importance of expenditure categories that are quite different from those observed by Mauro (1998) and Gupta et al. (2001), the results that are presented in table 1 are in line with the theoretical predictions laid out in sections 2 and 3. Realizing that I limited the empirical analysis to developed countries and used panel-specific estimation techniques as well as a longer time series than previous investigations the novelty regarding the specific nature of the distortions in the budget composition is not surprising.

There are in particular two aspects that deserve special attention when speaking of industrialized as opposed to developing countries. First, democracy ensures that politicians in industrialized countries pay attention to voter's sensitivity towards military expenditures (Hartley and Russett, 1992) as well as expenditures on education (Tepe and

[22]Note that the correlations with health and social protection expenditures are larger in terms of percentage point changes since these categories are two of the largest shares of the total budget.

Vanhuysse, 2009) in order to maximize the likelihood of being elected.[23] Basically all OECD countries are democratic even though there is some variation. In worldwide samples or historic datasets for one particular country a distinction between democratic and autocratic countries would be more suitable (see for example Aidt and Eterovic (2011)). Second, a free press leads to better informed voters, which in turn strengthens the functioning of democracy and further impedes the distortion of expenditure types to which voters pay increased attention.

Moreover, it should be noted that on a global scale corruption in the military sector appears to rely mostly on a link between arms firms in developed countries and government officials in developing countries. If governments from Western countries are at all involved in these instances of corruption, then in a sense that public officials promote arms sales in developing countries (Willett, 2009). Finally, given that many developing countries are currently involved in armed conflicts it is much easier for government officials in these countries to conceal corruption-related increases of defense expenditures.

5.2 Sensitivity analysis

5.2.1 Robustness check 1: Random effects

Two-way fixed effects estimations only take into account the within-variation of the data. Since existing investigations mostly rely on cross-sectional estimations and since the Hausman test does not clearly indicate whether I should use random or fixed effects, I will now investigate to what extent the results change with random effects.[24] The key difference is that in fixed effects estimations one assumes that the time-invariant characteristics of a

[23]Hartley and Russett (1992) provide evidence that US military expenditures between 1965 and 1990 were influenced strongly by public opinion, which implies that policymakers' decisions regarding military expenditures are closely followed by the public. Tepe and Vanhuysse (2009) find that teacher hiring across German states is accelerated by incumbents during election periods and partly reversed thereafter in order to maximize re-election probabilities.

[24]I have chosen to conduct the baseline estimations and robustness checks I to V with two-way fixed effects since they are jointly significant at the 1% level. In addition, this allows us to deal with unobserved heterogeneity and the existence of common exogenous shocks.

country are correlated with the explanatory variables, while in random effects estimations they are not correlated. In table 5 in appendix B, I collect the estimation results.

Table 5 has the same structure as table 1 and reports the results for models 1b to 10b. The most important insight gained from table 5 is that with random effects the relationship between corruption and the composition of public expenditures is almost the same as with country fixed effects. In congruence with the estimation results in table 1, expenditures on health and environmental protection increase significantly, while expenditures on social protection, recreation, culture and religion decline significantly. The magnitudes of the coefficients hardly change, while the coefficient for lagged corruption is now significant at the 5% level for health expenditures (10% level in table 1).

5.2.2 Robustness check 2: Inclusion of political control variables

The second robustness check re-estimates the models in table 1 adding three political control variables in order to address the problem of omitted variable bias. The three variables that are additional included are a left-wing government dummy, the number of years left in the current term, and the extent of government fragmentation. The results for this robustness check are summarized in table 6.

Again, the size of the coefficients for corruption are hardly affected, while their level of significance has slightly increased through the inclusion of additional controls. In the equations that use health expenditures and recreation, culture and religion as dependent variables, the corruption coefficient is significant at the 5% level (10% level in table 1). In addition, the t-statistic for corruption in the estimation that uses environmental protection expenditures as the dependent variable has increased from 1.53 to 1.6. To conclude, I find strong confirmation of the results in table 1.

5.2.3 Robustness check 3: Inclusion of lagged dependent variable

A third test for the robustness of the baseline results includes a lagged dependent variable to account for the persistence in the expenditure shares over time. This leads to a slightly

smaller sample as the number of observations drops from 341 to 338. Table 7 reports the estimation results for models 1d to 10d.

First, it has to be noted that in all models except for two the coefficient for the lagged dependent variables is quite large (around 0.5 to 0.6) and highly significant. For expenditures on economic affairs and housing and community amenities, there is no significant persistence over time.

There are some differences in the estimation results when comparing the results in table 7 with the baseline estimations in table 1. Generally, one would expect that the coefficient for corruption becomes smaller and less significant since the lagged dependent variable will provide a lot of explanatory power.

Indeed, the coefficients for corruption are smaller when the lagged expenditure shares are included. With a one-unit increase in corruption the share of health expenditures and environmental protection expenditures increase by 0.17 and 0.04, respectively. In table 1, the coefficients were 0.39 and 0.07. On the other hand, the coefficients for corruption in the equation that use social protection expenditures and expenditures on recreation, culture and religion as a dependent variable have shrunk by about two-thirds and have become insignificant.

To conclude, when including a lagged dependent variable the distortion of the budget composition occurs in favor of the same two categories as in the baseline estimations. Yet, the relative decline in other expenditure categories is more dispersed so that no category significantly shrinks. These results are in line with the theoretical predictions as the model predicts where expenditures will increase but not how many expenditure categories are negatively correlated with corruption and how strong this negative relationship is in each case.

5.2.4 Robustness check 4: Expenditures as a share of GDP

The fourth robustness check presents an alternative way to measure the expenditure shares while at the same time taking into account that the total size of government

is associated with the budget composition. Table 8 in appendix B collects the results for models 1e to 10e where the dependent variables are the types of expenditures as a share of GDP instead of total expenditures. In addition, each model controls for the public-expenditure-to-GDP ratio as a proxy for government size.[25]

The results suggest that an increase in government size is correlated with an increase in all of the expenditure shares. The size of the correlation varies of course. More importantly, the results again confirm the baseline results. The positive association of corruption with the health-expenditures-to-GDP ratio is significant at the 5% level, while the positive correlation with environmental protection expenditures is significant at the 10% level. For social protection expenditures, the t-statistic for corruption is -1.61 and for recreation, culture, and religion expenditures there is a negative relationship that is significant at the 5% level. The corruption coefficients are about half as large compared to the coefficients in table 1 which is expected due to the change in the scaling of the dependent variable.

5.2.5 Robustness check 5: ICRG corruption measure

The final robustness check uses an alternative corruption measure given that there is some discussion in the literature regarding the reliability of the year-to-year variation in the CPI. In particular, the estimations in table 9 use the ICRG corruption measure. Due to this change the number of observations increases from 341 to 346.

The results for this final robustness check differ in some respects from the baseline results, even though they confirm the implications of the theoretical model. The result that stands out the most is the highly significant coefficient for corruption in the model that uses the health expenditure share as the dependent variable. This coefficient is significant at the 1% level. On the other hand, the t-statistic for the corruption coefficient in the model that uses social protection expenditures as a dependent variable is -1.41. For the case of recreation, culture and religion as well as environmental protection expen-

[25]This specification is inspired by the empirical strategy by Kenny and Winer (2006) who investigate among other things how total tax revenues affect the importance of tax revenues from different sources.

ditures the signs of the corruption coefficients are the same as in the baseline estimations even though they are statistically insignificant.

In summary, the five robustness checks confirm the results obtained for the baseline estimations and support the implications of the theoretical model. The most robust result is that corruption is associated with a higher share of expenditures on health.

6 Conclusion

This paper analyzes the relationship between corruption and the composition of public expenditures. The theoretical part derives how a distortion in public spending arises using a rent-seeking model with endogenous rent-setting that captures both "political corruption" and "bureaucratic corruption". The model illustrates how industry-specific degrees of competition and transaction costs in concealing bribery affect the share of the rent obtained by an industry, while the willingness of a politician to make resources available to the rent-seeking contest depends on the prevailing culture of corruption.

The empirical analysis is based on a panel dataset for 29 OECD countries over the time period from 1996 to 2009. The results suggest that with an increase in corruption the shares of spending on health and environmental protection increase, while the shares of expenditures on social protection and recreation, culture and religion decline.

The findings in this paper raise concerns about the wider implications of a distortion in the budget composition. First of all, not only the distortion in the allocation of public resources itself may represent a source of inefficiency. In addition, bribe payments represent social waste as they are spent to influence the allocation of an income that has already been earned (Hillman, 2009). If one additionally assumes that bribe payments between politicians and bureaucrats occur in a multi-stage hierarchical contest, the extent of this social waste is even more considerable (Hillman and Katz, 1987).

Second, a distortion in the budget composition leads to a failure of the government in fulfilling its objectives. For instance, due to an allocation of resources to private sector

firms other than the most efficient suppliers, both the quantity and quality of public provision will be less satisfactory. As a consequence, voters' disenchantment with politics may increase which means that more and more voters abstain from following the news. More importantly, politicians will have even more freedom in distorting the allocation of public resources. Hence, the problem feeds itself and public sector corruption is likely to have more serious consequences in the future. To conclude, the results in this paper suggest that the fight against corruption should rank high on the agenda of international institutions and decision-makers and should not be limited to developing countries.

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Appendix A: Data description

Table 2: Items included in OECD expenditure categories

Category	Included items
Social protection	Sickness, disability, old age, survivors, children, unemployment & housing
Health	Medical products & equipment, outpatient, hospital & public health services
Education	(Pre-)primary, (post-)secondary, tertiary education incl. subsidiary services
Defense	Military defense, civil defense and foreign military aid
General public services	Executive & legislative organs, financial, fiscal & external affairs, basic research, transfers between different levels of government, foreign economic aid, general services & public debt transactions
Public order & safety	Police services, fire-protection services, law courts & prisons
Economic affairs	Economic, commercial & labor affairs, agriculture, forestry, fishing, hunting, fuel, energy, mining, manufacturing, construction, transport, communication
Housing & community amenities	Housing & community development, water supply & street lighting
Environmental protection	Waste management, waste water management, pollution abatement, biodiversity & landscape protection
Recreation, culture & religion	Recreational & sporting services, broadcasting & publishing services, cultural services, religious & other community services

Source: European Commission (2007)

Table 3: Definitions and Sources of Variables

VARIABLE	DESCRIPTION	SOURCE
	Dependent variables	
Expenditure shares	Public expenditures divided into ten categories (see table **??**) as a share (scaled from 0 to 100) of total public spending	Own calculations based on OECD National Accounts
	Explanatory variables	
Corruption (CPI)	Corruption Perceptions Index (CPI) on a reversed scale from 0 (not corrupt at all) to 10 (very corrupt)	Transparency International
Interest rate on government bonds	Interest rate on 10-year government bonds	OECD Economic Outlook No. 86
Unemployment rate	Harmonized unemployment rates	OECD Annual Labour Force Statistics (ALFS)
Real GDP per capita	Real GDP per capita (PPP-adjusted and in US$)	OECD National Accounts
Age-dependency ratio	Sum of the population older than 65 yrs and younger than 15 yrs divided by working-age population	World Bank - World Development Indicators
Population density	Total population divided by surface area in square km	World Bank - World Development Indicators
	Additional control variables (see tables 6, 8 and 9)	
Left-wing government	1 = left-wing government, 0 else	Database of Political Institutions (DPI)
Years left in current term	Number of years left in the current term for the ruling government (0 indicates election year)	Database of Political Institutions (DPI)
Government fragmentation	Probability that two deputies picked at random from among the govt parties will be of different parties	Database of Political Institutions (DPI)
Government size	Total public spending as a share of GDP	Own calculations based on OECD National Accounts
ICRG corruption index	Corruption as perceived by foreign investors on a reversed scale from 0 (least corrupt) to 6 (most corrupt)	Political Risk Services

Table 4: Summary Statistics

Variable		Mean	Std. dev.	Minimum	Maximum	Observations
Social protection spending	Overall	33.932	8.314	8.728	46.637	341
(share of total public spending)	Between		8.100	10.255	44.774	29
	Within		1.679	26.410	41.754	11.759
Health spending	Overall	14.053	2.804	5.738	21.072	341
(share of total public spending)	Between		2.805	5.827	19.504	29
	Within		1.371	9.389	19.590	11.759
Education spending	Overall	12.617	2.796	6.047	19.927	341
(share of total public spending)	Between		2.984	7.634	18.331	29
	Within		0.658	8.972	14.572	11.759
Defense spending	Overall	3.866	3.053	0.033	17.297	341
(share of total public spending)	Between		3.316	0.089	16.226	29
	Within		0.500	2.196	6.891	11.759
General public services spending	Overall	14.746	3.734	8.476	26.683	341
(share of total public spending)	Between		3.391	10.333	22.989	29
	Within		1.795	10.838	26.252	11.759
Public order & safety spending	Overall	3.736	1.100	1.507	6.210	341
(share of total public spending)	Between		1.047	1.847	5.682	29
	Within		0.267	2.314	4.612	11.759
Economic affairs spending	Overall	10.743	4.132	4.074	33.755	341
(share of total public spending)	Between		3.794	5.666	24.277	29
	Within		1.709	6.726	28.199	11.759
Housing & comm. amenities spending	Overall	1.990	1.015	0.307	5.930	341
(share of total public spending)	Between		0.938	0.621	4.386	29
	Within		0.394	0.370	4.131	11.759
Environmental protection spending	Overall	1.737	0.958	0.000	5.334	341
(share of total public spending)	Between		0.907	0.000	4.273	29
	Within		0.250	0.541	2.948	11.759
Recreation, culture & religion spending	Overall	2.578	1.289	0.428	8.900	341
(share of total public spending)	Between		1.278	0.644	7.688	29
	Within		0.284	1.415	3.791	11.759
Corruption (CPI_{t-1})	Overall	2.776	1.796	0.000	6.600	341
	Between		1.853	0.424	6.050	29
	Within		0.411	1.726	4.973	11.759
Interest rate on	Overall	5.104	1.783	1.003	16.243	341
government bonds	Between		1.364	1.678	8.930	29
	Within		1.251	1.988	14.709	11.759
Real GDP per capita	Overall	23,236.98	10,929.57	3,730.28	56,412.28	341
	Between		11,170.22	4,728.18	47,998.82	29
	Within		2,238.26	12,159.94	31,650.44	11.759
Unemployment rate	Overall	7.019	3.496	1.900	20.000	341
	Between		3.207	3.127	15.573	29
	Within		1.715	-0.293	12.755	11.759
Age-dependency ratio	Overall	48.652	4.409	37.886	61.486	341
	Between		4.610	39.401	61.168	29
	Within		1.350	44.354	54.444	11.759
Population density	Overall	154.926	135.560	2.768	492.323	341
	Between		133.678	2.957	479.759	29
	Within		4.541	133.119	173.400	11.759
Left-wing government	Overall	0.413	0.493	0.000	1.000	341
	Between		0.330	0.000	1.000	29
	Within		0.386	-0.444	1.337	11.759
Years left in current term	Overall	1.742	1.236	0.000	4.000	341
	Between		0.371	1.000	3.000	29
	Within		1.195	-0.591	4.028	11.759
Government fragmentation	Overall	0.319	0.265	0.000	0.828	341
	Between		0.249	0.000	0.791	29
	Within		0.112	-0.122	0.665	11.759

Continued on next page

Table 4 – *Continued from previous page*

Variable		**Mean**	**Std. dev.**	**Minimum**	**Maximum**	**Observations**
Government size	Overall	44.824	7.286	21.213	62.917	341
	Between		6.756	25.286	55.716	29
	Within		2.736	37.851	57.666	11.759
ICRG corruption index$_{t-1}$	Overall	1.736	1.181	0.000	4.000	346
	Between		1.068	0.000	3.703	29
	Within		0.585	-0.037	3.133	11.931

Appendix B: Robustness checks

Table 5: Robustness check I: Random effects estimations, 1996 - 2009

	Model 1b	**Model 2b**	**Model 3b**	**Model 4b**	**Model 5b**	**Model 6b**	**Model 7b**	**Model 8b**	**Model 9b**	**Model 10b**
	Social protection	Health	Education	Defense	General public services	Public order & safety	Economic affairs	Housing & community amenities	Environ-mental protection	Recreation, culture and religion
Corruption (t-1)	-0.597**	0.400**	0.038	-0.033	0.301	0.018	-0.052	0.110	0.066	-0.080*
	(-2.174)	(2.153)	(0.351)	(-0.583)	(0.982)	(0.248)	(-0.217)	(1.071)	(1.373)	(-1.828)
Interest rate on government bonds	-0.147	-0.330***	-0.158	0.052	-0.124	0.035	0.721***	0.045	0.007	-0.023
	(-1.057)	(-4.856)	(-1.547)	(0.569)	(-0.565)	(0.837)	(3.042)	(1.311)	(0.178)	(-0.859)
Log of real GDP per capita	0.632	1.310	0.857	-3.331**	1.472	-0.635	-0.655	0.039	0.025	0.121
	(0.303)	(1.456)	(0.849)	(-2.092)	(0.821)	(-0.945)	(-0.606)	(0.096)	(0.086)	(0.276)
Unemployment rate	0.401***	-0.261***	-0.092*	-0.054	0.250***	-0.052**	-0.178**	-0.004	-0.035**	-0.028
	(5.489)	(-2.706)	(-1.915)	(-1.329)	(2.679)	(-2.323)	(-2.019)	(-0.123)	(-2.562)	(-1.464)
Age-dependency ratio	0.286	0.086	-0.037	-0.035	-0.014	0.003	-0.335***	-0.032	-0.058	0.013
	(1.100)	(1.011)	(-0.606)	(-0.686)	(-0.110)	(0.083)	(-3.421)	(-1.180)	(-1.590)	(0.681)
Population density	-0.013	-0.009**	-0.003	-0.005	-0.002	0.002	0.007	0.000	0.004***	0.001
	(-1.046)	(-2.554)	(-0.805)	(-1.050)	(-0.556)	(0.978)	(1.555)	(0.186)	(2.839)	(0.596)
R^2	0.311	0.606	0.263	0.342	0.524	0.137	0.163	0.065	0.219	0.189
Observations	341	341	341	341	341	341	341	341	341	341
Countries	29	29	29	29	29	29	29	29	29	29

[a] The dependent variable is one of the ten expenditure shares where the denominator is total public spending and each of the variables is scaled from 0 to 100
[b] Hypothesis tests are based on standard errors that are robust to heteroscedasticity and that are clustered at the country-level
[c] t-statistics in parentheses
[d] Stars indicate significance at 10% (*), 5% (**) and 1% (***)
[e] R-squared values are adjusted for country fixed effects
[f] Time fixed effects are jointly significant at the 1% level

Table 6: Robustness check II: Inclusion of political control variables, 1996 - 2009

	Model 1c	**Model 2c**	**Model 3c**	**Model 4c**	**Model 5c**	**Model 6c**	**Model 7c**	**Model 8c**	**Model 9c**	**Model 10c**
	Social protection	Health	Education	Defense	General public services	Public order & safety	Economic affairs	Housing & community amenities	Environ-mental protection	Recreation, culture and religion
Corruption (t-1)	-0.543**	0.395**	0.077	-0.041	0.240	0.010	-0.250	0.115	0.071	-0.072**
	(-1.975)	(2.068)	(0.824)	(-0.790)	(0.869)	(0.160)	(-1.528)	(1.212)	(1.595)	(-1.969)
Interest rate on government bonds	-0.110	-0.309***	-0.173**	0.027	-0.114	0.037	0.614***	0.048	0.000	-0.025
	(-0.812)	(-3.799)	(-2.089)	(0.458)	(-0.613)	(1.018)	(3.088)	(1.363)	(0.004)	(-0.775)
Log of real GDP per capita	3.111	5.033	1.576	-4.877**	6.429	-0.343	-9.840***	-0.147	-1.311	0.436
	(0.478)	(1.435)	(0.646)	(-2.444)	(1.111)	(-0.216)	(-2.912)	(-0.120)	(-1.596)	(0.504)
Unemployment rate	0.421***	-0.237***	-0.087*	-0.059*	0.320***	-0.051**	-0.227***	-0.005	-0.048***	-0.026
	(4.649)	(-2.677)	(-1.816)	(-1.702)	(3.338)	(-2.214)	(-3.072)	(-0.152)	(-3.622)	(-1.511)
Age-dependency ratio	0.368	0.159*	-0.028	-0.068	0.061	0.004	-0.403***	-0.024	-0.086*	0.019
	(1.083)	(1.893)	(-0.357)	(-1.188)	(0.323)	(0.090)	(-2.633)	(-0.871)	(-1.924)	(0.829)
Population density	-0.076	0.018	0.013	-0.036**	-0.042	0.008	0.091***	-0.007	0.014**	0.016***
	(-1.068)	(0.538)	(0.647)	(-2.148)	(-0.946)	(0.744)	(3.298)	(-0.693)	(2.015)	(3.055)
Left-wing government	0.466	0.038	0.015	-0.032	-0.331	-0.096*	-0.154	0.139**	-0.043	-0.002
	(1.382)	(0.139)	(0.112)	(-0.325)	(-1.223)	(-1.888)	(-0.954)	(2.259)	(-0.901)	(-0.045)
Years left in current term	0.007	0.067**	0.005	-0.020	-0.034	-0.007	-0.041	-0.002	0.011	0.014
	(0.143)	(2.206)	(0.239)	(-1.327)	(-1.110)	(-0.621)	(-0.672)	(-0.062)	(1.584)	(1.575)
Government fragmentation	0.028	0.732	1.206***	0.141	-0.638	0.373**	-0.650	-0.710	-0.305*	-0.190
	(0.026)	(1.358)	(3.535)	(0.394)	(-0.619)	(2.282)	(-0.696)	(-1.350)	(-1.646)	(-0.592)
R^2	0.334	0.623	0.306	0.408	0.543	0.187	0.214	0.128	0.271	0.241
Observations	341	341	341	341	341	341	341	341	341	341
Countries	29	29	29	29	29	29	29	29	29	29

[a] The dependent variable is one of the ten expenditure shares where the denominator is total public spending and each of the variables is scaled from 0 to 100
[b] Hypothesis tests are based on standard errors that are robust to heteroscedasticity and that are clustered at the country-level
[c] t-statistics in parentheses
[d] Stars indicate significance at 10% (*), 5% (**) and 1% (***)
[e] R-squared values are adjusted for country fixed effects
[f] Country and time fixed effects are jointly significant at the 1% level

Table 7: Robustness check III: Inclusion of lagged dependent variable, 1996 - 2009

	Model 1d	**Model 2d**	**Model 3d**	**Model 4d**	**Model 5d**	**Model 6d**	**Model 7d**	**Model 8d**	**Model 9d**	**Model 10d**
	Social protection	Health	Education	Defense	General public services	Public order & safety	Economic affairs	Housing & community amenities	Environ-mental protection	Recreation, culture and religion
Corruption (t-1)	-0.195	0.167**	0.083	-0.049	0.091	0.004	-0.243	0.102	0.044**	-0.023
	(-1.059)	(2.258)	(1.388)	(-1.061)	(0.696)	(0.137)	(-1.629)	(1.329)	(2.176)	(-0.832)
Lagged dependent variable	0.681***	0.621***	0.536***	0.683***	0.522***	0.601***	0.081	0.217	0.642***	0.550***
	(8.238)	(10.370)	(9.073)	(7.372)	(4.864)	(5.850)	(0.585)	(1.278)	(8.751)	(5.956)
Interest rate on government bonds	-0.096	-0.240***	-0.168***	-0.039*	0.051	-0.023	0.599***	0.046*	-0.001	-0.039*
	(-0.981)	(-3.286)	(-2.988)	(-1.780)	(0.370)	(-1.154)	(2.732)	(1.667)	(-0.061)	(-1.824)
Log of real GDP per capita	0.901	1.092	-0.067	-2.481**	4.086	-0.358	-8.122**	0.003	-0.472*	-0.035
	(0.324)	(0.770)	(-0.049)	(-2.349)	(1.522)	(-0.512)	(-2.282)	(0.004)	(-1.683)	(-0.063)
Unemployment rate	0.197***	-0.108**	-0.040*	-0.005	0.206***	-0.018*	-0.207***	-0.015	-0.020***	-0.019*
	(3.767)	(-2.267)	(-1.655)	(-0.238)	(3.284)	(-1.730)	(-3.069)	(-0.498)	(-3.867)	(-1.648)
Age-dependency ratio	0.066	0.052	-0.012	-0.044	0.019	0.002	-0.341*	-0.019	-0.030*	0.011
	(0.521)	(1.202)	(-0.295)	(-1.494)	(0.192)	(0.119)	(-1.819)	(-0.721)	(-1.901)	(0.749)
Population density	-0.011	0.008	0.006	-0.015*	-0.030	0.001	0.084***	0.004	0.005**	0.006*
	(-0.350)	(0.637)	(0.553)	(-1.657)	(-1.225)	(0.149)	(2.972)	(0.386)	(1.978)	(1.753)
R^2	0.620	0.769	0.504	0.727	0.675	0.473	0.217	0.175	0.603	0.463
Observations	338	338	338	338	338	338	338	338	338	338
Countries	29	29	29	29	29	29	29	29	29	29

[a] The dependent variable is one of the ten expenditure shares where the denominator is total public spending and each of the variables is scaled from 0 to 100
[b] Hypothesis tests are based on standard errors that are robust to heteroscedasticity and that are clustered at the country-level
[c] t-statistics in parentheses
[d] Stars indicate significance at 10% (*), 5% (**) and 1% (***)
[e] R-squared values are adjusted for country fixed effects
[f] Country and time fixed effects are jointly significant at the 1% level

Table 8: Robustness check IV: Expenditures as a share of GDP and inclusion of government size, 1996 - 2009

	Model 1e	**Model 2e**	**Model 3e**	**Model 4e**	**Model 5e**	**Model 6e**	**Model 7e**	**Model 8e**	**Model 9e**	**Model 10e**
	Social protection	Health	Education	Defense	General public services	Public order & safety	Economic affairs	Housing & community amenities	Environ-mental protection	Recreation, culture and religion
Corruption (t-1)	-0.184	0.180**	0.017	-0.046	0.120	0.019	-0.133	0.039	0.030*	-0.038**
	(-1.608)	(2.072)	(0.343)	(-1.214)	(0.989)	(0.604)	(-1.476)	(1.065)	(1.796)	(-2.112)
Government size	0.228***	0.094***	0.079***	0.046***	0.163***	0.027***	0.290***	0.029***	0.024***	0.024***
	(5.919)	(4.800)	(5.120)	(3.757)	(4.917)	(4.579)	(4.497)	(3.121)	(3.946)	(4.134)
Interest rate on government bonds	-0.009	-0.100***	-0.097***	-0.028*	-0.021	0.020*	0.225***	0.009	-0.003	-0.007
	(-0.149)	(-2.623)	(-3.767)	(-1.704)	(-0.264)	(1.777)	(3.178)	(0.684)	(-0.211)	(-0.467)
Log of real GDP per capita	-0.750	0.591	0.744	-0.977	4.277*	-0.095	-3.505**	0.256	-0.467	0.100
	(-0.291)	(0.422)	(0.719)	(-1.373)	(1.741)	(-0.141)	(-2.455)	(0.522)	(-1.347)	(0.258)
Unemployment rate	0.180***	-0.093***	0.000	-0.009	0.138***	-0.011	-0.172***	0.002	-0.024***	-0.011
	(4.014)	(-2.921)	(0.023)	(-0.533)	(3.047)	(-0.981)	(-3.697)	(0.168)	(-3.314)	(-1.224)
Age-dependency ratio	0.112	0.056	-0.011	-0.002	0.041	0.007	-0.169**	-0.002	-0.032*	0.004
	(0.877)	(1.293)	(-0.310)	(-0.086)	(0.547)	(0.341)	(-2.456)	(-0.133)	(-1.650)	(0.304)
Population density	-0.017	0.005	0.007	-0.018*	-0.032*	0.006	0.034*	0.002	0.007**	0.007**
	(-0.554)	(0.307)	(0.976)	(-1.778)	(-1.850)	(1.442)	(1.954)	(0.555)	(2.298)	(2.195)
R^2	0.691	0.647	0.556	0.430	0.676	0.432	0.542	0.204	0.341	0.330
Observations	341	341	341	341	341	341	341	341	341	341
Countries	29	29	29	29	29	29	29	29	29	29

[a] The dependent variable is one of the ten expenditure types as a share of GDP
[b] Hypothesis tests are based on standard errors that are robust to heteroscedasticity and that are clustered at the country-level
[c] t-statistics in parentheses
[d] Stars indicate significance at 10% (*), 5% (**) and 1% (***)
[e] R-squared values are adjusted for country fixed effects
[f] Country and time fixed effects are jointly significant at the 1% level

Table 9: Robustness check V: ICRG index as an alternative corruption measure, 1996 - 2009

	Model 1f	**Model 2f**	**Model 3f**	**Model 4f**	**Model 5f**	**Model 6f**	**Model 7f**	**Model 8f**	**Model 9f**	**Model 10f**
	Social protection	Health	Education	Defense	General public services	Public order & safety	Economic affairs	Housing & community amenities	Environ-mental protection	Recreation, culture and religion
Corruption (t-1)	-0.439	0.721***	0.093	-0.085	-0.065	0.065	-0.380	0.077	0.021	-0.032
	(-1.413)	(2.928)	(0.758)	(-0.953)	(-0.375)	(0.874)	(-1.549)	(0.995)	(0.622)	(-0.845)
Interest rate on government bonds	-0.056	-0.171***	-0.119***	0.038	-0.051	0.042**	0.372***	0.013	0.002	-0.006
	(-0.638)	(-3.112)	(-2.911)	(0.868)	(-0.479)	(1.967)	(3.490)	(0.381)	(0.095)	(-0.314)
Log of real GDP per capita	3.844	-2.526	2.641	-6.228**	5.836	-0.711	-2.112	-1.309	-0.796	1.343*
	(0.558)	(-0.420)	(0.988)	(-2.482)	(1.027)	(-0.507)	(-0.472)	(-1.032)	(-0.955)	(1.746)
Unemployment rate	0.362***	-0.218***	-0.055	-0.068*	0.320***	-0.053**	-0.208***	-0.011	-0.046***	-0.019
	(3.389)	(-3.282)	(-1.160)	(-1.768)	(3.762)	(-2.175)	(-3.261)	(-0.365)	(-3.213)	(-1.378)
Age-dependency ratio	0.233	0.113	-0.077	-0.048	-0.013	0.015	-0.193	-0.027	-0.076*	0.020
	(0.746)	(0.972)	(-1.036)	(-0.866)	(-0.072)	(0.411)	(-0.988)	(-0.757)	(-1.756)	(0.867)
Population density	0.083***	-0.028**	-0.012***	-0.032***	-0.010	-0.002	-0.016**	-0.000	0.008***	0.009***
	(8.754)	(-2.179)	(-2.688)	(-7.048)	(-1.383)	(-0.958)	(-2.032)	(-0.133)	(7.210)	(9.236)
R^2	0.310	0.618	0.287	0.434	0.478	0.174	0.207	0.049	0.232	0.204
Observations	346	346	346	346	346	346	346	346	345	346
Countries	29	29	29	29	29	29	29	29	29	29

[a] The dependent variable is one of the ten expenditure shares where the denominator is total public spending and each of the variables is scaled from 0 to 100
[b] Hypothesis tests are based on standard errors that are robust to heteroscedasticity and that are clustered at the country-level
[c] t-statistics in parentheses
[d] Stars indicate significance at 10% (*), 5% (**) and 1% (***)
[e] R-squared values are adjusted for country fixed effects
[f] Country and time fixed effects are jointly significant at the 1% level